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CONTENTS

MEASUREMENT OF QUALITY PROPERTIES OF DRIED PLUM VARIETIES

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ABSTRACT

This paper deals with a comparison between two different drying processes. Hot air and a vacuum-freeze drying processes were used for drying samples of plum [Prunus domestica L.] varieties ('Cacanska lepotica', 'Cacanska rana' and 'President'). The main objective of our research was to analyse and simulate the change of the quality parameters formed during dehydration by comparing two known drying procedures convective dehydration and lyophilisation.
The study shows the heat and mass transfers of the two drying methods, and examines some special parameters which characterize the quality of dried products, including the chemical components, rehydration, and surface hardness

1. INTRODUCTION

Drying is one of the possible ways of processing vegetables and fruits. The most frequently applied method of this ancient preservation procedure is the artificial convective drying. This procedure became popular mainly as a result of its simple use and low operational costs; however, we should not forget its disadvantages, which are related to the quality of the dried product. These disadvantages include significant decreases in nutritional value, shrinkage, formation of a hard, non-permeable layer, and denaturation of proteins (Karel, 1980; Bouraout et al., 1994; Lewicki, 1998).
Research has been conducted for a long time on preserving fruits and vegetables in such a way that they keep their original properties for the cold winter months as well. Nowadays, in the 21st century the requirements set out for dried fruits and vegetables including that they should be microbally stable, keep their physical, chemical and mechanical parameters and have excellent storage, packaging and transportation properties. In addition, they should have high nutrient contents suitable for producing functional foods and food supplements. Only a few drying methods are suitable for satisfying the above-mentioned demands on preservation. According to our present knowledge, the most tolerant dehydrating method is vacuum freeze-drying. Better quality of lyophilized products results from the fact that the temperatures applied during lyophilization are much lower than during traditional drying and that the denaturation processes typical of the traditionally dried products does not occur. During lyophilization, no internal diffusion takes place because the sublimation starting from the surface gradually spreads to deeper layers; the ice directly passes into steam (Karathanos et al., 1996; Kerekes et al., 2008).

2. MATERIAL AND METHODS

2.1. Description of the materials used in the trials

During the measurements we tested plum varieties (*Prunus domestica* L.) ('Cacanska rana', 'Cacanska lepotica', 'President') of exactly known origin purchased from local

producers and traders (Nyíregyháza, Hungary). d the material to be dried and cut it to size then placed it on the tray of the dryer in one layer. The samples were cut into 20 mm pieces, and total mass of the samples were 300 grams. We performed the drying test of the varieties both simultaneously and separately. The analyses were replicated three times.

2.2. Description of the dryers applied in the experiments

We performed the dehydration of the horticultural products (plum varieties) used in the experiments with the following dryers:
1. Convective drying - LP 302 laboratory cylindrical drying cabinet (drying parameters: 9-11 h; 75-80 °C; 1,1-1,5 m/s).
2. Lyophilisation – Armfield FT 33 laboratory vacuum freeze drier (drying temperature from -50 to 20°C; the pressure ranged from 80 to 150 Pa, drying time: 24-26 h).

In order to exactly analyse the processes taking place during the drying, we equipped the laboratory freeze dryer with a data recording system. The described apparatus with the data recording system (platform cell – scale instrument – DATPump software) can be seen in Figure 1.
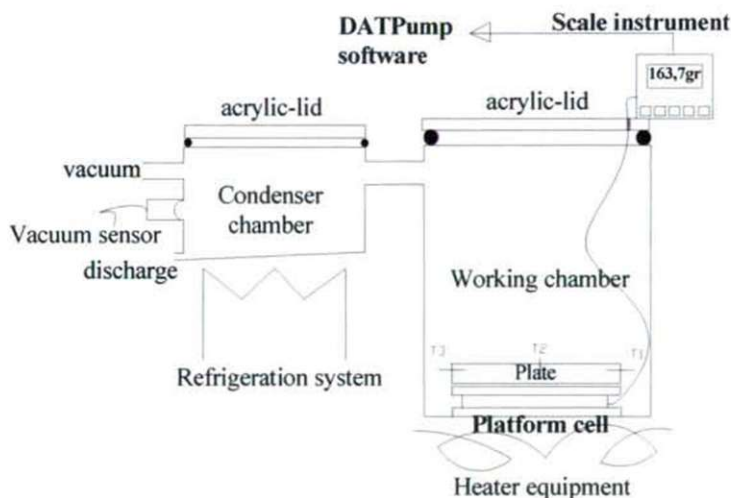
Figure 1. Armfield FT33 lyophilisation apparatus with data recording system

2.3. Description of measuring instruments and measuring techniques

The characteristics influencing the quality of the dried products were measured and evaluated with the following instruments and methods:
- Moisture content measurement: PRECISA HA 60 type quick moisture meter.
- Measurement of the drying parameters of the convective method: TESTO 4510 type measuring instrument.
- Detection of the chemical composition of the material: with analytical procedures and instruments (HPLC, Mobil XRF Analyzer).

- Measurement of the rehydration activity of the dried material in moistening agent (Tein et al., 1998).
- Determination of the product strength: MGA-1091 type electronic penetrometer (Fekete et al., 1994).

3. RESULTS AND DISCUSSION

3.1. Results of the tests of heat and mass transition

During the drying process one of the most important tasks was to determine the drying diagrams (change of water content in function of the time).

Figure 2 demonstrates the change of moisture level in plum samples ('President'), during freeze drying and convective dehydration.

$$w = 0,0114\,t^3 - 0,4488\,t^2 + 1,1525\,t + 78,489$$
$$R^2 = 0,9995$$
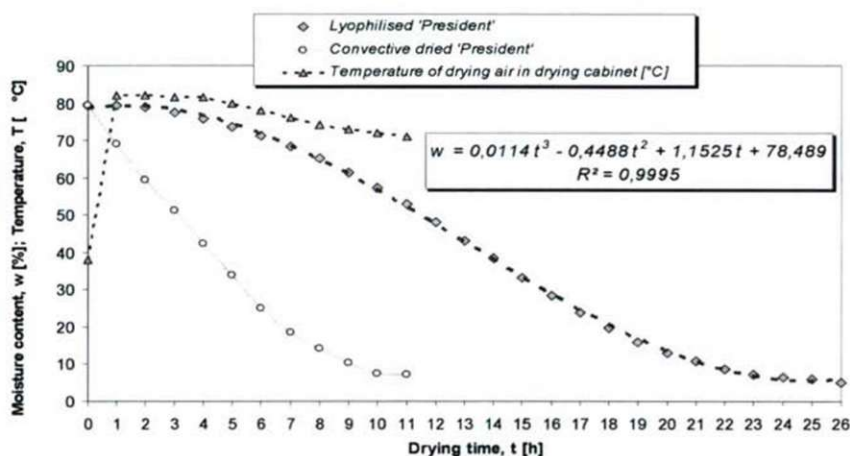
Figure 2. Drying curve of convectively and vacuum freeze dried plum slices

The figure indicates that the drying period of the vacuum-freeze drying process is longer than the convective dehydration, because of the minor drying rate.

The drying curve of the lyophilization is a higher degree polynomials; the formula can be read in the figure and Table 1.

Table 1. Coefficients of the third-degree polynomial

Description	Coefficients			
	a [-]	b [-]	c [-]	k [-]
Plum varieties				
Cacanska rana (d.t.=24 h)*	0,0126	0,441	0,1702	83,017
Cacanska lepotica (d.t.=24 h)*	0,0145	0,5345	1,5046	78,523
President (d.t.=26 h)*	0,0114	0,4488	1,1525	78,489

* drying time

3.2. Analytical results of dried plum

The most important chemical components of the dried plum samples were determined in the Agricultural and Molecular Research Institute of the University College of Nyíregyháza. The results can be studied in Table 2.

The main conclusion from the data presented in the tables is that all the components of the lyophilised samples have a significantly higher value, compared with the conventionally dried fruits.

Table 2. Chemical components of dried 'Cacanska lepotica' samples

Component	Raw material	Convective dried	Lyophilised
General characteristics [%]			
Water	79,27	8,6	5,88
Protein	0,58	0,23	0,39
Carbohydrate	9,8	4,33	7,84
Vitamins [mg/100g]			
Vitamin-B_1	2,2	1,17	1,74
Vitamin-B_2	1,86	1,12	1,44
Vitamin-C	15,2	7,75	11,2
Phenoloids [mg/100g]			
Coumaric-acid	5,82	0,61	4,73
Gallic-acid	1,23	0,54	1,11
Chlorogenic-acid	15,7	4,52	12,6
Minerals [mg/100g]			
Na	16	12,1	15
K	374,1	333,6	352,1
Ca	21,45	19,8	20,39

3.3. Results of the rehydration tests

The process of the experiment was as follows: we measured the weight of the samples dehydrated by various methods, then placed them in pots filled with water of 35 °C and 75 °C. During the experiment, we ensured the permanent temperature of the liquid by means of liquid supply. We removed the samples from the liquid after 0.5, 5, 10, 15, 30, 60 min periods and eliminated the surplus moisture from their surfaces with an absorbent. At the end of the experiment we measured the weights of the rehydrated samples and calculated the rehydration rate (RR). The value of the rehydration rate (RR) shows how much the amount of the water absorbed again can increase the weight of the dried product.

The rehydration curves of the dried plum samples ('Cacanska rana') are illustrated in Figure 3, at 35 and 75 °C water temperature.
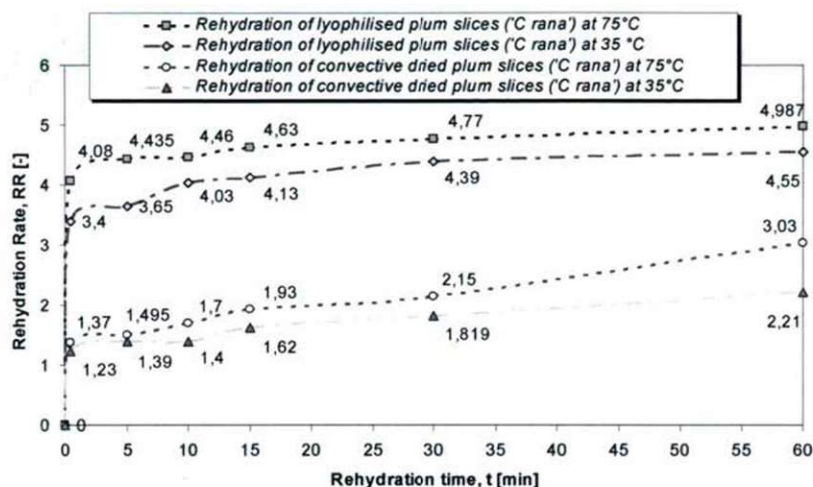
Figure 3. Rehydration curves of the dried plum ('Cacanska rana')

The rehydration rate (RR) can be calculated in the following way:

$$RR = \frac{m_{rh}}{m_d}$$

where:

m_{rh} – mass of the rehydrated material [g],
m_d – mass of the dried material [g].

It can be seen in the figure that the lyophilized samples have a higher rehydration rate than the conventionally dried fruits.

Moreover, the tests proved that rehydration at a higher temperature resulted in a faster moisturing process and larger rehydration rate.

In the Table 3, we indicated the percentage moisture content of the rehydrated product as compared to the original moisture content.

Table 3. Moisture content of rehydrated dried fruits

Description	Moisture content, w [%]		
	Raw material	Convective dried	Lyophilised
Plum varieties			
Cacanska rana	82,71	70,93	82,18
Cacanska lepotica	79,27	62,37	79,41
President	79,43	67,37	79,17

3.4. Surface hardness of dehydrated fruits

Besides the quality features (chemical and physical properties), it is important to discuss the mechanical parameters, with special regard to the hardness of the fruit. In order to ensure the quality during harvest and post-harvest technologies (drying, storing), it is essential to know the hardness of the yield.

Results of the hardness of the dried plum samples are as shown in Figure 4.

The penetration tests confirmed that the surface of the convection-dried materials is significantly harder than that of the freeze-dried products.
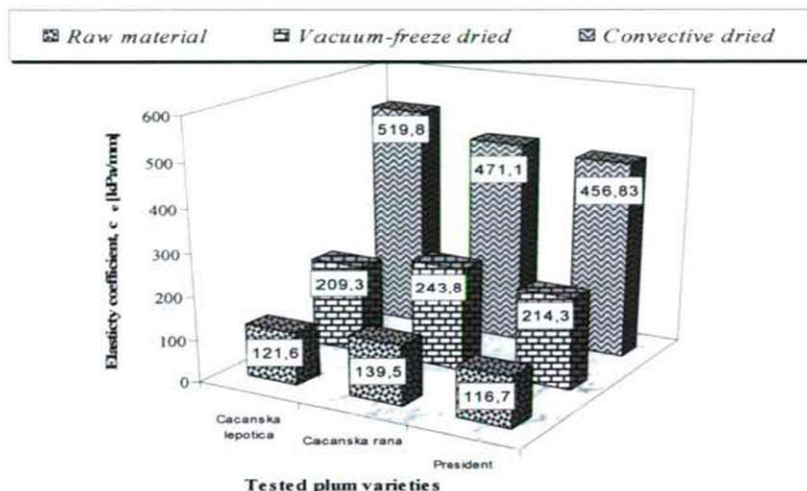
Figure 4. Comparison of the surface hardness of dried fruits to the surface hardness of the raw material

4. CONCLUSIONS

With regard to the results of the heat and mass transports, we found that the temperature and pressure applied for the freeze-drying is much less while the drying time is much longer than those for the convection drying.

We defined a relationship for the characterisation of the drying processes of lyophilised plums. The processes can be approximated with third-degree polynomials. The functions representing the moisture content reduction of the drying materials can be described with the following equation: $w=at^3-bt^2+ct+k$, where: w – moisture content of the product [%]; t – drying period [h], a, b, c, k – coefficients of the third-degree polynomial the values of which depend on the characteristics of the material: the variety, the freezing speed, the ripeness and the tendency to lose water.

Through the analytical inspection of dried plum varieties we stated that the nutrient contents – carbohydrates, proteins, phenoloids, and vitamins – were reduced by 10-33% for the lyophilized samples, while 20-89% reduction was measured for the materials dehydrated by convection, as compared to the initial status.

We proved that during their rehydration the freeze-dried materials regain almost at their original water content and keep their original shape and size as well. The reason for this is that the lyophilised products have porous, spongy structure which is able to absorb moisture and regenerate.

Through the rehydration tests we revealed that small amount of freeze-dried materials seemed to be softer after rehydration than the raw material. The samples dried with the convective method kept their hard, solid surface at the end of the rehydration process, so they could not recover their original shape and moisture content.

Through the penetration tests, we noted that the surface of the plum varieties dried with the convection method is at least 1,93 – 2,48 times as hard as that of freeze-dried products. The reason for this is that during the drying the water leaves the surface of the product by evaporation and the evaporated water is supplied by diffusion from the internal layers. During its movement, the water diffusing from the internal parts takes dissolved materials along with it, which remain on the surface after the evaporation of the water, are

concentrated and form a hard layer. During lyophilisation, no internal diffusion occurs since the sublimation starts from the surface, spreads to the deeper layers step by step and the ice is directly transformed into steam without a liquid phase.

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HISTORICAL BASINS SEDIMENTS

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ABSTRACT

Modifications of small water reservoirs in the past focused primarily on addressing issues of capacity and stability of the reservoir capture. By the impact of changes in the use of reservoir surroundings, by acceleration of the erosion processes on the adjecent land and non-periodical maintenance of the capture leads to morphological changes in the reservoir, which causes changes in the in the reduced flowage of the basin and thus in changes of the flood protection degree of adjacent land. This reduces the accumulation part of the basin and subsequently its economic use in fish rearing

Bottom sediments of dams are products of erosion of agricultural and forest soils, the main flow of the river basin and tributaries connected to the dam or a system of dams. They have the basic properties of surface layers of soil erosion

KEY WORDS: bottom sediment, subsidence, the origin of the bottom sediments, dam, water reservoir

1. INTRODUCTION

Unique technical design in water management contributed to the greatest expansion of mining and the most glorious period in history of Banska Stiavnica in the first half of 18th century when it was the third largest city in Hungary. In the years 1740-1760 14 tons of gold and 475 tons of silver was produced in the area. The first university of mining was established here as well especially due to ingenious utilization of water resources.

It was Matej Kornel Hell and especially Samuel Mikovini with his student Jozef Karol Hell junior who resolved the problem of drawing water from flooded mines. Samuel Mikovini, an excellent mathematician, cartographer and geodesist came to Banska Stiavnica in 1735 delegated by the emperor Charles VI and designed and built most of the reservoirs which outlasted to the present. He filled up these reservoirs by means of dozens of kilometres of collecting channels in relatively small area without any rivers. His system of head-water channels and a specific concept of interconnecting the reservoirs by tunnels were also ingenious.

The basis of this water-management framework was the interconnection of the reservoirs, utilization of rainfall water often from greater area than offered the river-basin and its transmit to the reservoirs. This means that we can speak of the most accomplished water

utilization framework of the 18th century. No other system of this kind was able to accumulate greater amount of rainfall water than the one of Banska Stiavnica.

Rainfall water brought erosive material from the surroundings which subsided on the bottom of the reservoirs during decades.

In general sediments besides their chemical influence change the function of a reservoir by reducing its volume from the bottom and by changing its area from the sides.

2. MATERIAL AND METHODS

The reservoirs in Banská Štiavnica – so called „tajchy" – are historically the oldest and most influenced ones by sediments. Today their maintenance is in the competence of Slovak water-management enterprise (Slovenský vodohospodársky podnik, š. p., Odštepný závod Povodie Hrona). In the present the reconstruction of water outlets and dam fortification in the reservoirs of Velká Kolpašská nádrž and Malá Kolpašská nádrž are being finalized.
The reconstruction works on Belianska reservoir, Rozgrund and others have already been finished and the project will continue. We can clearly observe changes in the attitude to revitalization of the reservoir system.

The Kolpašské tajchy complex has been under reconstruction since 2008 prebieha rekonštrukcia Kolpašských tajchov. In the past the comlex originally included three reservoirs: Veľký and Malý Kolpašský tajch a Rybník. Veľký and Malý Kolpašský tajch are situated in the vicinity of Banský Studenec village. Rybník was located near the nowaday railway station in Banská Štiavnica. All three reservoirs helped system of stúp in two valleys first in Rybnická dolina and later in Mestská dolina.

Water from these reservoirs together with water from the reservoirs of piarská skupina supported system of stúp in Antolská dolina. Water from Veľký Kolpašský tajch and Malý Kolpašský tajch passed through a ditch part of which created an interesting aquaduct. Since the second half of the 19th century water from the reservoirs was used for the needs of smeltery and ore finishing workshop in Banská Štiavnica as well.

Veľký Kolpašský tajch was built from in the year 1730. According to the budget of construction from april 16th apríla 1730 the expenses had to be 90 000 gold coins that had to be paid from the future profit. As early as the works on the dam had finished, its insufficient quality became evident. Water leaked out and even some ruptures appeared. Samuel Mikovíni prepared the reconstruction project in 1735 and rebuilt it.

In the following years continual reconstruction works cost great amounts of money. It was possible that Mikovíni wasn't allowed to design the reconstruction project as he wished because none of the other dams he projected ever needed bigger modifications.

The volume of Veľký Kolpašský tajch in 1855 was 798 900m^3, volume of Malý Kolpašský tajch 107 400m^3. Maximum depth of the first one was 13,5m, the second one 6,6m. Veľký Kolpašský tajch has the dam crest lenght of 182,1m, width 20,9m and height 14,2m, flooded area was 10,2 ha , volume of water in the reservoir was 799 thousandm3.

According to present measurings the area of the reservoir is 8,742 ha which is almost 1,5 ha less than in the original documents.

Malý Kolpašský tajch has and Veľký Kolpašský tajch have a common dam while their height rates are identical. The first mentioned was built in 1763. It has the dam crest lenght of 79,9 m, width 15,2 m and height 6,8 m, flooded area is 1,0 ha, volume of water in the reservoir is i 107 thousand m3. (Lichner, 1997).

3. RESULTS AND DISCUSSION

System of ditches that supplies both reservoirs brings deposits from surrounding areas caused by erosion. Soils there are shallow to medium deep, mostly kambizeme vzniknuté na vulkanitoch, tvoriacich materskú horninu. The summary is in the chart 1.

Table 1 Banský Studenec – soils in the surrounding areas of Veľký a Malý Kolpašský tajch
(from:www.podnemapy.sk)

BPEJ	Popis pôdnej jednotky	Zrnitosť	Hĺbka pôdy
1081682	KM – Kambizeme na vulkanických horninách na výrazných svahoch stredne ťažké až ťažké	Stredne hlinité	ťažké Stredné 30 – 60 cm
1077462	KM – Kambizeme plytké na vulkanických horninách stredne ťažké až ťažké	Stredne hlinité	ťažké Stredné 30 – 60 cm
1081885	KM – Kambizeme na vulkanických horninách na výrazných svahoch stredne ťažké až ťažké	Stredne hlinito piesoč	ťažké Stredné 30 – 60 cm
1077465	KM – Kambizeme plytké na vulkanických horninách stredne ťažké až ťažké	Stredne hlinito piesoč	ťažké Stredné 30 – 60 cm
1061442	KM – Kambizeme typické na na zvetralinách vulkanických hornín, stredne ťažké	Stredne hlinité	ťažké Plytké do 30 cm
0981682	KM – Kambizeme na vulkanických horninách na výrazných svahoch stredne ťažké až ťažké	Stredne hlinité	ťažké Stredné 30 – 60 cm

Soil qualities significantly affect qualities of sediments in Kolpašské tajchy. Chemical characteristics of sediments can be evaluated through relatively complicated reactions between individual stages , especially between water solution and coloid part of the sediments. We use the same characteristics to describe soils.

Basic characteristics of sediments include
- soil reaction
- absorption capacity and the nature of sorption complex
- organic ratio (humus content).

After sampling we performed three analyses mentioned above, at first for the samples taken at Malý Kolpašský tajch.
One of the most important qualities of soil is its pH value. Soil reaction influences solubility of substances in soils and their efficiency for living organisms, accessibility of nutrients, adsorption and desorption of cations, biochemical reactions, soil structure andthereby physical characteristics. Following great complexity of relations in soil we

distinguish active and interchanging soil reaction. The pH value is expressed Hodnotenie by means of extensive scale USDA.

Table 2 Evaluation of soil by the soil reaction (USDA)

pH/H$_2$O	Rating
<3,5	very sour
3,5-4,4	extremely acidic
4,5-5,0	very strongly acid
5,1-5,5	strongly acidic
6,1-6,5	slightly sour
6,6-7,3	neutral
7,4-7,8	slightly alkaline
7,9-8,4	moderately alkaline
8,5-9,0	strongly alkaline
>9,0	very strongly alkaline

We made a pH analysis of the samples taken in 2008 in SPU laboratories. The results are displayed in the following chart:

Table 3: Results of measured values pH v KCl a H2O

KCl		H$_2$O	
Sample	pH	Sample	pH
1	3,05	1	3,82
2	2,86	2	4,02
3	3,19	3	3,81
4	2,8	4	4,25
5	3,4	5	3,9
6	2,1	6	4
7	2,44	7	3,79
8	3,24	8	3,58
9	2,9	9	3,63
10	2,37	10	3,8
11	3,3	11	4
12	2,88	12	4,1
13	3,325	13	3,6
14	2,8	14	3,69
15	3	15	3,69
16	3,375	16	4,3
17	2	17	4,53
18	2,8	18	4,2
19	3,18	19	4,6
20	3,2	20	4,15

The analyses show that samples from all the sampling places are characterized as acidic or extremely acidic soil.

We do not know the cause of this. One of the possible reasons could be acidic rains in the locality where we measured pH value of rainfall – in melting snow the value was pH 5,29. Certain substances which cause acidity of the rainfall might accumulate in the reservoir and during water evaporation their concentration and overall value change.

Proportion of organic content (humus) is the indicator of agricultural land fertility, the content of humic substances. In the case of sediments i tis is an indicator of contained organic matter which has come into the sediment rather from dead planktonic organisms from dead and decomposition of other dead organic matter. The average humus content as an indicator of Cox in the soil are shown in Table 4 (Sánka 2001).

Table 4. Rating humus content in soils (Sánka 2001).

The content of humus in%	Stock humus
< 0.5	extremely low
0,5 – 1,0	very low
1,0 – 2,0	low
2,0 – 3,0	medium
3,0 – 5,0	good
> 5,0	very good

The content of humus (organic substance) is a very important parameter affecting the basic features and functions of soil. I tis determined by setting of oxidizable organic carbon (COX) and multiplying by a conversion factor of 1.724 for humus. This calculation is based on the assumption that humus contains 58% carbon.

Table 5. Evaluation of the humus content in the sediment samples collected from Malý Kolpašský tajch.

sample number	carbon content results in the average (%)	humus content conversion factor of 1.724
1	10,8753	18,749
2	10,1477	17,4946
3	10,1515	17,5011
4	5,679	9,7905
5	10,1812	17,7356
6	9,4237	16,2464
7	8,5225	14,6927
8	9,1858	15,9316
9	7,8377	13,5121
10	8,0829	13,9349
11	5,734	9,884
12	0,9003	1,5521
13	7,3925	12,7446
14	9,2411	15,9316
15	10,4346	17,9892
16	8,0744	13,9202
17	8,3317	14,3638
18	9,8091	16,9108
19	8,8131	15,1937
20	10,1117	17,4325
21	1,4312	2,4674
22	2,1375	3,685
23	4,4481	7,6685
24	3,2819	5,6579

Obtained values indicate an extremely high content of organic matter. It is caused by the residue after planktonic organisms from the reservoir. More detailed surveys of sediments clearly show their layered arrangement, where the layers of lighter minerals alternate the ones with darker minerals.

The proportion of dead microorganisms in the total volume of sediments is significant. Places with a lower content of organic matter were always on in the steeper the bank, where the sediment consisted of material from the erosion of reservoir shores.

When trying to determine the volume of sediment, first we need to determine their thickness in different sections. Given the condition of the sediments - their great humidity and our technical possibilities and we estimated the thickness of the layer in the upper part at about 0.50 to 0.60 m. At the bottom the layer thickness gradually increased to about 2.5 m. With the area of 6,130 m2 and the average thickness of 1.55 m the volume of sediments would be at least 9501 m3. Even the reservoir area surface is smaller than the literature indicates, and so we estimate that the present volume of the reservoir is around 60,000 m3 of water.

Part of the sediment was removed and taken away but most flooded again after the reconsruction works had finished. Their chemical characteristics woul probably affect the quality of the intercepted water.

In the future it is necessary for the reconstruction of other reservoirs to compare obtained values and to evaluate the possibility of adverse changes in their characteristics.

4. CONCLUSIONS

The work was to evaluate the formation and qualities of historical sediments of water reservoirs in Banská Štiavnica. In present time Kolpašské Tajchy in Banský Studenec are under reconstruction. During maintenance works after deletion of the reservoirs they become available for exploration of sediments. After determining of their deposit and their amount, samples were taken for mechanical and chemical analysis. After their evaluation, we found out that their qualities are significantly influenced by their resources and operation. Interesting It is not only extreme soil reaction which is interesting but also a high content of organic matter. And also their large volume, despite the fact that water flows in only by means of rain ditches.

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ETHICAL CONSIDERATIONS IN THE FOOD CHAIN

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ABSTRACT

There are numerous questions to be discussed which are linked to agricultural ethics. Raw material production, animal husbandry, food production, commercialization and consumption have several ethical aspects. Nevertheless, up to now we have not dealt with ethical issues related to agricultural and food sciences comprehensively and institutionally. The agricultural ethics must find its proper place in the system of modern ethics along with bioethics, environmental ethics, business ethics and engineering ethics.

All of us are interested in foods, their availability, safety, nutritional status and wholesomeness. Our survival, health and welfare depend on the food supply, the production, processing and distribution of safe and healthy foods. In the developed world nowadays the question is not if we have enough to eat but more if the product is of high quality, safe and if it has been produced in a sustainable way while the environment and biodiversity was protected.

Owing to the technical and technological accomplishments of the 20th century, the domination of man has immensely grown on the environment. The activities of the participants of the food chain effect not only the natural but the sociocultural environment as well. Has mankind utilised rationally the available natural resources serving as a substantial background for the agricultural production and in this way for its own supply?

Does our quality of life improve with our growing wealth? Should we further burden the environment for our economic welfare? What will be the result of wasting the available and non-renewable resources? Can we meet the increasing demand of consumer society? Must we satisfy these expectations? Who has the right to decide which technology we may apply to achieve these goals? Are we aware of all the possible consequences of the new technology made by us? (Bánáti, 2008).

This paper reflects on some topics and questions of agricultural ethics such as global population growth, food security, rural-to-urban migration, ecological footprint, environmental concerns, consumption habits, food waste, biodiversity and new technologies which need more thorough discussion and debating in order to develop a long-term approach for a sustainable agriculture as the safeguard of future generations is needed. Of course, there are further ethical matters such as animal welfare, international trade or the question of bio fuels and brain drain which needs unfolding, however, this paper does not touch on these points.

1. INTRODUCTION

Ethics, simply put, refers to the rightness or wrongness of actions. People, groups, or institutions act ethically when they do "the right thing," and act wrongly when they do "the wrong thing." Obviously, one of the first problems encountered when thinking about ethics is "What makes actions right or wrong?" This thinking is referred to as the problem of finding ethical standards or criteria.

Food safety is an ethical issue because in the modern food production-transportation-processing-wholesaling-retailing chain, foods can be exposed to chemicals or microbial pathogens, or simply can be mishandled. The well-known food scandals of the last few decades such as the BSE, melamine, dioxin, avian flu or the H1N1 cases and the concerns of all kinds of residues, additives, antibiotics and hormones in foods generated consumers' fear of food worldwide.

Raw material production, animal husbandry, food production and commercialization have various ethical aspects. Nevertheless, up to now we have not dealt with ethical issues related to agricultural and food sciences comprehensively and institutionally. The agricultural ethics must find its proper place in the system of modern ethics along with bioethics, environmental ethics, business ethics and engineering ethics.

2. ETHICAL CONSIDERATIONS IN THE AGRI-FOOD CHAIN

There are numerous questions to be discussed which are linked to agricultural ethics. All are general topics, and a complete analysis is much more than can be presented here.

2.1. Global population growth

The world's population growth is currently following an exponential curve and is projected to reach approximately 9 billion by 2050 (FAO, 2001).

Could the Earth's resources sustain such a population? Common sense tells us that such growth cannot continue - otherwise within a few hundred years every square foot of the Earth's surface would be taken up by a human. Global population growth has already contributed to a serious loss of biodiversity and will pose serious ethical challenges to food production and distribution in the future.

Connected to the global population growth there is a problem of ageing population. Initially experienced by the more developed countries, the process has recently become apparent in much of the developing world as well. For the near future, virtually all countries will face population ageing, although at varying levels of intensity and in different time frames (Rahman et al. 2009).

2.2. Food security

792 million people lack access to food in the developing world (FAO, 2001). In the face of persistent and widespread hunger, therefore, the 1996 Rome Declaration on World Food Security and the World Food Summit Plan of Action reaffirmed the right of everyone to have access to safe and nutritious food and specified the need to clarify the definition of the right to food. They also reaffirmed the fundamental right of everyone to be free from hunger urging attention to the implementation and realization of these rights as a means of achieving food security for all (FAO, 1996).

2.3. Rural-to-urban migration

Rural-to-urban migration also continues in many parts of the globe, leading to a world that will soon have more urban than rural inhabitants. Given that young adults account for the majority of migratory moves, rural-urban migration tends to accelerate demographic ageing in rural areas, resulting in considerable shrinkages in the rural labour force. This

will have profound consequences for agriculture, as the transportation and processing of food products and people's ability to purchase them become even more essential as components of food security (FAO, 2001).

2.4. Ecological footprint

Our ecological footprint is the measure of our consumption level. An average of 2.28 hectares per person is needed to provide food, energy, fibre and other input for life. Huge inequalities exist around the world. Hardly more than half a hectare (0.53 ha) is needed in Bangladesh,
but the ecological footprint is 9.5 in the USA, 8.04 in Denmark, 5.4 ha in the UK, 4.98 ha in Austria, 3.96 in Poland, 3.55 ha in Hungary and 2.87 in Romania.
The ecological footprint includes the space needed for the production of crops, vegetables, catching fish et cetera, so, mostly the land used by agriculture for the production of raw materials. There are over 100 cities or regions worldwide which have assessed their ecological footprint. In 1961, the first year for which ecological footprint accounts are available, humanity's footprint was about half of what the Earth could supply – it was living off the planet's annual ecological interest, not drawing down its principal. Human demand first exceeded the planet's ability to meet this demand around 1986 and this state of overshoot has characterized every year since.
There are different approaches to reduce the ecological footprints, either aiming to reduce our direct impact on the environment by becoming more efficient in the use of resources or considering environmental matters when deciding which products and services to buy.
Consumers in industrialized, highly developed countries have much bigger footprints thus bigger responsibility than others. The total area of the Earth's surface needed to support our individual existence, our ecological footprint very much depend on the foods we buy, consume and waste (Bánáti, 2008).

2.5. Environmental concerns

Global agriculture will be under significant pressure to meet the demands of rising populations using finite, often degraded, soil and water resources that are predicted to be further stressed by the impact of climate change. The sector deserves more attention when it comes to both climate change threats and opportunities. The impact of climate change on agriculture could result in water shortages and drought, new diseases, heat stress and we can expect to see flooding and droughts becoming more frequent and more severe. Destruction of tropical forests and other native vegetation for agricultural production has a role in elevated levels of carbon dioxide and other greenhouse gases. Higher temperatures would eventually reduce yields of desirable crops, encourage weed and pest proliferation.
Agricultural production practices can have toxic effects through organic wastes and chemical pollution, which can affect no target organisms, leave chemical residues on food, and expose farm workers and other human beings to harm. Second, agricultural use of soil, water, and genetic resources can be wasteful. In many areas of the world, plant and animal genetic resources and land, air, water, forest and wetland resources - the renewable natural resources on which human life depends - are being rapidly degraded. Overuse of marginal lands continues apace, turning fields into deserts and depriving future generations of vital crop and pasture land. Simultaneously, misuse of irrigation water is depleting aquifers and causing the salinization of fertile lands. Long-term approach and the safeguard of future generations is needed (FAO, 2001).

2.6. Change in lifestyle and consumption habits

There is a change in lifestyle and consumption habits. Consumers in the developed regions of the world have a wide choice of what and how much to eat, how to consume and waste their foods. They have a sufficient supply of safe and nutritious foods, very often even a surplus of foodstuffs (Bánáti, 2008). The less frequent shopping, longer shelf-life foods, the consumption of highly processed and ready-to-eat convenience foods often result in unhealthy conditions of humans in these countries. There are an increasing number of overweight and obese people suffering from diet-related diseases and there is a strong correlation between bad consumption habits and these diseases. Responsibility lies not only with food producers, food business operators, policy-makers but also with individuals and their choices in food consumption. However, contradictory information provided by the media on what to eat, how much to eat or about matters such as GM foods and food additives is not helping consumer awareness either.

Moreover, there is the question: as billions of people around the world seek to emulate the high meat-consuming diets of the developed countries, how long will the Earth's natural resources be able to sustain an industrial agricultural system devoted to high-volume, low-cost, monoculture production of animal feedstuffs? (CAST, 2005).

2.7. Food waste

The wastage of food occurs at all stages of the life cycle of food, starting from harvesting, through processing and production via trade and finally consumption and household level. A 50 % reduction in food waste could reduce the environmental impact (in the form of greenhouse gas emissions) by 25 %. However, besides the considerable impact on the environment the expenditures of labour, energy, resources and waste management which have to be spent along the food's life cycle need to be looked at from an ethical point of view (Schneider, 2008).

2.8. Biodiversity

Biodiversity is threatened as a result of widespread specialization in agricultural production, industrial pollution, deforestation and the introduction of invasive species. Traditional and modern farming methods need to be reconciled in order to maintain indigenous knowledge of diversified farming systems and biodiversity.

Today's limited use of plant biodiversity for food production can be illustrated as shown in Figure 2.

250 000 plant species are known to humankind

More than 30 000 plant species are edible

About 7 000 have been used for food

About 120 are cultivated today

9 species provide more than 75% of human food

Only 3 species provide more than 50% of human food
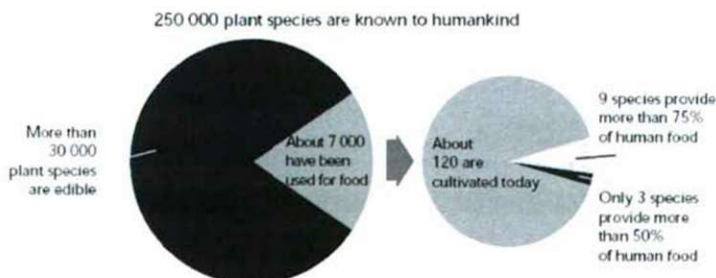
Figure 2. Today's limited use of plant biodiversity for food production (FAO, 2001)

2.9. New technologies

Another reason for ongoing ethical dilemmas is that new technologies might have unexpected consequences. Science and technology have provided great benefits in the past and are likely to do so in the future, as long as they are properly managed and applied.

New technologies such as xenotransplantation, cloning, genetic modification and nanotechnology have emerged into the agro-food industries and with their help we can meddle in nature in an unbelievable way. How far should we go?

New technologies generate both admiration and fear in society. They ensure unprecedented opportunities (e.g. the genetically tailored diet) but they can also carry unforeseen hazards (e.g. the accumulation of nanoparticles). Modern technology gave numerous opportunities into the hand of mankind and we must set its limits. Simultaneously with the appearance of new ethical norms, we must be prepared for analysing the consequences to be observed in the future (Bánáti, 2008). Science and technology have provided great benefits in the past and are likely to do so in the future, as long as they are properly managed and applied. When deciding whether certain developments or technologies should be accepted or promoted, we have to look at the risks and the benefits.

3. CONCLUSION

After all, the most direct strategy for institutionalizing ethics is for everyone in the food system to begin to include some consideration of ethics in the actions, decisions, and policies they create or support. This strategy means that farmers, food processors, scientists, research administrators, regulators, and decision makers at the highest levels routinely would reflect on the ethical rightness or wrongness of their own actions and decisions, as well as those of others; engage in debate as appropriate; and, ultimately, try to act ethically. The improvement of sustainable production in agriculture, including forestry and fisheries, should generally be beneficial to all.

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TRANSLATIONAL MOTIONS IN HUMAN KNEE JOINT MODEL

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ABSTRACT

Different authors are dealing with description of motion components of human knee joint. The relative motion between femur and tibia realized by knee joint is ensured by complicated condyle surfaces and ligaments. Main part of authors focus merely on rotational displacement of human knee joint such as flexion-extension, abduction-adduction, tibial rotation. In order to achieve implanted prostheses we have to recognize not only the rotational but also translational kinematical parameters of human knee joint.

Authors of this paper for description of motion of knee joint joined coordinate-systems on the basis of anatomical landmarks to the femur and tibia moreover joined a three-cylindrical mechanism as mechanical model to the axes of coordinate-systems. In 2nd phase authors determined the six independent kinematical parameters of tibia compared to the fixed femur during flexion and extension. The experimental examinations were carried out on cadaver knees. The positioning was tracked by optical positioning appliance.

1. INTRODUCTION

Different constraints enable relative motion of joined rigid bodies referring to each other. The constraints depending on their shapes have one or more degree of freedom. In case of joints the degree of freedom cannot be always determined. It is expedient to treat the human knee joint as six degree of freedom because of its complicated shape. In this case to the precise description of motion achieved by knee joint we need six independent position parameters [1, 7].

In recent years the number of kinematical models of anatomical joints has increased. In case of certain models so many researchers have measured and described joint motion with less than six degrees of freedom. Obviously the treatment of six degree of freedom models is the most difficult. The motion of human knee joint can be described by following components: The flexion-extension is defined around the medio-lateral axis, internal-external rotation around the tibial axis and the abduction-adduction around the anterior-posterior (floating) axis. The medio-lateral translation is measured along the medio-lateral axis, proximal-distal translation along the tibial axis and antero-posterior translation along the mutually perpendicular floating axis.

Description of motion components in such a way a little bit subjective. In order to descript the motion components precisely it is needed to join coordinate-systems to the femur and tibia consequently.

In recent decades to measure kinematical parameters of human knee joint different methods have been developed. In these methods it is measured and processed the motion of markers fastened to femur and tibia referring to each other. In vitro mechanical

investigations are mainly phantom or simulated computer models or cadaver motion experiments [7].

The visual examinations were based on marker technique to sign single points or axis of the extremities delineating their motion. In spite of that the newly introduced techniques developed in an enormous numbers in the last decades e.g. the radiology, fluoroscopy, three-dimensional CT, MRI, stereophotogrammetry, ultrasound, etc. most of the results were unreliable, inconsistent with other published data [3, 4, 5, 6]. The range of the tibia out and in-rotation along the flexion-extension motion of the knee had been established by different authors as between 5 up to 17 degrees, moreover the character of this diagram is variable [8, 9]. On the basis of difference of published results it is quite difficult to establish exact character concerning the motion of knee joint.

2. METHOD

Authors developed a special appliance [10, 11, 12] in order to make a serial experiments. The aim of them was the determination of change of six independent kinematical parameters of tibia (shin bone) compared to femur (thigh bone) during of motion of human knee joint. From recorded data needed parameters can be determined by the aid of kinematical model.

To the presented sensitivity investigation it is necessary to determine anatomical landmarks on femur and tibia moreover coordinate-systems joining to the determined anatomical landmarks. Details of this process can be found in paper of Katona et al [13, 14, 15]. Considering the biological characters of femur and tibia the optical positioning of anatomical landmarks can be achieved with more or less position mistakes. The aim of this paper is the determination of the effects on kinematical parameters of position mistakes during flexion-extension of human knee joint.

Authors on the basis of current international standards and conventions (e.g. from the International Society of Biomechanics) [16] using the above mentioned anatomical landmarks joined coordinate-systems to femur and tibia.
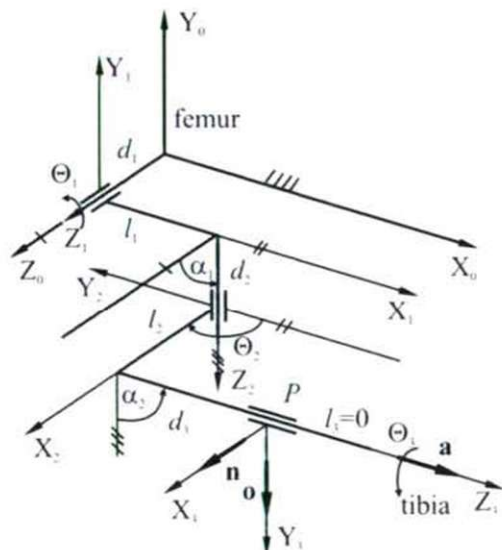
Figure 1. Model in straighten position of the knee joint

3. THE KINEMATICAL MODEL OF THE KNEE JOINT AND OBTAINED RESULTS

The Denavit-Hartenberg coordinates **Hiba! A hivatkozási forrás nem található.** can be used with advantage if the kinematical pairs are cylindrical or planar joints (moving in 3 dimensions). The three-cylinder model of the knee joint: The HD coordinates can be seen at straightens position of the knee joint in Fig. 1. The parameters $(a_i, l_i, (i=1,2,3))$ can be manipulated optionally because of the specific geometry of the knee joint. On the basis of recommended references the following values are proper approaches: $a_1=a_2=90°$, $a_3=0°$, $l_1=l_2=l_3=0$.
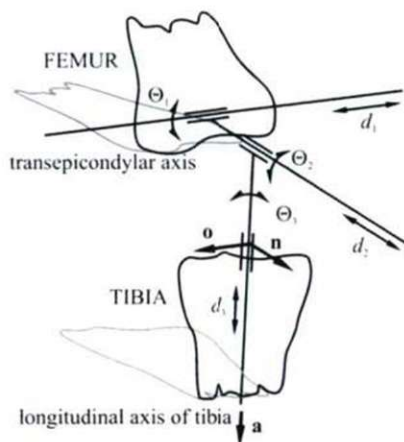
Figure 2. The three-cylinder kinematical model of the knee joint

If these are applied to a three-cylinder model, then the kinematical model of the knee joint is suitable for determining the variables in motion as a three dimensional open-chain mechanism (Fig. 2.).

The definition of these is:

$-\Theta_1$ – flexion,

$-\Theta_2$ – ab/adduction,

$-\Theta_3$ – rotation of the tibia,

$-d_1, d_2, d_3$ – moving on accordant axes.

It is practical to plot these values in function of flexion [1,2]. The matrix-equation will be the next if the perpendicularity of the axes is taken for granted as the previous.

$$\begin{bmatrix} \cos\Theta_1 & 0 & \sin\Theta_1 & 0 \\ \sin\Theta_1 & 0 & -\cos\Theta_1 & 0 \\ 0 & 1 & 0 & d_1 \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} \cos\Theta_2 & 0 & \sin\Theta_2 & 0 \\ \sin\Theta_2 & 0 & -\cos\Theta_2 & 0 \\ 0 & 1 & 0 & d_2 \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} \cos\Theta_3 & -\sin\Theta_3 & 0 & 0 \\ \sin\Theta_3 & \cos\Theta_3 & 0 & 0 \\ 0 & 0 & 1 & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} n_x & o_x & a_x & P_x \\ n_y & o_y & a_y & P_y \\ n_z & o_z & a_z & P_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The next system of equations can be derived from the matrix-equation.

$$n_x = \cos\Theta_1 * \cos\Theta_2 * \cos\Theta_3 + \sin\Theta_1 * \sin\Theta_3$$

$$n_y = \sin\Theta_1 * \cos\Theta_2 * \cos\Theta_3 - \cos\Theta_1 * \sin\Theta_3$$

$$n_z = \sin\Theta_2 * \cos\Theta_3$$

$$o_x = -\cos\Theta_1 * \cos\Theta_2 * \sin\Theta_3 + \sin\Theta_1 * \cos\Theta_3$$

$$o_y = -\sin\Theta_1 * \cos\Theta_2 * \sin\Theta_3 - \cos\Theta_1 * \cos\Theta_3$$

$$o_z = -\sin\Theta_2 * \sin\Theta_3$$

$$a_x = \cos\Theta_1 * \sin\Theta_2$$

$$a_y = \sin\Theta_1 * \sin\Theta_2$$

$$a_z = -\cos\Theta_2$$

$$P_x = d_3 * \cos\Theta_1 * \sin\Theta_2 + d_2 * \sin\Theta_1$$

$$P_y = d_3 * \sin\Theta_1 * \sin\Theta_2 - d_2 * \cos\Theta_1$$

$$P_z = -d_3 * \cos\Theta_2 + d_1$$

Several conditions should be considered to derive and solve the system of equations. The conditions were the knowledge of the **n, o, a** unit vectors and the origin (P) of the $X_3Y_3Z_3$ coordinate-system attached to the tibia in the $X_0Y_0Z_0$ system (Fig. 1.). The roots of the system of equations: Θ_1, Θ_2, Θ_3, d_1, d_2, d_3. In Fig. 3-4 the obtained diagrams can be seen.

W-3, right leg, 11-05-2009

Flexion-extension, degree (teta 1)

—♦— Abduction-adduction, degree (teta 2)   —■— Tibial rotation, degree (teta 3)
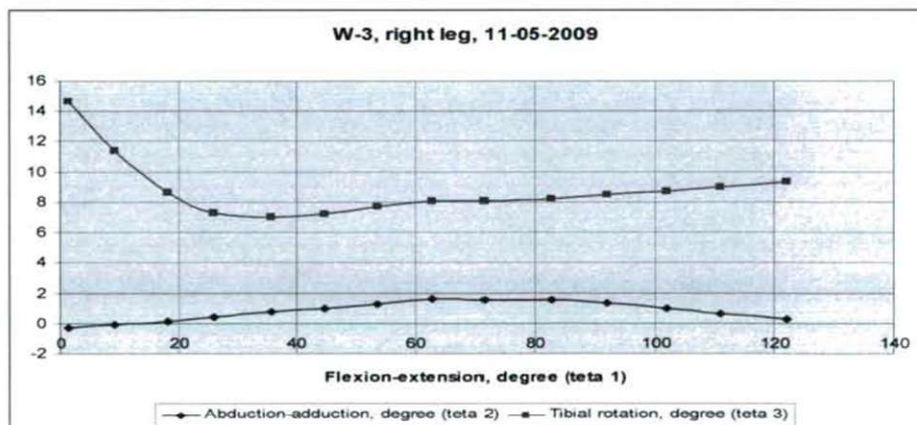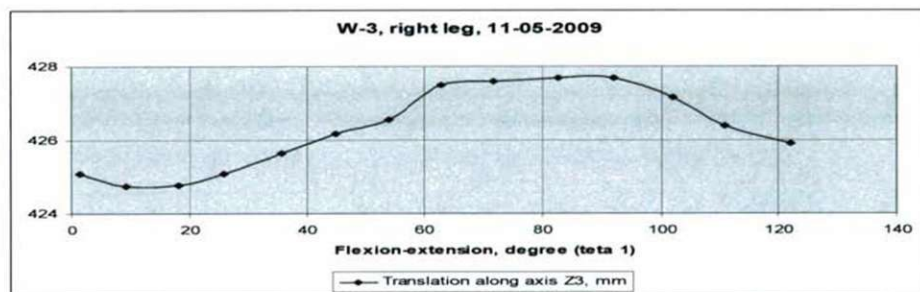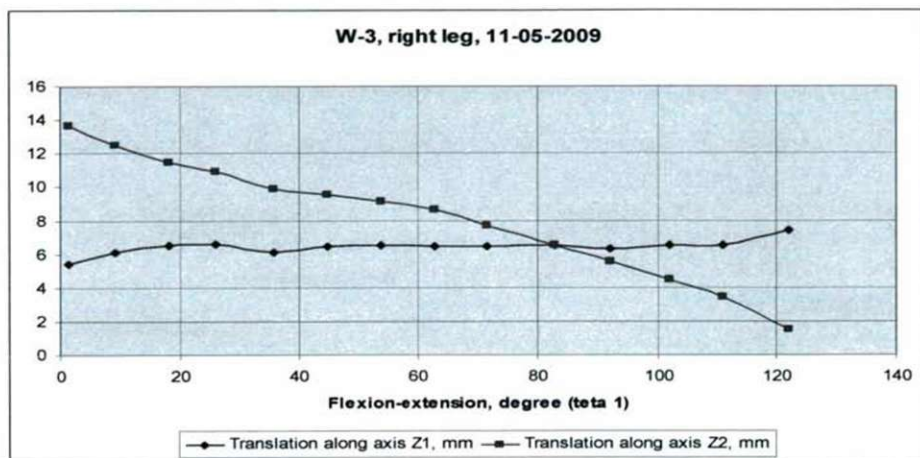
Figure 3. Obtained kinematical parameters of right cadaver knee joint
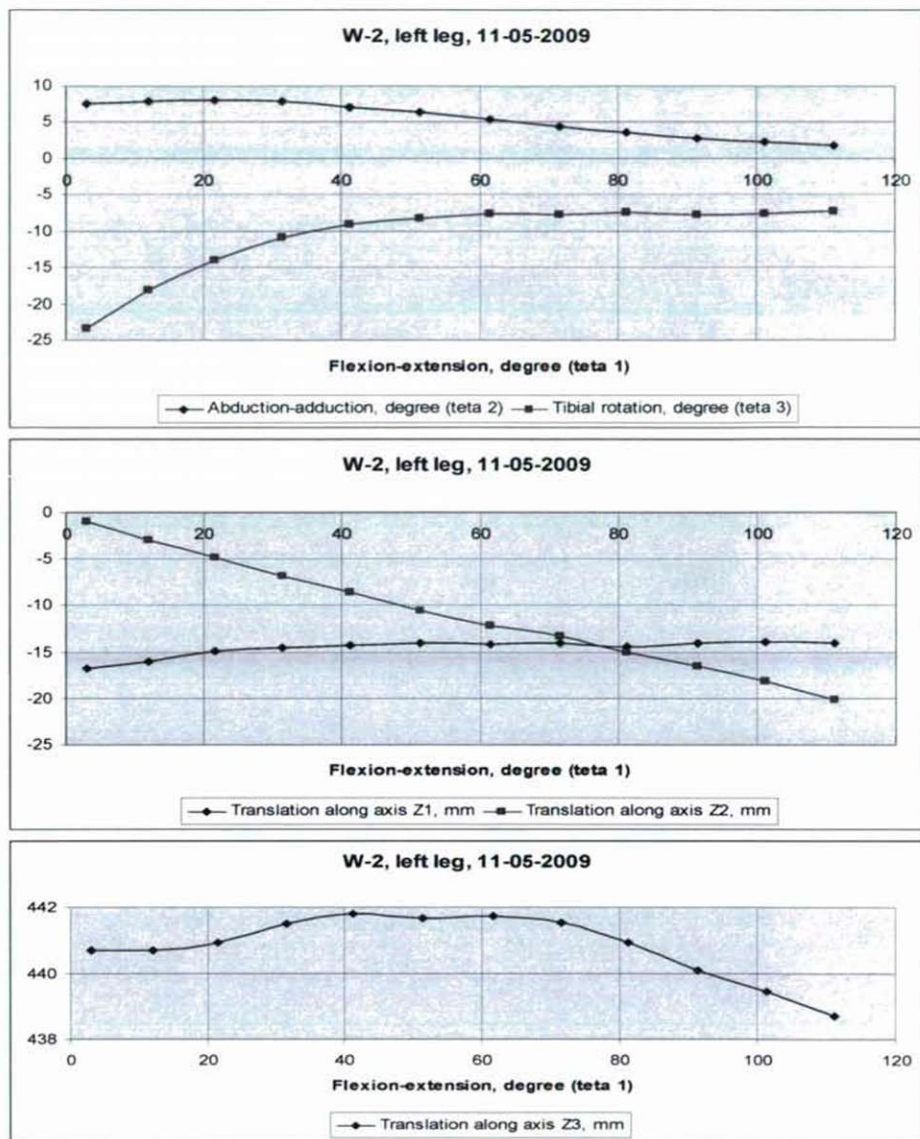
Figure 4. Obtained kinematical parameters of left cadaver knee joint

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INFLUENCE OF DIFFERENT CATALYSTS ON TRANSESTERIFICATION OF SUNFLOWER OIL

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ABSTRACT

Biodiesel, nontoxic environmentally-friendly renewable fuel, is a mixture of different fatty acid methyl esters produced by transesterification of vegetable oil triglycerides. Content of particular FAMEs is one of the qualities of biodiesel that is regulated (standard EN 14214). FAME composition of biodiesel depends upon the feedstock and its quality. In Serbia for production of biodiesel rapeseed and sunflower oil (SFO) are mostly used, although waste frying oil from household and restaurants is possible and economically more favorable feedstock.

Since transesterification of triglycerides is catalyzed reaction, aim of this work was to investigate the influence of different catalysts on FAMEs yield. NaOCH3, NaOH and KOH with HCl were studied as the catalyst for reaction of transesterification. FAMEs mixtures derived by transesterification of refined and different waste frying SFO samples in the presence of mentioned catalysts were qualitatively and quantitatively analyzed using gas chromatograph coupled with mass spectrometer as a detector.

Content of FAMEs was the highest both for refined and waste frying SFOs when KOH and HCl were used as catalyst for transesterification. The method which uses KOH and HCl as catalyst was the fastest among investigated methods.

1. INTRODUCTION

A shortage of fossil fuel recourses, alongside high prices of these fuels, has caused intensive researches in the field of renewable fuels. Biodiesel is nontoxic environmentally-friendly renewable fuel which is produced from animal fats and vegetable oils. It can be used solely, or as a mixture of different ratios with fossil diesel, as a fuel for diesel engines. Biodiesel is a mixture of fatty acid methyl esters (FAMEs) that are produced by transesterification of triglycerides of vegetable oils or animal fats. In Serbia the most important feedstock for production of biodiesel are rapeseed and sunflower oil. Although vegetable oils are main feedstock for biodiesel production, waste frying oils from restaurants and households are possible and economically more favorable feedstock. Properties of biodiesel are regulated by standard EN 14214, which specifies, among others, the FAMEs content in fuel [1]. This content, on the other hand, depends upon feedstock qualities, as well as production i.e. transesterification method.

Transesterification (alcoholysis) is catalyzed reaction of vegetable oils' triglyceride and alcohol, usually primary or secondary aliphatic ones, resulting in a formation of fatty acid alkyl ester and glycerol. In a case of methanol, as mostly used alcohol, different fatty acid methyl esters (FAMEs) are obtained [2, 3]. Wide range of parameters has an influence on the rate of the transesterification of the triglycerides from vegetable oils: molar ratio of the reactants, temperature, reaction time, stirring rate and type of catalyst [2, 3]. Possible catalysts for transesterification are acid, alkali or enzyme. According to the literature data reaction with alkali catalysts is faster that the transesterification with acid catalysts and less

corrosive. Researches of enzymatic catalysts have started recently; however, their use is still expensive and time-consuming. Possible alkali catalysts are NaOH, KOH, $NaOCH_3$, $KOCH_3$ and carbonates [2, 3].

In this work the influence of three alkali catalysts namely NaOH, $NaOCH_3$ and KOH with HCl was investigated with aim to determine which one gives the highest yield of FAMEs. Gas chromatography coupled with mass spectrometry was used for qualitative and quantitative determination of FAMEs content in samples of transesterified refined (RSFO) and waste frying sunflower oil (WFSFO). The results of transesterification of WFSFO were compared with the results of RSFO.

2. EXPERIMENTAL

2.1. Materials

Two WFSFO samples, one collected from household and the other from restaurant, with experimentally measured iodine numbers 104.76 and 101.62 and acid values 2.21 and 2.58, respectively, and RSFO sample with an iodine number of 113.94 and an acid value of 6.68 provided by "AD Dubravka", were used for transesterification. For GC-MS analysis FAME mix C8-C22 18920-1AMP, producer Supelco, Bellefonte was used as external standard.

2.2. Methods

The Hanus method for the iodine number [4] and the AOCS Cd 3a-63 method for the acid value [5] were used in this work.

Acid value is determined by neutralizing 1-2 g of oil diluted in 50 ml of acetone with 0.1M solution of KOH in alcohol in the presence of phenolphthalein as an indicator.

Transesterification of 100 mg of oil sample with 10 ml of freshly prepared 0.28M solution of $NaOCH_3$ in methanol is done on 75°C for 20 minutes with constant stirring rate 1000 rpm in round bottom flask equipped with condenser. Mixture is transferred into the separation funnel where 20 ml saturated NaCl solution is added. FAMEs are extracted by adding 10 ml diethylether and 50 ml distillated water. FAMEs from water layer are extracted one more time with 15 ml diethylether after separation of the layers. Organic layers from first and second extraction are joined are dried by adding Na_2SO_4. Sample is left over night, filtrated and evaporated (35°C, atmospheric pressure) to 1 ml [6].

Transesterification with NaOH is used for neutral oils with acid value below 2. 0.5 ml methanol solution of NaOH (1 mol/l) is added to mixture of 4 g oil and 40 ml methanol. Mixture should be heated up to a boiling point. The reaction reaches end point when mixture becomes clear usually after 5-10 minutes. After cooling, 20 ml heptane and 40 ml water are added to the mixture. FAMEs layer is separated and dried with Na_2SO_4. After filtration solvent is removed by evaporation (50°C, 150mbar) [7].

First step of transesterification with KOH and HCl is saponification of triglycerides with KOH and the second step is esterification of the soaps in the presence of HCl into FAMEs. 120 mg of oil is placed in 10 ml tube with ground cork. After adding 2.4 ml petrol ether, a mixture is shaken for 10 s. 0.6 ml methanol solution of KOH (2 mol/l) is added to the mixture which should be shaken again for 20 s. The mixture is heated for 1 minute in water bath at 60°C. After the mixture is shaken for 20 s, 1.2 ml HCl solution in methanol (1

mol/l) is added. 4 ml petrol ether is added in tube. After shaking ester layer is removed. Petrol ether is removed by evaporation in nitrogen stream up to 1 ml [8].

The cleanup of the FAME samples before GC-MS was done on silica gel column which was prepared inside Pasteur pipette. Glass wool is placed on the bottom of the pipette. 0.3 g activated silica (heated at 120°C for 2h) and 0.3 g anhydrous Na_2SO_4 are put above the wool, respectively. The column is conditioned with 5 ml cyclohexane. After the sample is applied, FAMEs are eluted with 5 ml mixture cyclohexane:ethylacetate=2:1 v/v. Elute is collected is 25 ml round bottom flask. After adding 1 ml toluene, sample is evaporated up to 1 ml.

GC/MS system consisting of instruments Trace GC and Trace MS, Thermo Finnigan, Germany with capillary column OPTIMA 240, Machery Nagel: 60m × 0.25mm ID × 0.25 μm film thickness was used for analysis of the samples after transesterification. Working temperature of GC column was programmed as follows: initial temperature 80°C, 20°C/min to 120°C, 3°C/min to 240°C that was held for 10 min. Helium flow of 1.5 ml/min was constant. 1 μl of the sample was injected automatically by AS 2000 autosampler, Thermo Finnigan, Germany. PTV injector, which was working with split ratio 10:1, had initial temperature 60°C that was constantly risen 14.5°C/min up to 260°C. MS parameters were set to following values: interface temperature 250°C, ion source temperature 220°C, ionization energy 70eV. Full scan mode was done with ion mass range 50-500 a.m.u. For quantitative analysis of the samples by external standard method SIM technique was used.

Qualitative analysis of the FAME was done applying NIST library of mass spectra for EI.

Total relative content of FAMEs which represents mass fraction of FAMEs (C14:0-C21:1) in sample after transesterification is determined by modified standard method JUS EN 14103 [9]. Methyl ester of margaric acid is used in this method as internal standard.

Relative content of each FAME was determined by modified AOAC-IUPAC method [10]. Relative content of FAMEs was calculated after assessing of correction factors for transfering area into mass fractions.

Content of each FAME was determined by external standard method. FAME standard solutions in hexane of following concentrations 0.005 mg/ml, 0.05 mg/ml, 0.25 mg/ml, 0.5 mg/ml and 1 mg/ml were used for obtaining a calibration curve. Blank sample, standards and samples were analyzed in triplicate.

3. RESULTS AND DISCUSSION

Determined acid values of the RSFO and WFSFO from household and restaurant were 6.68, 2.21 and 2.58 (analysis were done in triplicate expressing results as mean value), respectively. Since acid values of all samples were higher than 2, transesterification with NaOH was not applicable.
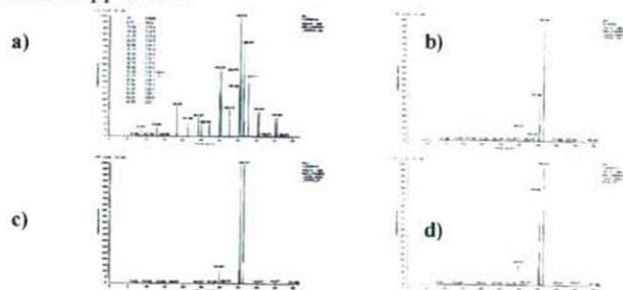
Figure 1. Chromatograms of: a) FAMEs standard and FAMEs obtained from b) RSFO c)WFSFO household d) WFSFO restaurant

Chromatograms of FAMEs standard and FAMEs obtained from RSWO, household and restaurant WFSFO when KOH with HCl was used as catalyst are shown in Figure 1. For all analyzed samples peaks of FAME C14:0, C15:0 C16:0, C16:1, C17:0 C18:0, C18:1 cis, C18:2 cis, C18:2 trans, C18:3, C16:1, C20:0, C20:1 and C20:1 are well separated.

Total relative content of FAMEs, shown in Table 1, is higher for all samples when KOH with HCl was used as catalyst, instead of $NaOCH_3$.

Table 1. Total relative content of FAMEs obtained by transesterification of RSFO and WFSFO

Sample	Total relative content of FAMEs (%)	
	$NaOCH_3$	KOH+HCl
RSFO	86.58	99.33
WFSFO Household	88.94	99.96
	79.79	96.23

Relative content of FAMEs (%) is given in Table 2. Since the standard mixture does not contain trans form of linoleic acid, content of linoleic acid was calculated as sum of its trans and cis form using correction factor for cis form. A choice of the catalyst reflected the most on the relative content of obtained FAMEs in the case of RSFO. Change of relative content of two dominant FAMEs, namely C18:1 cis and C18:2 cis+trans, for both WFSFO samples was less than 0.9%.

Table 2. Relative content of FAMEs obtained by transesterification of RSFO and WFSFO

FAME	Relative content of FAMEs (%)					
	RSFO		Household WFSFO		Restaurant WFSFO	
	$NaOCH_3$	KOH+HCl	$NaOCH_3$	KOH+HCl	$NaOCH_3$	KOH+HCl
C14:0	0.09	ND	0.07	0.05	0.14	0.11
C15:0	ND	ND	0.01	0.01	ND	ND
C16:0	5.53	6.21	7.25	6.53	9.59	9.84
C16:1	ND	ND	0.50	0.30	0.66	0.38
C17:0	ND	ND	ND	ND	ND	ND
C18:0	7.83	0.77	3.98	3.65	5.73	5.71
C18:1 cis	28.09	16.96	38.03	38.58	28.03	28.69
C18:2 cis+trans	55.92	76.07	49.19	50.17	54.86	54.44
C18:3	0.31	ND	0.15	0.10	0.18	0.10
C20:0	0.55	ND	0.18	0.13	0.22	0.19
C20:1	0.25	ND	0.18	0.13	0.22	0.18
C22:0	1.43	ND	0.46	0.34	0.37	0.35

The contents of detected FAMEs (mg/g) are given in Table 3. Total FAMEs yield was higher for all samples when transesterification was catalyzed by KOH with HCl. The highest influence of catalyst was observed when RSFO was transesterified: the FAMEs yield was 306.53 mg/g when $NaOCH_3$ was used as catalyst and 955.56 mg/g when KOH with HCl was applied as catalyst. The highest yield of FAMEs 957.32 mg/g was obtained when RSFO was transesterified in the presence of KOH with HCl.

Table 3. Content of FAMEs determined by external standard method

FAME	FAMEs content (mg/g)					
	Raw SFO		Household WFSFO		Restaurant WFSFO	
	NaOCH₃	KOH+HCl	NaOCH₃	KOH+HCl	NaOCH₃	KOH+HCl
C14:0	0.05	1.76	0.59	0.94	1.10	3.60
C15:0	0.08	0.29	0.17	0.13	0.12	0.23
C16:0	16.70	42.50	58.47	53.84	59.42	63.91
C16:1	1.27	3.75	4.01	4.51	4.50	5.82
C17:0	0.19	0.31	0.46	0.41	0.55	0.65
C18:0	29.02	37.09	47.59	35.82	40.24	45.02
C18:1 cis	84.75	212.53	372.06	390.86	165.01	179.42
C18:2 cis+trans	159.49	629.83	417.47	452.68	347.46	566.75
C18:3	2.52	8.26	9.23	9.64	7.81	7.94
C20:0	2.28	6.29	2.35	2.06	2.14	6.46
C20:1	2.80	3.74	1.11	1.06	0.56	0.79
C22:0	7.38	9.21	6.56	5.37	4.68	9.95
SUM	306.53	955.56	920.07	957.32	633.59	890.54

4. CONCLUSION

NaOH was not used as a catalyst since acid values of RSFO and both WFSFO were higher than 2. Total relative content of FAMEs and content of FAMEs in obtained mixture was higher for both refined and waste frying SFO when KOH with HCl was used as catalyst for trasesterification in comparison to NaOCH₃. Relative content of particular FAMEs is less dependent of the catalysts for WFSFOs than for the refined SFO. Transesterification of RSFO in the presence of KOH with HCl gave the highest yield.

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EFFECT OF LACTOSE HYDROLYSIS ON MILK FERMENTATION AND SOME PROPERTIES OF CURD

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ABSTRACT

Much of the World population suffers in lactose intolerance so these people mustn't eat milk and milk products without lactose pre-hydrolysis. Nowadays, dairy firms produce more and more lactose hydrolysed milk products for people suffered in lactose intolerance and enjoy the benefit of milk and milk products consumption. One of the most popular milk products are the fermented products such the yogurt. Well known, that lactose hydrolyzed milk has a sweeter taste and more prone to strong Maillard reaction. But the other technological properties and/or consequences of these are less investigated.

We observed a significant effect of the rate of lactose pre-hydrolysis on the acid clotting time, pH, and the gel firming. The pre-hydrolysis of raw milk (from 4.62% to 3.87%) accelerated the pH decrease so the clotting time was about 30 minutes shorter than in the control samples. The hydrolysis of raw milk accelerated the speed of pH decrease in lactase inactivated milk samples. Further difference was observed in the gel firming. The pasteurized than pre-hydrolysed and lactase inactivated milk samples showed better gel firmness at 4,6 pH. The biggest difference in gel firming was approximately four fold in hydrolysed raw milk samples versus control samples. The trend of pH and clotting changes was different in doubly pasteurized milk samples.

Keywords: lactose hydrolysed milk, fermentation, yogurt, acid gelation

1. INTRODUCTION

Lactose is the main carbohydrate in milk. The average content in cow's milk is usually between 4.5-5.0% (wt/vol) in cow, sheep and goat milk. During a normal digestion in a human lactose is hydrolyzed into glucose and galactose a process catalyzed by lactase normally in the intestinal mucosal cells and released to the intestinal juice (1). Low lactase activity is a relatively common abnormality of the small bowel in man. These lactose intolerant people don't able to hydrolyze lactose so lactose intake affects gastrointestinal symptoms in this people. Lactose intolerance is prevalent in most areas where there are few dairy animals or where adults use little or no milk. The proportion of lactose intolerance varies widely among region, from 10 to 90% (2).

Hydrolysis of lactose also will take place during milk processing, more exactly during fermentation and the monosaccharides produced are assumed to be utilized by the organisms. This fermentation reduces lactose in milk about to two thirds of the original level (2) so lactose intolerant to be given a chance to consume these products, but the partially hydrolysis don't guarantee the lack of symptoms fully. Lactose free milk products produced by lactase adding don't cause symptoms. Furthermore, the lactose maldigesters

should be able to tolerate foods small amount of lactose, not more than 2-6g per serving (3).

It is important to note, that the lactose derivatives lactulose, lactitol and galacto-oligosaccharides find applications in foods and pharmaceutical preparations as prebiotics to promote gut health. Similarly to non-digested lactose, these compounds enhance the intestinal absorption of calcium and magnesium. Other lactose-derived compounds (e.g., tagatose and lactobionic acid) have potential applications as bioactive ingredient in foods (4). So the lactose hydrolysed milk products have more benefit compared to the products from non-hydrolysed milk. It is found many lactase enzyme products in the market having different activity and properties, but problems can appear in milk processing inhibiting the fully hydrolysis. Further problems the excellent quality, heat stability, and the shelf life. It was observed a high reactivity of lactose-hydrolyzed milk to the Maillard reaction and the more limited chemical stability of products during storage (5, 6).

More inactivating and reactivating agents of lactase have already investigated. The enzyme can be inactivated by ethylenediaminetetraacetic acid tetrasodium salt or dialysis against distilled water, and activity can be recovered partially upon addition of magnesium ++ or manganese ++ salts at optimal concentrations. Heavy metals and p-chloromercuribenzoate can strongly inactivate the enzyme, indicating sulphydryl groups and their requirement for lactase activity. O-nitrophenyl-/3-D-galactopyranoside hydrolysis also can inhibit competitively by lactose, methyl-fl-D-galactoside, galactose, galacturonic acid, ribose, and galactitol; but neither glucose nor melibiose can affect enzyme activity (7).
Heat treatment also affect the enzyme activation. It was observed that heat treatment of milk significantly increases lactase activity, due to the liberation of free SH groups. Authors suggested, that this enzyme activation can be reversed by oxidizing the reactive sulfhydryl groups, proving that the observed effect may be related to the release of free SH to the medium, rather than to the denaturation of a thermo labile protein inhibitor (8)
The heat sensitivity of enzymes extracting from different microorganisms is different. The lactase from Bacillus stearothermophilus is quite heat resistant (9) so this enzyme can used in hot milk (70°C) so we can make lactose hydrolysis and microbe killing simultaneously.
These mentioned observes confirms, that the lactose hydrolysis has significant effects on the processing and quality of these milk products.
Our aim was to observe the effect of lactose hydrolysis on the fermentation speed and the coagulation properties (coagulation time, viscosity of gel) using yogurt as a test product.

2. MATERIAL AND METHODS

2.1. Making of samples
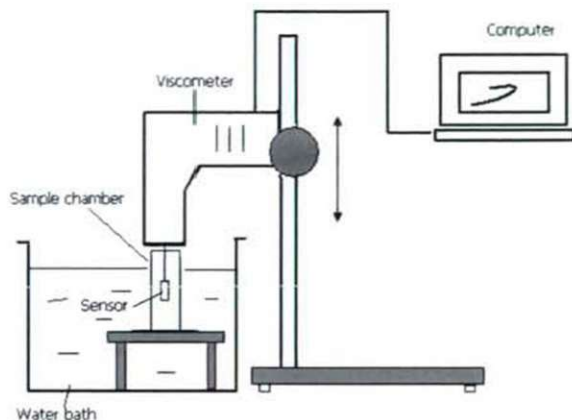
Figure 1. The coagulation measurer system

Raw com milk was homogenized (20 MPa), pasteurized (90°C with 30 sec. holding) and cooled (at 40°C) cow milk for lactose hydrolysis adding 1.00 ml Maxilact 2000 lactase enzyme (Gijst Brocades) to 3.0 litres milk. Hydrolysis was performed at 40°C in a thermostat (Memmert UNB 200, Schwabach, Germany) for 15, 30 and 45 minutes in raw milk samples and for 60 minutes in pasteurized milk samples than the samples were heated up to 80 °C (with 1 min. holding) to inactivate the enzyme. The samples were cooled to 45 °C for inoculation and fermentation. So we had samples which were heat treated once and twice.

For fermentation Chr. Hansens Yo Fast 88 starter was used inoculating into the pre-treated samples. First, solution was made from 0.20 g lyophilized culture and from 9.80g distilled water, than 30 minutes conditioning was used before inoculation with 0.500 ml into 100 ml milk. Each measuring was repeated fivefold.

2.2. PH and gelation measure

PH was measured with Thermo Orion-3 Star pH meter (Thermo Fisher Scientific Inc).

Coagulation properties were investigated with SV 10 oscillatory viscometer (A&D Company, Japan). The sensors of viscometer cut the protein net partly, but this time (point) is affected by the clotting ability of milk. Therefore it able the observing to show the differences in the clotting ability of the milk samples resulted different pre-treatment (hydrolysis). The constant temperature of samples was kept with water bath (Memmert WNB 14 Schwabach, Germany)

3. RESULTS AND DISCUSSION

We observed unexpected differences in the pH and gel properties between once and double pasteurized milk samples. The development of fermentation was faster in hydrolyzed but

only once heated milk samples than in non hydrolyzed samples (Fig 2.). This phenomenon corresponds with the information of the producer.
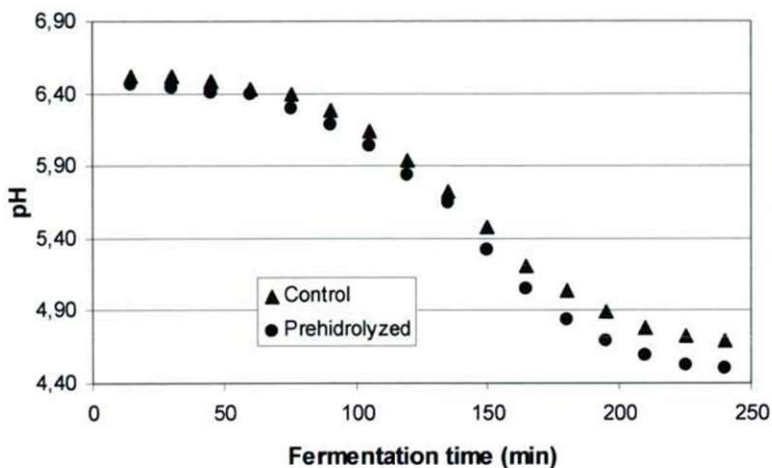
Figure 2. PH changing in milk samples during the fermentation

The clotting occurred sooner (after 210 min) in hydrolysed milk samples than in non hydrolysed samples. The clotting time of non hydrolysed samples was 240 min. So the clotting time of hydrolysed milk samples were 30 min. shorter than in non hydrolysed milk. The explanation of this remarkable difference of clotting time and pH can be the faster microbe growing in milk is rich in monosaccharides This difference is markedly affect the processing time of lactose hydrolysed yogurt but this time gain in the fermentation only compensates the time of hydrolysis.

The trend of lactose decrease was similar both in hydrolysed and control milk samples. The lactose content of control samples was 3.30% at the clotting (30% decrease). The degree of lactose decrease was better in hydrolysed milk samples (40%) as compared to the initial 3.83% and the lactose content at the clotting was 2.32% (Fig 3.).

This markedly lower lactose content can decrease further during the cooling and storage probably, but most likely doesn't reach the wanted low level, so this is not a lactose free milk product. Even so, this low lactose level in yogurt doesn't causes symptoms likely in many lactose intolerant people or these people can eat more yogurt without symptoms (10).
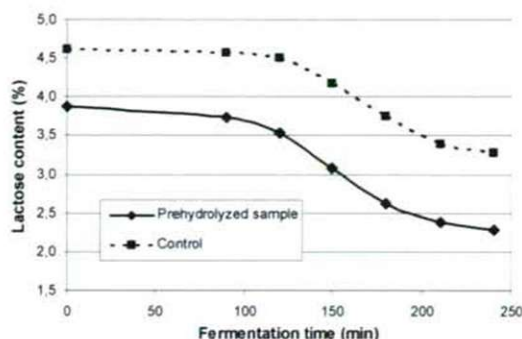
Figure 3. Lactose changing in milk samples during the fermentation

Fig 4. demonstrates the changes in the clotting time and gel viscosity among the control and hydrolysed samples with different hydrolysation time. As it can be seen, longer lactose hydrolysis time caused shorter clotting time (the peak of curves).
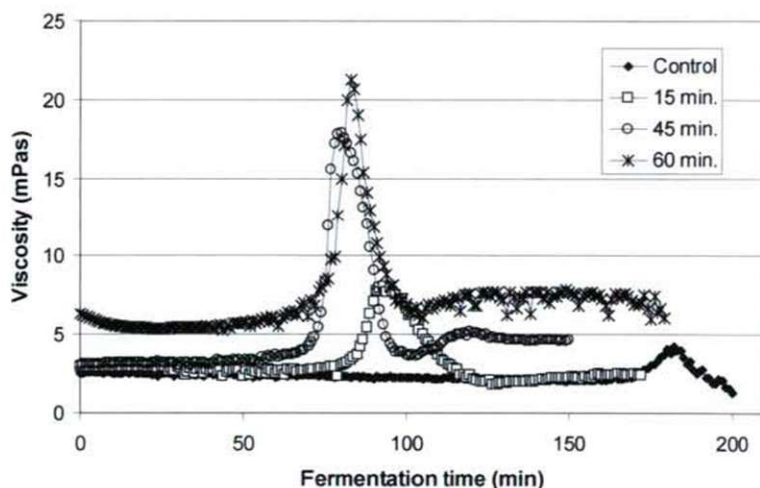
Figure 4. Clotting curves of control and different scale hydrolysed milk samples (represented time values are the time of hydrolysation)

The first 15 min. hydrolysis decreased the clotting time about a half compared to the control. This finding agree the result of (11) observed the clotting time decreasing effect in Twarog production. Further hydrolysis did not cause remarkable changes in clotting time but it caused big changes in viscosity of gels. The viscosity of hydrolysed (for 60 min) milk gel was about four fold than in the control samples, 4.1mPas versus 22.56mPas. Now, we have to note that this viscosity is not typical for a common set type yogurt gel has 50-120 mPas viscosity. These observed low values occurred due to the conditions of the experiments presumably.

The trends clotting time and viscosity changed in double heated milk samples (Fig 5.). Control samples clot sooner than hydrolysed samples and the gels of hydrolysed samples had higher viscosity, but the differences were not too big. The difference in clotting time was 12 min. but in viscosity was only 0.8 mPas. So the use of HTST (High Temperature

Short Time) to hydrolyse and and lactase inactivation at 80 °C for 1 min. gave different results compared to the use of raw milk for hydrolysis.

The different heat treatments of the samples may have caused this different tendency. Heat treatment significantly increases the enzyme activity (8) and affects the microbe activity so the speed of hydrolysis and the exact changes in milk during the fermentation also can be different.

The different lactose content and some side product (galacto-oligosaccharides and other prebiotics) of hydrolysis at the lactase inactivation by heating also can cause differences in the gelation.
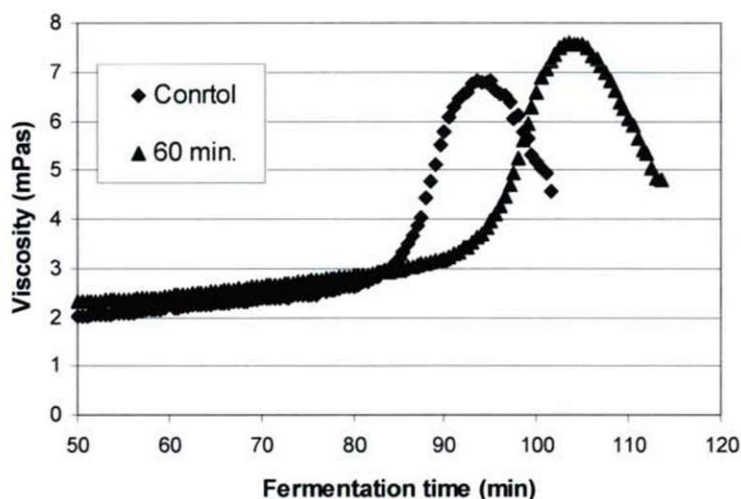
Figure 5. Clotting curves of control and hydrolysed HTST milk samples (60 min.: 60 min. pre-hydrolysis of HTST milk)

Further, we observed difference in the sensory properties of yogurt made from hydrolysed and non-hydrolysed milk. Yogurt from hydrolysed milk had lower flavour intensity mainly lower acid flavour. This result agrees with results investigated the sensory properties of cheeses from low, high and lactose free milk (12).

CONCLUSION

We observed contrary phenomena's during the fermentation of non-hydrolysed and different scale hydrolysed milk samples. The clotting time was shorter and the viscosity was higher using raw milk for hydrolysis versus using HTST milk for hydrolysis. Even so, these differences between the properties of acid gelation of different milk samples were remarkable. Other important observe was the lower flavour intensity in yogurt from lactose hydrolysed milk. Important problem was the lack of expected sour flavour in yogurt from pre-hydrolysed milk. We can not give an exact explanation for these contrary results but the pre-treatment of milk, the side products of lactose hydrolysis and also the second heating of milk (lactase inactivation) can play a role separately or jointly in the appearance of gelation of these samples. We have to continue these preliminary experiments due to the mismatching data to the interest of obvious results, and to clear the trend in the acid gelation of lactose hydrolysed milk. The finally

aim our future work is to give data and methods for producing of lactose free yogurt with the expected texture and sensory properties.

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INTRODUCTION OF SIX SIGMA TOOLS INTO THE SUPPLY CHAIN QUALITY MANAGEMENT OF FEED PRODUCTION

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ABSTRACT

Primer agricultural products and by-products of the food industry provide the mass of animal feeds. These ingredients have great variance in their quality that influences the feed product. Six Sigma tools helped to understand and provide solutions to manage the variance occurring in the supply chain. Due to the sourcing and the nature of these raw ingredients, the probability, that the feed product meets the target values, may need to be considered and if needed, increased at the manufacturer.

1. INTRODUCTION

The most of the literature in relation to Six Sigma refers to industrial manufacturing processes that intend shifting the standard of their performance from $+\text{-}3\sigma$ (93.32% long term yield) to $+\text{-}6\sigma$ (99.99% long term yield). Little research had been done in the applicability of Six Sigma in agricultural production systems in particular, where natural and environmental effects influence yield, standard performance, quality and efficiency significantly. Generally speaking, Six Sigma improves the way that any process works, hence the deployment of Six Sigma tools into industrial compound feed manufacturing, formulation and the quality management of its supply chain. The toolbox of the methodology provides help in data collection, conducting analytical assessments, solving performance problems and optimizing processes. The focuses on quality improvement, cost reduction and improved delivery performance, resulting in higher profits and customer satisfactions. It is important to underline, that in case of compound feeds, the customer needs also include the physiological needs and health of the livestock consuming the final product. The reduction of unwanted variation in outputs with critical importance to customers by finding and eliminating causes of defects in processes is the target of the Six Sigma approach. The understanding of critical-to-customer characteristics and the variability around their averages is necessary to focus on the variables that control these functionalities. (Stamatis). Six Sigma approach also ensures continuous improvements. Even though reaching Six Sigma performance is absolutely challenging and not the ambition of a compound feed producer, the toolbox of the method still can help to improve quality. Six Sigma projects focus not only on problems but also on the opportunities.

3. LITERATURE REVIEW

In the EU-27, meat and animal products had the value of 136 billion € in 2009. This is 42% of the total farm production. Farm animals consumed 465 million t feedstuffs, and this takes the biggest chunk of animal production costs (i.e. up to 77% of the farm gate value of

poultry). 30 % of the feeds are considered to be industrial compound feeds that represent 20% of the estimated 740 million t global compound feed production. 48% of the total feed materials are cereals. (FEFAC, 2010)

To maximize the production performance of the animals their nutritional needs must be fulfilled on the optimal level through feeding stuffs. At the same time, the cost of feeds needs to be kept at the minimum in order to increase the efficiency and profitability of the animal production. Modern compound feed formulation uses powerful software tools to calculate the least cost diets that fall into the optimal ranges of various nutritional parameters. The calculation method of these software tools is based, in most of the cases, on linear programming, where the linear objective function is the cost. The ingredients available for the formulation are populated with their typical, expected nutritional values and prices in the tool that calculates the optimal combination of the raw materials meeting the nutritional or other requirements of the product. Ingredient nutrients are varying and hardly ever known accurately in reality. Each uncertain ingredient nutrients, as variable inputs within the formulation model, are assigned a "best guess" estimate. Assuming symmetrical probability distributions of ingredient nutrients, the expected nutrient levels of the product will be achieved only 50% of the times.

As a solution to achieve more reliable nutritional composition of the product, Nott and Combs (1967) proposed the use of a safety margin for each nutrient by subtracting one-half of a standard deviation from the mean value of the nutrients. In this way the probability of meeting an animal's requirement would be higher. Pesti and Miller (1998.) states that higher than 50 % probability of success can be achieved by adding safety margins to the rations, which, in terms of concept, is closely related to stochastic programming.

Roush et al. (2004.) identified the variability of feed ingredient nutrients as a major risk of diets having insufficient nutrients. As a nonlinear input variable this variation breaks the linearity of the program and it has been proven that the linear program with a safety margin would over formulate at a higher than requested level of probability Roush et. Al. (2007.) The method of stochastic programming would provide better accuracy in meeting the requested probability levels and reach better controlling of nutrient variation.

Broers (2009) pointed out that the formulations should take the real ingredient quality of every lot into account during production ⬜ptimized⬜⬜n to reduce the nutritional variations of the final product. However, often, the analysis of parameters of conventional raw ingredients is difficult or takes longer time. Feed producers are not always equipped with on-site laboratory to control all quality characteristics. Raw material nutritional analysis and data processing to derive means and standard deviations are done retrospectively. (Roush, 2004.) By the time the data is available about a batch, it is likely to be mixed and fed to the animals. The least cost and the most accurate diet could be formulated if the raw materials had limited or no variations at all, which is never the case, particularly for primer agricultural products.

Variability of quality attributes of a feed ingredient may occur due to multiple vendors, seasonality, processing variations of the supplier, deviations of laboratory analysis methodologies. In order to minimize the variability and accurately formulate diets the nutritionists must assess which ingredients impact the product performance significantly and statistically analyze and evaluate the distribution of the characteristics of the ingredients.

Raw material batches, even being from the same type, may significantly differ from each other due to different sources or supplier processes. Supplier quality management activities could address those raw material characteristics that cause significant deviations in the end

product, and the cost benefits of this approach can be quantified by running simulations for diets based on the improved ingredient nutritional profiles. The measurement and analysis of quality data is necessary not only for accurate ration formulation, but the conclusions drawn from the analysis also must drive essential supplier quality development processes.

Shewhart (1980) defined quality that can be described as numerical measurement, which makes possible to see if the quality of the product for a given period differs from that for some other period taken, as a basis of comparison. It can be also the comparison of product qualities for two or more periods to determine if the differences are greater than should be left to chance. The establishment of standards is essential for industrial quality control and the quality requirements should be expressed as quantitatively measurable physical properties.

Deming (2000) underlined the importance of standards and measurement in buyer and seller relationships. The specification of an item is meaningless without operational definition. It must contain quantitative attributes and refer to the measurement considering that the instruments are in statistical control. The principles, laid down by Shewhart and Deming, provide the universal foundation of modern quality management.

Modern feed formulation requires a disciplined, systematic, data based approach. Nutritionists must define the customer requirements, measure, analyze, improve and control the variations occurring in ingredients, feed products that impact the performance of the target animal group. These are the typical steps of Six Sigma methodology for minimizing mistakes and ☐ptimized☐ value. Schroeder et al. (2008) indicated that one of the distinctive features of Six Sigma from TQM was the higher emphasis on data and the use of specific metrics to highlight the importance of process improvements and encourage difficult but attainable goals for improvement.

The validation of the problem statement happens in the define stage by reviewing existing data to confirm that the problem exists, it is important to customers (Voice of the Customer), it is important to the business (Voice of the Business) and it can be improved. This step includes the creation and validation of process maps, the development of project plans with key milestones. The measure stage reviews the current state of the process (baseline capability analysis, SIPOC Supplier – Input – process - Output – Customer diagram, control charts) and reliable data on critical inputs and outputs are collected in terms of quality, speed, costs. Of course a capable measurement system must enable these tasks. The Analyse stage verifies those causes that affect the key input and output variables (root cause analysis, narrowing potential causing through Pareto analysis, statistical analysis to confirm cause-and-effect relationship, or strength of the relationship) (Voice of the process). In the Improvement phase potential solutions are developed, evaluated, and the ☐ptimized. Lastly, in the control step project completion takes place with launch implementation, auditing and validate the results, and performance. (George et al. 2005)

In the supply chains, specification limits of the components (ingredients) are usually set by the buying company. For the end-product manufacturer, often the product specifications are set by the customer. Quality is determined as two sets of characteristics: the characteristics of component parts (lower-level), and the characteristics of the product (higher-level). The proper definition of the specification of the lower level characteristics is important, because these affect the higher-level quality characteristics. In Six Sigma context parameter and tolerance design are included in the determination of these lower level specifications (Park, 2008).

According to the Six-Sigma based on Taguchi's loss function, additional cost incurs when the supplier performance moves away from the target in the specification. Therefore,

supplier developments should target getting a characteristic to be on target value with as little variation as possible that goes beyond managing suppliers to stay within the specified range defined as lower and upper limits. If the distribution narrower than the specification limits, it is possible to make all or nearly all of the units to match the specification, especially is the distribution is centered around the target. (Ross, 1996)

3. METHODS AND MATERIALS

In the case study, a basic pet food product was taken as an example. The diet had been formulated from 9 ingredients (wheat, maize, wheat bran, digest, choline supplement, calcium carbonate, vitamin and mineral mix, pork fat, and poultry meal) and on 18 nutritional parameters in WinFeed 2.8 software tool with linear programming. The nutritional profile of the ingredients had been populated with their measured averages on each parameter in the linear programming tool. Even though the raw ingredient nutrients had average figures in the software, the set of end product analysis indicated varying results on calcium against the maximum level in the product specification (1.4%), and this characteristic becomes the target of the theoretical improvement project. With the help of Six Sigma tools a process map had been drawn, the possible inputs have been listed in cause-effect matrix, Pareto diagram were made to assess which ingredients may influence product calcium levels the most. Statistical analysis of data and diagrams were made with SPC for Excel software. After these steps, the variation of calcium content of the ingredients was analyzed in histograms and also capability analysis was carried out on the data per suppliers. The cost impact of using the material from one or the other vendor had been assessed with the formulation tool, where the different average Calcium levels were populated and the diet was re-optimized.

4. RESULTS

The formulation process map provides a visual explanation of the operation. To formulate the diets accurately, ingredient nutrients, prices are needed from the supply chain and the product specification is driven by the animal needs and other customer requirements. The problem with the occasionally occurring high calcium levels is belonging to the finished product, therefore every element that is before the end product stage may potentially have impact. Also, once non-conformities are recognized, corrective and preventive actions can be taken in the steps beforehand the place of occurrence.
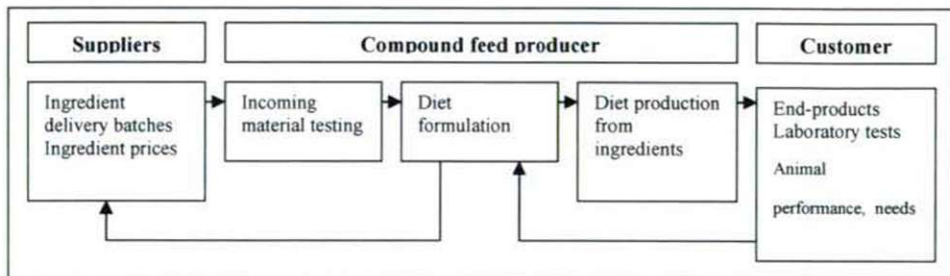
Figure 1: Process map of animal feed formulation

The most important and possible causes of high calcium levels in end-products have been captured in cause-and- effect analysis as inaccurate scales weighting incorrect ingredient amounts, homogeneity of the feed blends, laboratory measurement precision, wrong data in the formulation tool for ration optimization, actual calcium content of ingredients varies too much around the target.

Investigating the causes related to raw ingredient variability the Pareto diagram highlighted that in the test diet the animal meal and the calcium-carbonate are the main contributors to the product calcium level due to their mineral content and proportion in the recipe. Taking into account that the calcium carbonate is a pure mineral source, less variability is expected.
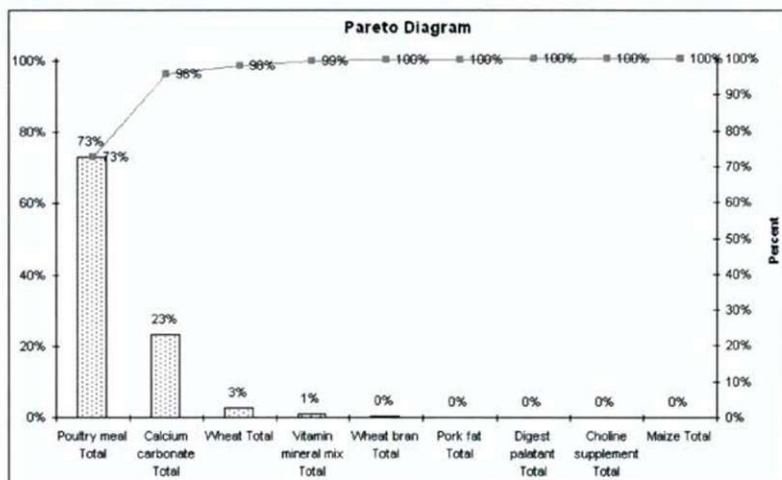
Figure 2: Pareto diagram

Looking at the data available about the calcium content of the animal meal the variability is displayed on a histogram. (Figure 3.) The LSL and USL lines are defining the acceptable, expected range of variation. The statistical analysis compares the actual performance on a parameter in a given time period to the specified limits. The statistical tool also calculates the sigma level of the operation, the average that traditionally would be populated in the linear programming tool for ration formulation, if the similar performance is expected in that period when the product will be produced.
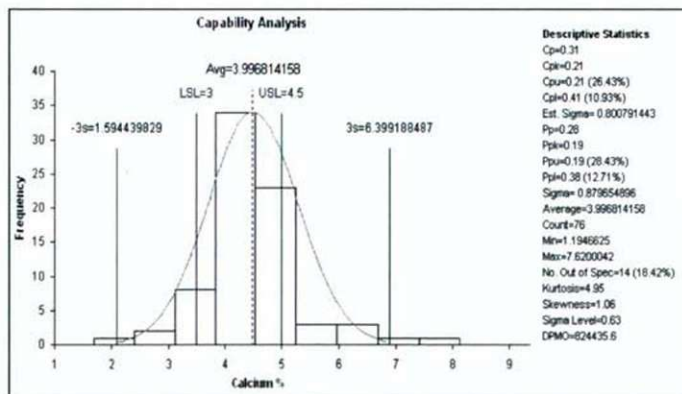
Figure 3. Variability of Calcium content of the animal meal batches

The same dataset (calcium content of every batch) can be graphically displayed and analyzed in time sequence with run charts. Here the additional element in the analysis is the time line, which can flag if any particular movement happens (trend, shift, run) in the characteristic over time. (Figure 4.) The advantage of run sequence plots is that it helps to recognize outliers easily. In this case three data points (three batches: 1.2%, 6.7% and 7.6%) had calcium levels that are considered to be outliers caused by a measurement error or the distribution has a heavy tail.
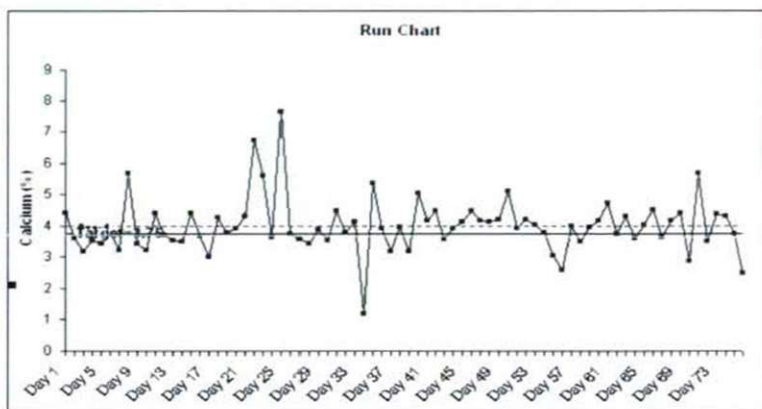
Figure 4: Run chart of calcium content of animal meal batches

Box and Whisker plot (Figure 5.) displays the difference in terms of calcium content of the meals between two suppliers. The plot for the comparison was been made with excluding the outliers. The average calcium level of batches from Supplier B was lower than from Supplier A. The dispersion, spread of the data is more for supplier B than for supplier A. From formulation point of view, if linear programming is used, the average needs to be carefully selected for the software tool, as it impacts the nutritional profile and drives cost of the diet. The other important factor visible in the plot is that the variation of the parameter is different between the two suppliers and this triggers greater variations in end-product calcium around the expected value. If this end-product parameter is a critical-to-customer characteristic, the supplier quality management activities should address this variation.
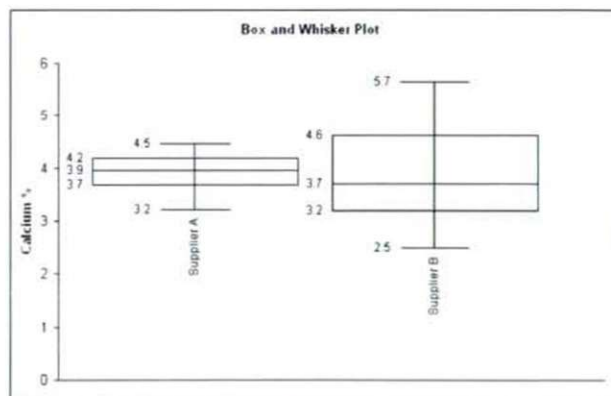
Figure 5. Box and Whisker plot to compare the data distribution from two suppliers

5. CONCLUSIONS

Component variations drive the variability of end-product characteristics. Six Sigma tools provide logical and reasonable assessment of causes that effect the final product quality. In agri-food operations, where the variability of ingredients are very much dependent on various environmental conditions the good understanding of these variabilities enable the design and manufacturing of products that conform to their specifications and fulfill customer needs. In compound feed production the diets are formulated in specific ranges of characteristics. Linear programming is a deterministic method that considers input data as typical, descriptive figures with ignoring the probability of their occurrence. Therefore when a product expected to contain a nutrient in a certain amount (usually the measured average), in reality, the amounts of this nutrient is going to vary around the average. So, if the linear programming tool finds the optimal diet on the higher edge of the allowed nutrient range, the end product nutrient may be higher than the maximum of the formulation range. This needs to be taken into account when minimum and maximum limits are set for formulation so that the end product will still fulfill customer requirements. Although, tighter ranges in linear programming result in more expensive diets, it may bring quality improvements. The other alternative is using stochastic programming for ration optimizations, where each ingredient has its nutritional profile populated with measured average and the standard deviation.

The commonality of the two formulation methods that both need a sound basis of statistical analysis on input and output data (ingredient variability) to maintain and improve quality. Formulation tools help to quantify the effects of variability and provide powerful solutions on the least cost of the business. Following the principles of Six Sigma and with the help of the Six sigma toolbox, feed or food producers can get into the loop of measuring, analyzing, improving, and controlling factors that influence quality improvements, even though achieving Six Sigma performance may not be realistic for some of the processes in the industry.

Customer orientation can be realized along the supply chain if the supplier performance is measured against delivering components according to specifications and these components can be effectively and safely used in end products. Dealing with primer agricultural products, the compound feeds may have tighter specified ranges than what the ingredients would fit into. This case the variability needs to be managed and set aside by proper differentiation of quality sub-groups either by the suppliers or the producer. Supplier chain quality management can help to tackle these problems, with the condition of having adequate data to do the analysis with Six Sigma tools. To assess and improve quality of supplier processes Six Sigma tools can be used as well, either by the vendor, or with the facilitation of the buyer firm. This second case could promote and enhance customer-orientation in the supply chain.

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EFFECT OF SPICE EXTRACTS ON THE GROWTH OF PENICILLIUM SPECIES

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ABSTRACT

The inhibitory effect of various concentrations (0, 0.1, 0.5, 1 and 2%) of caraway, garlic and oregano extracts on growth of four species of *Penicillium* were investigated. Among the spices used, caraway showed the strongest effect on all moulds. It completely inhibited growth of *P. aurantiogriseum* at the level of 0.5% extract and *P. commune*, *P. griseofulvum* and *P. corylophilum* at the level of 1%. The garlic extract completely inhibited the growth only of *P. aurantiogriseum*, but was ineffective against *P. commune* and *P. griseofulvum*. Oregano showed partial effect in inhibition of all four species, with significant growth reduction at concentration of 2%.

1. INTRODUCTION

Aromatic plants (either fresh or dried) have been widely used for flavouring of various foods. Essential oils and extracts obtained from natural aromatic plants have been gaining increasing attention in food industry due to their tremendous potential in the prevention of microbial spoilage of food and as an alternative to synthetic preservatives. It has been confirmed that caraway, cloves, mustard, coriander, thymus, and cinnamon are effective antimicrobial agents which inhibit fungal growth (Karapiran, 1985; Soliman and Badeaa, 2002; Suhr and Nielsen, 2003; Velluty et al., 2003). Moreover, many studies revealed that some spices do not exert antifungal activity, e.g., vanila (Nielsen and Rios, 2000) whereas some have stimulative effect (Mabrouk and El-Shayeb, 1980; Ozcan, 1998; Boyraz and Ozcan, 2005).

Essential oils are complex and consist of many components. Their active constituents such as eugenol, thymol, cinnamaldehyde, cariofilen, geraniol, sulphuric and other compounds have been subjected to extensive research (Bullerman et al., 1977; Hitokoto et al., 1980; Moleyar and Narasimham, 1986; Mahmound, 1994; Mansour et al., 1996; Matamoros-Leon et al., 1999; Moriera et al., 2005). Guynot et al. (2003) reported about the preventive activity of essential oils against fungi through contact with volatiles at various water activity levels. Authors found that five out of total 16 essential oils completely inhibited the growth of all tested fungi over a wide range of water activities (0.80-0.90 aw). Somewhat earlier, Nielsen and Rios (2000) demonstrated that mustard essential oil and its major constituent allyl isothiocyanate (AITC) can be successfully used to prevent fungal growth. Fungi are responsible for the development of offensive odour and production of cytotoxic, carcinogenic and allergenic compounds. They prevail more frequently than other microorganisms on medium or low humid, acidulous food which has been inadequately stored.

The objective of this work was to examine the inhibitory potential of extracts of caraway, garlic and oregano against four fungal species from genus *Penicillium* which have been frequently encountered in food and recognized as food spoilage agents. *P. aurantiogriseum, P. griseofulvum* and *P. commune* are known producers of many toxic

metabolites (Frisvad and Thrane, 2004) whereas *P.corylophilum* is the most xerophilic of all *Penicillium* species (Pitt and Hocking, 1985) but its toxigenic activity has not been affirmed (Singh et al., 1991).

2. MATERIALS AND METHODS

2.1. Materials

Extracts of caraway, garlic and oregano used in this study were commercially available products procured from ETOL Celje Comp., Slovenia. Test microorganisms *P. commune*, *P. griseofulvum*, *P. aurantiogriseum* and *P. corylophilum* were maintained on Potato dextrose agar (PDA) slants at 4°C. For the experiment, the microorganisms were cultivated on the same medium for 10 days at 25°C.

2.2. Antifungal assessment

Determination of antifungal activity was conducted on PDA medium. The test medium was poured into 250 ml Erlenmeyer flasks and autoclaved at 121°C for 15 min. After sterilization, spice extracts were separately added to the flasks to obtain concentrations: 0, 0.1, 0.5, 1 and 2%. The culture medium was then poured into sterile Petri plates (9 cm diameter) in equal volumes (12 ml per plate).

Suspension of conidial spores was prepared in a medium that contained 0.5% Tween 80 and 0.5% agar in distilled water (Nielsen and Rios, 2000). The concentration of suspension was adjusted to 10^6 spores/ml using a haemocytometer. For each tested extract and concentration, triplicate plates were centrally inoculated by spreading 1 μl of spore suspension (10^3 spores/ml), including a control samples, too.

The growth inhibition was evaluated by daily measurement of radial growth of colonies during the days of incubation at 25°C.

3. RESULTS AND DISCUSSION

Inhibitory effect of all spice extracts against the tested *Penicillium* species are displayed in Table 1. The extract of caraway completely inhibited the growth of *P. aurantiogrisum* at 0.5% dose. At the same dose, the growth of *P. griseofulvum* was almost completely inhibited (91.3%) whereas significant inhibitory effects were observed with *P. commune* and *P. coryphilum* (50.0 and 73.1%, respectively). At 1% dose, the growth of all tested microorganisms was inhibited.

The extract of garlic was totally inefficient against *P.commune*, it even exhibited a growth stimulating effect within the tested doses. Also, the highest doses applied (1 and 2%) did not show any activity against *P. griseofulvum* whereas *P. corylophilum* was partially inhibited (34.6 and 53.8%). Solely *P. aurantiogriseum* was completely inhibited by the garlic extract.

The lowest applied dose of oregano extract was found inefficient against *P. griseofulvum*, *P. aurantiogriseum* and *P. corylophilum* with weakly inhibitory effect against *P. commune*. The next dose (0.5%) was also actually inefficient against *P. commune*, but it reduced the growth of other tested species by 13.6% (*P. griseofulvum*), 14.8% (*P. aurantiogriseum*) and 7.7% (*P. corylophilum*). Although the oregano extract did not exhibit complete

inhibitory effect against any of the tested species, a 2% dose had strong activity which was maximal (85.2%) against *P. aurantiogriseum* and minimal (50%) against *P. commune*.

Table 1. Antifungal activity of spice extracts on the growth of moulds

Extract	Conc. (% v/v)	Inhibition colony growth (%)			
		P. commune	P. griseofulvum	P. aurantiogriseum	P. corylophilum
Caraway	0.1	10.7	19.6	33.3	19.2
	0.5	50	91.3	100	73.1
	1	100	100	100	100
	2	100	100	100	100
Garlic	0.1	0	0	7.4	15.4
	0.5	0*	0	25.9	23.1
	1	0*	2.3	100	34.6
	2	0*	2.3	100	53.8
Oregano	0.1	11.1	0	0	0
	0.5	13.0	13.6	14.8	7.7
	1	29.6	68.2	40.7	38.5
	2	50	83.6	85.2	84.6

0* -stimulation colony growth

The effects of caraway, garlic and oregano on germination and growth rate of fungi is presented in Figures 1, 2 and 3.

The growth rate of *P. aurantiogriseum* was more markedly reduced in the presence of caraway extract indicating higher sensitivity of the species. Low extract concentration (0.5%) delayed the colony growth of *P. commune* for 4 days, *P. corylophilum* for 6 days and *P. griseofulvum* for 7 days but it was found inefficient in the case of other species (Fig. 1).
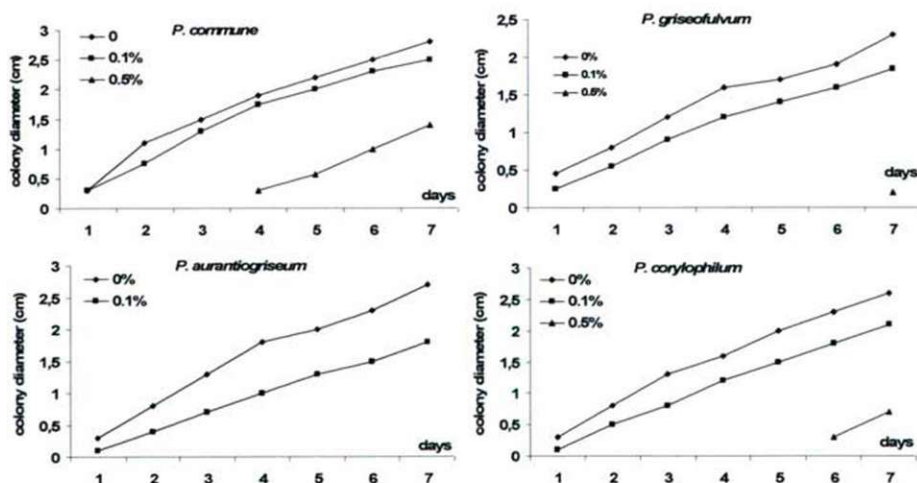
Fig. 1. Inhibition of Penicillium spp. by caraway extract

In all treatments with the garlic extract, the period of colony growth delay for *P. commune* and *P. griseofulvum* was virtually the same as for the control. Garlic favoured the growth of these fungal species. Moreover, this effect was intensified with increasing extract

concentration in the case of *P. commune*. At 0.5% concentration, *P. aurantiogriseum* and *P. corylophilum* were completely inhibited for 2 days. At higher concentrations, the growth of *P. corylophilum* was delayed for one more day (Fig. 2).
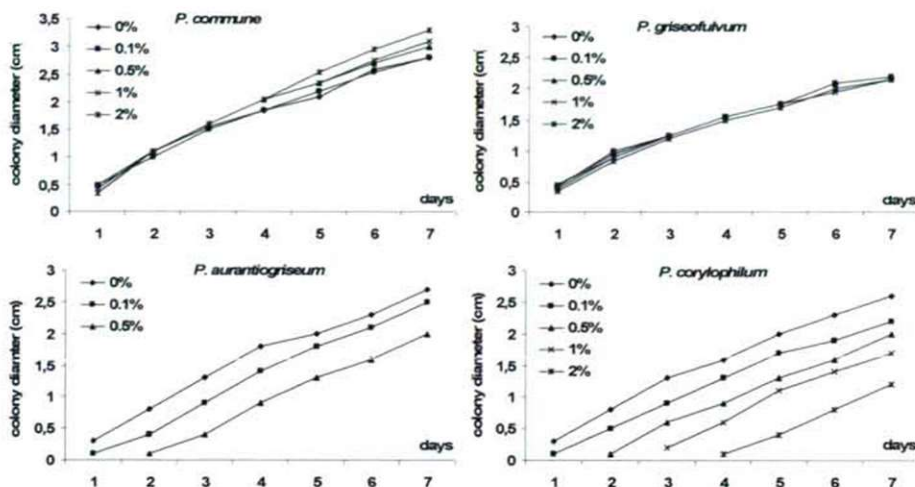
Fig. 2. Inhibition of Penicillium spp. by garlic extract

The treatments with oregano extracts revealed a growth delay for *P. aurantiogriseum* and *P. corylophilum* at concentrations over 0.5% for the same number of days. The colony growth continued with similar activity over the further experimental period. The inhibitory effect on the growth of *P. griseofulvum* at 2% concentration remained constant until the fifth day of the experiment after which it was gradually diminished (Fig. 3).
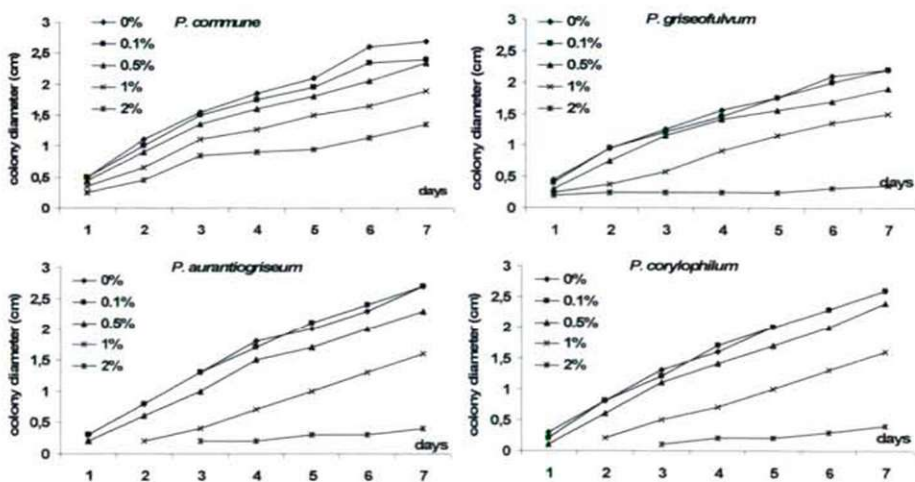
Fig. 3. Inhibition of Penicillium spp. by oregano extract

The experimental results demonstrated that solely the caraway extract had the ability to completely inhibit the growth of all tested *Penicillium* species. The garlic extract showed a

total inhibitory effect on *P. aurantiogriseum* and partial on *P. corylophilum* whereas it was ineffective against the other two species. The oregano extract failed to inhibit the germination of the tested fungal species; however, it exerted a strong antifungal activity at the highest concentration. The most sensitive species to the effect of spice extracts was *P. auratiogriseum*. The increasing concentrations of extracts caused an absence or growth delay of fungal species and showed various effects on the rate of fungal growth that ranged from inhibitory to stimulating.

The antifungal activity of the tested extracts is associated with their major constituents such as carvacrol (caraway, oregano), limonene (caraway) and sulphuric compounds (garlic) (Barrata et al., 1998; Ceylon and Fung, 2004).

It has been reported that essential oils of caraway, clove, garlic, onion and oregano might prevent the synthesis of sterigmatocystine, aflatoxins and ochratoxin A produced by some toxigenic fingi (Hitokoto et al., 1980; Hasan and Mahmoud, 1993; Basilico and Basilico, 1999). Benkeblia (2004) concluded that EO extract from garlic behaved different to that of red onion by showing strong inhibitory effect against *P. cyclopium* at lower doses (50 and 100 ml/l). Moreover, micromorphological changes in fungi have been documented after exposure to volatile essential oils of some spices (Arras and Usai, 2001; Rassoli et al., 2006).

3. CONCLUSION

The current results confirmed that the shelf-life of food can be ensured with natural antimicrobial agents such as spice extracts. Their application can contribute to lowering the use of synthetic preservatives commonly used to limit the fungal growth. *Penicillium* species are the most important contaminants of stored food commodities and present a considerable health risk.

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DSC OF RESISTANT STARCH PRODUCED BY DIFFERENT METHODS

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ABSTRACT

Resistant starch (RS) refers to the sum of starch and starch degradation products that are not absorbed in the small intestine of healthy individuals. The fact that resistant starch escapes digestion confers to it many positive health effects like reducing the glycemic response and acting as a functional prebiotic. Resistant starch also interacts with dietary macronutritients such as fats and protein, and with micronutritient such as minerals. Resistant starch type 3 comprises retrograded starches.

In this study resistant starch type 3 was prepared by two different treatments. The samples obtained by suspending 10% and 20% (w/v) of maize starch in 1000ml of water were autoclaved at adequate conditions: pressure 1.1 bar, temperature 120°C, autoclaving time 30 min and volume 60 dm³. After autoclaving the samples were stored at 4°C for 24h and two autoclaving–cooling cycles were applied. The enzyme treatment means debranching of starch samples with pullulanase after gelatinization process. The maize starch gels were exposed to different concentration of pullulanase, 2% and 4% calculated on dry starch weight, and the reaction time was varied (1, 3 and 5h). Adequate analysis was performed after the preparation of the samples and also after three weeks of keeping them at 4°C.

A method of differential scanning calorimetry (DSC) measurements was used for thermal analysis of the samples. Hermetically sealed aluminum standard crucibles contained 5mg of each sample (mixed RS and distilled water). Heating range was from 25 to 200°C at heating rate of 10 °C/min. From DSC curves the temperature of degradation Td and enthalpy ΔH could be obtained. DSC thermal analysis of examined resistant starch showed significant higher values of Td and ΔH for the samples that were stored for three weeks than samples analyzed after preparation. It could be concluded that during that period the content of retrograded fractions, which are nondigestible and designate RS3 as resistant starch, increased.

Key words: resistant starch, enzymatic treatment, autoclaving, DSC analysis

1. INTRODUCTION

Starch has a major contribute to the appearance, structure and quality of food products. Starches can be classified according to the retention time in the gastrointestinal tract and accessibility to the enzymes into three major groups, as rapidly digestive starch (RDS), slowly digestive starch (SDS) and resistant starch (RS). (1, 2)

Resistant starch is indigestible by body enzymes so escapes digestion and absorption in the small intestine and may be fermented in the large intestine, providing many physiological functions similar to those of dietary fiber and many positive health effects. Resistant starch affects reduction of the glycemic response, acting as a functional prebiotic for some probiotic microorganisms and increases the production of short fatty acids chains, primarily acetates, propionates and butyrate. It has indirect influence to the pH value of the large intestine, colonic blood flow and mineral absorption. (3)

Four types of resistant starch vary: physically inaccessible starch (RS1), raw starch (RS2) that is in a certain granular form and resistant to enzyme digestion, retrograded or recrystallised starch (RS3) and chemically modified starch (RS4). (4)

RS3 represents the most resistant starch fraction and is mainly retrograded amylose formed during cooling of gelatinized starch. Most moist–heated foods therefore contain some RS3. In the formation of RS3, the starch granule is completely hydrated. Amylose leaches from the granules into the solution as a random coil polymer. The polymer chains upon cooling begin to reassociate as double helices that are ordered into a crystalline structure over a particular region of the chain and interspersed with amorphous enzyme degradable regions. The conformation and stability of recrystallised starch is accomplished during processing and storage. Crystalline structure type A is formed in gelatinized starch stored at high temperature, it has dense structure and it is less open than B form, which has hexagonal symmetry and is processed and recrystallised at low temperature. (2) The conformation and physico–chemical properties determine functionality, nutritional value and the health implications of recrystallised starch. Structural stability affects interactions between the starch and intestinal microorganisms, thus recrystallised starch possess bifidogenic and butyrogenic properties. RS3 is structurally and thermally more stable than others RS types, thus may be used as a functional fiber ingredient in many processed food. (4, 5)

2. DIFFERENTIAL SCANNING CALORIMETRY OF THE RESISTANT STARCH

Thermal analysis of resistant starch type 3 obtained by different processes is suitable method for determining physical properties and structural changes of resistant starch during thermal treatments and storage. DSC (Differential Scanning Calorimetry) is based on measuring the thermal effects that occurs during heating of the examined sample and a reference sample exposed to the same temperature regime. (6)

2.1. Preparation of the resistant starch

Resistant starch type 3 was prepared by two different treatments.

The samples were prepared by suspending 10% and 20% (w/v) of commercial maize starch obtained from local producer („Jabuka", Pančevo, Serbia) in 1000 ml of water. The suspensions were heated in a boiling water bath for 15 min with stirring and then autoclaved at the adequate conditions: pressure 1.1 bar, temperature 120°C, autoclaving time 30 min and volume 60 dm^3. Two autoclaving–cooling cycles were applied and then the samples were stored at 4°C for 24h.

The enzyme treatments means debrancing of starch samples using pullulanase after gelatinization process. Commercial debranching enzyme, pullulanase (PromozymeBrewQ, 400 PUN/ml), from *Bacillus acidipullulyticus* was obtained from Novozymes (Bagsvaerd, Denmark). The enzyme concentrations were 2% and 4% (calculated on dry starch weight) and the reaction time varied (1, 3 and 5h). After that the samples were heated at 95°C for 20 min, cooled down to room temperature and stored for 24h at 4°C. Finally, the samples were dried at 40°C and then stored in closed glass containers.

A method of differential scanning calorimetry (DSC) was used for thermal analysis of the samples. Measurements were performed at DSC Q20 V23.10, TA Instruments, UK, Ltd. and data were analyzed using manufacturer's software Universal V4.3A TA Instruments. Resistant starch and distilled water were mixed in the aluminum crucibles that contained 5 mg of each samples (3 mg of resistant starch and 2 mg of distilled water) and then were hermetically sealed. The samples and the empty crucible used as a reference were heated

from 25 to 200°C at heating rate of 10°C/min. From DSC curves the temperature of degradation T_d and enthalpy ΔH could be obtained. Thermal properties of examined samples were analyzed after preparation of the resistant starch and after storage at refrigerator temperature of 4°C for three weeks.

2.2. DSC analysis

Samples treated by enzyme pullulanase were exposed to different enzyme concentration, 2% and 4%, and different reaction time, 1, 3 and 5h. Determined parameters from DSC curves, the temperature of degradation T_d are presented in Table 1.

Table 1. Degradation temperature of resistant starch obtained by enzyme treatment

Sample	$T_d[°C]$	$T_{d\ (after\ three\ weeks)}[°C]$	Sample	$T_d[°C]$	$T_{d\ (after\ three\ weeks)}[°C]$
I (1h,2%)	138.93	169.58	IV (1h,4%)	139.70	158.30
II (3h,2%)	139.40	159.25	V (3h,4%)	139.85	167.36
III (5h,2%)	139.53	169.21	VI (5h,4%)	136.62	163.74

Longer time of enzyme action for the same enzyme concentration caused slightly increase of degradation temperature. Applied enzyme, pullulanase, is debranching enzyme that rapidly hydrolyses only the α–1, 6–glycosidic bonds of amylopectin molecule. Longer reaction time caused an increase of debranching degree and appearance of more short side–chains from the initial amylopectin molecule. Residual side amylopectin chains aligned and by hidratic bonds aggregated and hence form crystalline structures. More released side–chains lead to the formation of broad range of crystalline forms, thus more energy is required for decomposition (dissociation) of the sample, accordingly degradation temperature increased.

The addition of the higher amount of enzyme did not result in complete debranching, thus higher pullulanase concentration of 4% has not significant influence on DSC parameters.

Storage of resistant starch type 3 obtained by enzyme treatment at 4°C for three weeks significantly increased parameters of thermal properties. During storage the retrogradation of amylopectin occurred. It is slow process that requires several weeks and depends of storage temperature and water availability (7). Required degradation energy is higher and confirmation of that was a significant higher value of degradation temperature T_d and enthalpy ΔH of stored samples compared to the samples measured after preparation. Significant increase of enthalpy for stored samples is presented at Figure 1.
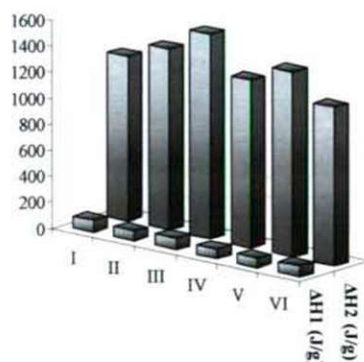
Figure 1. Enthalpy of resistant starch samples obtained by enzyme treatment: ΔH_1–enthalpy of samples measured after preparation, ΔH_2–enthalpy of samples stored for three weeks

Thermal characteristics of resistant starch samples obtained by autoclaving are presented in Table 2.

Table 2. Degradation temperature and enthalpy of resistant starch samples obtained by autoclaving

Sample	T_d [°C]	$T_{d\ (after\ three\ weeks)}$ [°C]	ΔH [J/g]	$\Delta H_{(after\ three\ weeks)}$ [J/g]
I (10%, I autoclav)	139.34	164.52	85.63	1771
II (10%, II autoclav)	139.44	163.10	52.27	1341
III (20%, I autoclav)	140.98	59.82	78.81	93.91
IV (20%, II autoclav)	138.56	48.31	43.09	104.2

Slight increase of degradation temperature points that increase of starch concentration in the suspensions caused higher resistant starch yield. The number of autoclaving cycles did not increase the number of released side–chains, thus amount of crystalline regions in the resistant starch structure was approximately equal, and differences between degradation temperatures were negligible. Storage of these samples at 4°C for three weeks led to retrogradation process. It affected the values of enthalpy and degradation temperature that were higher for stored samples.

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MODELLING AND OPTIMIZING IN AUTOCLAVING

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ABSTRACT

My examinations aimed at the positive role of software production programming on costs. In addition to the fact that reduction of expenses can be reached with rearrangement of production between shifts, I pointed out that with this simulation technique the following problems can be avoided: product bump on the production belt due to careless planning, product piling in the heat-treatment unit and thus, product deterioration due to the heat-treatment which was not started in time.

To put the experiences in practice I developed a software system based on factory data. In development I used Microsoft Excel and Access programs as software environments and I made the necessary program codes in the built-in Visual Basic for Applications, as a programming language. I elaborated a user-friendly operation mode to reach functions with a special menu. I applied form-technique to upload and to modify data. Production programming and scheduling software modules can be used easily with dialogue boxes. Queries can be applied to check product bump on the production belt and sufficiency of heat-treatment capacity.

1. INTRODUCTION

To increase quality is the primary aspect in food industrial researches. It is the most important aim to lessen the degree of conservation in food processing otherwise the food cannot preserve its original qualities, consuming and nutritional values. Furthermore, consumers claim the possibility to prepare their food more quickly, the safe and hygienic application, longer shelf-life, the constant and checked quality, the usability on wider scale and the solution of unexpected situations. All of them could be utilized by preserved food-makers but for this they have to employ modern work organization which follows the expectations of our time. (Biacs 1998, Goldberg 1994, Kiss 2000, Farkas 2001, Bíró and Bíró 2000)

Heat-treatment is used to prevent the microbiological danger thus it makes longer conservation-time possible. However, in case of an over-guaranteed heat-treatment there is a deterioration of quality, since sensory features, substance, taste, smell of the food can suffer a serious loss (discolouration on the surface in case of liver pastes, liquid exudation and jelly precipitation in case of meat, transformation into puree etc.)

It is worth involving engineering calculations, modelling, computer simulation in the research of this field, for the sake of the quality of products and expense-efficient production. A work organization should be formed which guarantees manufacture of products which are safe from microbiologal aspect; which keeps the regulations more precisely in the interest of higher quality and lower expenses. To do this there should be an informatic background which can provide the necessary assistance, on the basis of research results, to elaborate the suitable work organization. For this aim it provides the user-friendly operation surfaces, which fulfill the claims of our time, the simulating and optimizing technique, the predicting and problem solving services and the flexible enlargement possibilities.

2. THE PLAN OF THE SOFTWARE SYSTEM

Since our program involves a simulator, it is advisable to complement it with components which support the model parameters again. Thus, the program will be suitable to check the model periodically and it guarantees that other companies can adapt it easily.

Software environment

A database manageable with an Excel spreadsheet would serve the user's interest the most. Thus, data processing and tabulation, graph making, which fit to the different demands and cannot be planned in advance, could be done easily. Application of spreadsheet guarantees a simple opportunity to provide program functions for calculations and graph making, besides it can be used as a development environment with the service Visual Basics for Applications (VBA) to elaborate the program. In addition, the database manager program should be used because firstly, it is easier to realize data storage, secondly, the program could have more functions, thirdly, the user-friendly way of data entry can be guaranteed by the technique of forms. Fortunately, both the spreadsheet and database manager can be applied since Excel sheets can be used as attached tables with the database manager program. It means that physically the data storage is realized on Excel sheets, while Access manages these data as if they were stored in its own tables. Thus, data correction done in Access will be stored on Excel sheets.

User interfaces, main functions

After starting the program the first thing to appear is the main menu (Figure 1) which shows three submenus, besides log out. If we choose „Data input, modification", we can find the points shown by Figure 2.
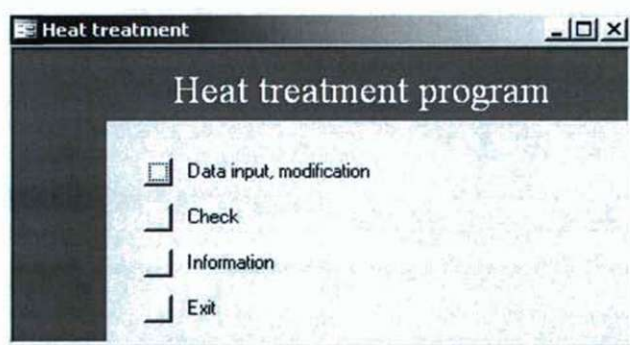
Figure 1: The main menu of Access
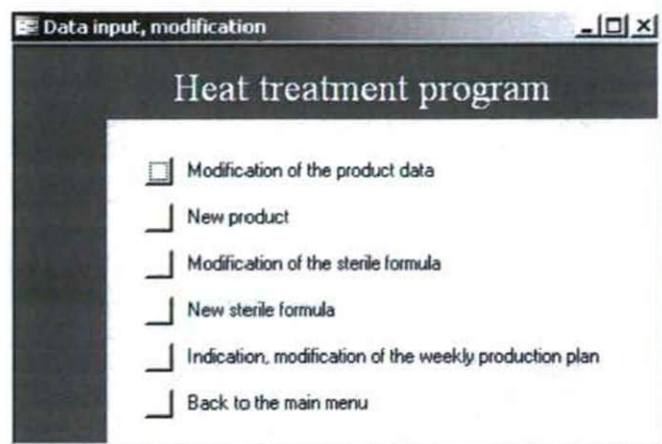
Figure 2: The submenu of „Data input, modification"

First of all, we can fix the data of tables „Product" and „Sterile formula" which can be modified only when a new product is to be manufactured or the regulations on the heat-treatment (sterile formula) of a given product should be modified because of the bigger security or the earlier over-guaranteed regulations. The user will rarely need these functions, the program provides forms of data input to realize them.

Figure 3: Form of indication and modification of the weekly production plan

Indication of the data of the weekly production plan is used in a weekly frequency in the program which can be done by means of a form (Figure 3).

Due to the applied technique of attachment, data manipulations done in Access forms are stored on Excel sheets, so they can be used directly in Excel.
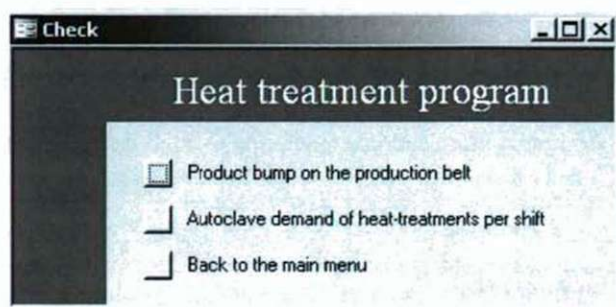
Figure 4: „Check" submenu

Data of the plan should be checked. The submenu „Check" guarantees these functions
(Figure 4). The first one examines if the plan contains a mistake in case of which more
products would arrive at one production belt at the same time (in the same shift). The list
of products bumping on the production belts are provided by a query available on the
Access surface which is shown by the program as the view print preview by means of a
report. Since the table stores, among the product data, which production belt it can be made
on, this result can be obtained without simulation.

The other checking function examines if the heat-treatments can be done in time. We can
get the printable report without simulation, since the number of the necessary autoclaves
can be calculated from the time spans of heat-treament stored in tables. If the demand of
any shifts exceeded the capacity, the plan should be modified. For this, the list shows when
the capacity is unemployed in the suitable measure and then we can move the product here
with the form which modifies the plan.
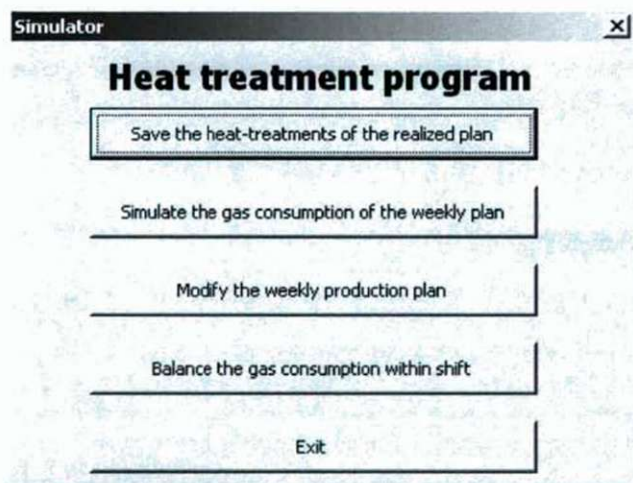
Figure 5: The main menu of Excel

Having the checked plan the Excel spreadsheet takes over the work from the Access
database manager to do the other tasks. It is the main menu shown in Fugure 5 which helps
us reach the functions that should be performed in the order of appearance with weekly
frequency.

First, we can save heat-treatments of the realized weekly plan, then we can simulate gas consumption of the plan for the following week. Then, the program generates heat-treatment data necessary for the input of the simulator, and makes the calculated data for gas consumption broken down in shifts appear on a diagram. Data generation is done with a VBA (Visual Basic for Applications) operation, while the program switch on the adequate sheet to make the diagram appear. The task of this function is to point out if it is necessary to modify the plan, provided gas consumption of each shift shows a big deviation. The manual data modification can be accomplished with a form made for data input, but plan modification can be done automatically, too, in case of which a VBA operation rearranges the products of the plan within shifts. Modification can be followed by the user in a table of a sheet, and then it can be printed, too.

The last function of the program guarantees that gas consumption within the given shift will be even, evolving the appropriate schedule by delaying the heat-treatment of the products. It is done by a VBA algorithm, together with the simulator, which in every shift of the production week tries to find the value variation of delay of heat-treatments which causes the gas consumption of the lowest standard deviation thus securing the even boiler-load and avoidance of high gas consumption peaks. In this function the maximum waiting time appears as a restriction since it cannot be exceeded to avoid spoilage of canned food. As a final result we can get the optimal value variation of the waiting time for the heat-treatment which then gives the recommended time to start heat-treatments.

Apart from the initial setting functions, the program should be used in a weekly frequency and by storing the data of the accomplished heat-treatments, it makes their registration possible. This registration is compulsory for the company but the stored data can provide an excellent basis for an informational system, too. In our database statements can be made with queries from different points of view, and our data can be displayed even in diagrams. We can easily observe changes, tendencies and seasonalities in the production profile. These functions can be formed in „Information" submenu. Thus, for example, we can have a statement on the weekly summary of production, a diagram of the changes in the produced amount of a certain product per week, production of a selected week per product etc.

3. DISCUSSION AND CONCLUSION

For the software developed for simulation, optimization and sceduling the Excel can be applied, in a user-friendly way, to store, process the data and to represent them in diagrams, to fulfill programming tasks, while the Access to feed data into the computer with forms and to form queries and reports. The developed computer system guarantees an easy possibility for data input and modification, to check product piling on the production belt, to avoid the long waiting lines for the heat-treatment by checking the autoclave capacity, to balance the gas consumption of the shifts and to prevent the gas consumption peaks. All in all, it can guarantee the manufacture of better quality products with lower direct costs.

With this simulation software system the production process, which starts with the production belts and finishes with heat-treatment on the autoclave group, can be organized so that products of better quality can be manufactured assuring regulations on heat-treatment, while it guarantees lower direct costs avoiding product bumps on the production belt and long waiting lines before heat-treatment and balancing the boiler load both within and between shifts.

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INNER CONTENT AND PROCESSING INDUSTRIAL CHARACTERISTICS OF NEW HUNGARIAN BRED SOUR CHERRY CULTIVAR CANDIDATE

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ABSTRACT

The Hungarian bred sour cherry cultivars play an important role in the global sour cherry sortiment among the grown sour cherry cultivars because their are grown in the most important sour cherry growing countries. The Hungarian bred cultivars are suited not only for industrial purposes but for fresh consumption because of their good tastes.

During our trials we have examined IV-3/48 cultivar candidate was bred at Research Institute for Fruit Growing and Ornamentals Budapest-Érd for industrial purposes and amounced for examination and named 'Érdi ipari' at Central Agricultural Office in Budapest. The IV-3/48 has very early ripening time (late May). We examinated suitability of this cultivar candidate for shaking and for changing of its inner content value during the ripening time. The samples were collected three times during the ripening time in 2008, 2009 and 2010. We determined the suitability of choosen candidate for food industrial purposes which appoint a ripening time when the content of antioxidant compounds is the highest. Our aim was to determine the suitability of IV-3/48 sour cherry cultivar candidate for producing food industrial products.

Refraction, titrable acid content, watersoluble antioxidant capacity, total antocyanin and polyphenol content of fruits were measured under laboratorical conditions.

According to the results of inner content value the optimal shaking time of this cultivar candidate can stated in the last stage of ripening time. In this stage the watersoluble antioxidant capacity, anthocyanin and polyphenol capacity of IV-3/48 sour cherry candidate is suitable. On the grounds of our results this candidate neared or exceeded both watersoluble antioxidant capacity and anthocyanin as well as polyphenol content of standard cultivars. According to our results this candidate is suitable for food industrial purposes for producing both fruit juice concentrate and dried cherries. During the drying IV-3/48 saved its natural color therefore the food industry can use it for natural coloring material.

1. INTRODUCTION

Nowadays examination of antioxidants as well as slight of artificial materiels and its taking out possibilites with natural materials are in the lime-light of reserach. The tart cherry (*Prunus cerasus* L.) is such a food industrial raw material is suitable for taking out the artificial aggregates and plays an important role in the health-care nutrition because of its biological active substances (Stéger-Máté et al. 2010).

Tart cherry has remarkable vitamin content next to its extrem high polyphenol and antocyanin content. Its B_1- (50µ1g/100g), B_2- (20µg/100g), B_6- (0,05mg/100g) as well as biotin (0,8µg/100g) content are also extrem high. Its mineral content is well-balanced (Ficzek et al. 2008), its potassium (186mg/100g), its calcium (186mg/100g), its magnesium (15mg/100g), its iron (0,6mg/100g) and its phosphorus (50mg/100g) content are notable. Its copper content is one of the highest among the grown fruit species (Bíró,Linder, 1999).

The fruit juice concentrates contain the most valuable inner content of the fresh fruits and those can be used as natural coloring material at some areas of food industry (Espín et al. 2000).

The consumer layer is increasing who wants to live and feed knowingly therefore this layer needs such food industrial products contain the biological active substances in natural form means keystone of progressive nutration.

The Hungarian bred tart cherries play an unique role in the heath-care because those cultivars are suitable for fresh consumption. The Reserach Institute for Fruit Growing and Ornamentals Budapest-Érd has bred a lot of tart cherry cultivars with excellent inner content and antioxidant capacity. The Research Institute has amounced for examination a novel tart cherry candidate with early ripening time is suitable for shaking and for industrial purposes. Our aim was to measure inner content value and to show possibilities for food industrial usages of this novel candidate in this study.

2. MATERIAL AND METHODS

2.1 Research material

Fruit samlpes of the examined self-fertile tart cherry candidate were collected at the Experimental Farm Érd-Elvira major of the Reserach Institute for Fruit Growing and Ornamentals Budapest-Érd. The orchard was involved in this study during the sample collection was in the full bearing period in 9th-11th leaves. Soil of the orchard was calcareous chernozem. The average yearly sunny hours were 2 000 hours, the average temperature in the vegetation period was 16,8 °C, the average yearly preciptation was 550 to 570 mm at the experimental orchard. Fruits of self-fertile IV-3/48 tart cherry candidate ('Érdi bőtermő' x 'Meteor korai') are dark red, their average weight is 3 g, their average fruit diameter is 19 to 21 mm. The fruits have stainy juice.

2.2 Sample collection

The samples were collected with hand from 15 trees, from four cardinal points of the trees. Fruit flash of 15 kg average sample was shaked and storaged in the deep fridge till the meansurings to determine inner content value of the samples. Refraction, titrable acid content watersoluble antioxidant capacity, total antocyanin and polyphenol content of fruits were measured under laboratorical conditions at the Department of Pomology of CUB in 3 replications.

Adaptibility of the choosen candidate for drying and producting fruit juice concentrate was examined at the Department of Food Preservation of CUB.

2.3 Refraction

Determination of water-soluble dry matter content (refraction) was carried out according to the regulation Codex Alimentarius 3-1-558/93 by a Zeiss-Abbé refractometer.

2.4 Titriable acid content

Total acid content of the sampes was determined by 0.1N NaOH titration by adding bromothymol blue indicator, according to MSZ 3619-1983 Hungarian regulation.

2.5 Determination of anthocyanin content

Examinations of colouring materials were made by the method of Füleki and Francis (1968) using hydrochloric acid and ethanol for colour extraction, at 530 nm with a U-2800A spectrophotometer.

2.5 Determination of polyphenol content

Polyphenol content was determined in the presence of Folin-Ciocaltens agent at 765 nm using spectrophotometry, on the base of a calibration curve made from gallic acid, according to the method of Singleton and Rossi (1965).

2.6 Ferric reducing/antioxidant power (FRAP)

The ferric reducing/antioxidant power (FRAP) assay was carried out according to Benzie and Strain (1996). The FRAP assay is based on the reduction of the $Fe3+$-2,4,6-tripyridyl-S-triazine complex to the ferrous form ($Fe2+$) and the intensity of the reaction is monitored by measuring the change of absorption at 593 nm.

2.7 Fruit juice concentrate and drying

The samples were dried in the atmospheric (60 °C, 5 hours) and vacuum (60 °C, 5 hours, 10 mbar) dryers. The samples were taken out every hour to determine the above mentioned parameters.

Fruit juice samples were made from the candidate to determine its adaptibility for producting fruit juice concentrate. The fruit juice samples were prepared on the following way: washing, pulping, handling with enzyme (40-45°C, Fruktozym-P pectindecoupling enzyme 0,1ml/kg, standing time: 1 hour), pressing, handling with pectindecoupling enzyme (Fruktozym-P pectindecoupling enzyme 0,05 ml/ l, standing time: 20-25 minutes), settling (silica 0,5 ml, standing time: 30 minutes, gelatine 0,1 g/l, stanind time: 30 minutes), filtration, evaporation (Rotadest vacuum evaporator, 100 mbar). Filtered fruit juice, semi fruit juice concentrate (29-32 ref%) and ready fruit juice concentrate (66-68 ref%) were made from every samples.

3. RESULTS AND DISCUSSION

3.1 Changing of inner content value of fresh fruits during the ripening time

According to 3 years study it can be statemented that the examined variety and the 'Érdi bőtermő' has excellent inner content and was used as controll showed the highest antioxidant content at the end of ripening period, between the 2nd and 3rd picking time in 80 to 90 % of mature (Table 1). There wasn't any effect of vintage on the tendency of antioxidant compounds but there was effect of vintage on quantity of them. The IV-3/48 candidate exceeded the inner content value of 'Érdi bőtermő'. This candidate contained extreme high antocyanin and polyphenol content.

Table 1. Results of raw material

IV-3/48					
Picking time	Antocyanin (mg/l)	Polyphenol (mg/l)	Refraction (%)	Titrable acid (%)	Frap (mM/l)
26.05.2008	180.17 ± 7.76	232.84 ± 20.62	13.3 ± 0.01	1.18 ± 0.01	5.44 ± 0.09
29.05.2008	250 ± 18.87	305.23 ± 25.54	12.9 ± 0.01	1.13 ± 0.23	5.96 ± 0.02
03.06.2008	417.5 ± 69.69	475.74 ± 24.65	15.2 ± 0.01	1.03 ± 0.01	7.50 ± 0.04
19.05.2009	150 ± 7.5	244.1 ± 10.05	10 ± 0.2	1,23 ± 0.03	5.85 ± 0.07
25.05.2009	107.5 ± 18.87	449.2 ± 22.42	12.5 ± 0.1	1.04 ± 0.03	7.42 ± 0.04
28.05.2009	215 ± 26.34	527.22 ± 22.12	12 ± 0.1	1.01 ± 0.01	6.11 ± 0.04
26.05.2010	107.5 ± 4.33	158.04 ± 2.41	9.1 ± 0.1	0.92 ± 0.02	4.47 ± 0.06
02.06.2010	167.5 ± 3.12	284.31 ± 24.41	9.7 ± 0.1	0.81 ± 0.01	5.95 ± 0.03
08.06.2010	420.5 ± 27.26	511.13 ± 59.81	11.5 ± 0.1	0.71 ± 0.01	6.98 ± 0.15
Érdi bőtermő					
Picking time	Antocyanin (mg/l)	Polyphenol (mg/l)	Refraction (%)	Titrable acid (%)	Frap (mM/l)
05.06.2009	115 ± 15.6	203.9 ± 12.4	16.5 ± 0.01	1.81 ± 0.12	3.64 ± 0.05
11.06. 2009	197.5 ± 11.45	296.9 ± 17.8	17.5 ± 0.1	1.65 ± 0.16	5.09 ± 0.04
22.06.2009	211.1 ± 6.76	422.3 ± 16.93	19.5 ± 0.2	1.26 ± 0.02	6.29 ± 0.03

3.2 Changing of antioxidant compounds during producting fruit juice concentrate

The watersoluble dry matter content of fruit juice was created the above described method was 15,35 % but the semi fruit juice concentrated contained 31,42 % and the filtered juice had 68,14 %. Anthocyanin and polyphenol content as well as the antioxidant capacity of the samples increased during the compression. We published data on 10 ref% to have a real picture about the changing (Table 2). According to Table 2nd's data the polyphenol content didn't change so the candidate's pressed fruit juice was tolerant to temperature was arose during the evaporation. The brauning processes are connected to the synthesis of polyphenols weren't characteristics for the examined cultivar (as against other cultivars e.g. 'Érdi Jubileum'), the antocyanin content remained stabil. Those parameters are important if the aim is to produce functional food (e.g. natural color material, producting products with high antioxidant contenct).

Table 2. Results of fruit juice concentrates

	Filtered juice	Semi fruit juice concentrate	Fruit juice concentrate
Refracio (ref%)	15.35	31.42	68.14
Antocyanin (mg/l) Antocyanin (mg/l) (for 10ref%)	466 303	1038 330	2415 355
Polyphenol (mg/l) Polyphenol (mg/l) (for 10ref%)	1665 1081	3786 996	7588 1031
FRAP mMAS/l) FRAP (mMAS/l) (for 10ref%)	10,52 6.83	17 5.41	15.5 2.28

3.3 Examination for drying

The original moisture content of the IV-3/48 candidate was 72,34 % it was decreased by 4,84 % at the end of atmospheric drying but by 10,5 % after vacuum drying (Table 3). Polyphenol content of the samples increased significantly (by 18,7 %) among atmospheric conditions but their antocyanin content decreased (by 10,5%). It was an opposite change in the vacuum drying: the polyphenol content decreased but the antocyanin content remained stabil. According to our results the vacuum drying method can suggest for processing IV-3/48 candidate so the quantity of antocyanin can be saved and the important polyphenolic brouning won't appear.

Table 3. Results of drying

	raw	1st hour	2nd hour	3rd hour	4th hour	5th hour
Moisture content (%)						
atmospheric	72.34	34.37	52.49	29.44	16.18	4.84
vacuum	72.34	-	17.4	-	15.2	10.1
Polyphenol (mg/l)						
atmoszférikus atmospheric (for	1045	1368	1956	3240	3891	4930
14ref%)	1150	1080	1100	1160	1190	1241
vacuum (for 14ref%)	1045	-	3602	-	4733	5758
	1150	-	1090	-	1010	1102
Antocyanin (mg/l)						
atmospheric	603	771	940	1595	1676	2145
atmospheric (for 14ref%)	603	600	524	550	500	520
vacuum (for 14ref%)	603	-	2140	-	2644	3238
	603	-	602	-	620	640

4. CONCLUSIONS

The IV-3/48 was amounced for examination contained both fresh and in processed form extrem high antioxidant compouns are important in the health-care. According to our results the examined candidate is suitable for taking out the artificial coloring material as well as producting food products have functional effects.

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TENDENCIES IN EATING HABITS CAUSED BY THE CHANGE OF HOUSING STRUCTURE IN HÓDMEZŐVÁSÁRHELY

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ABSTRACT

Lifestyle can be shortly described like this: how do we live? Specific features can be experienced in the housing conditions, in the economic structure, in the way we do our work, in the way of living and finally, in changes that touched traditions and eating habits, too.

In this essay we are focusing on the following fields: mass migration into town due to the disappearance of farmsteads as a special settlement form, and analysis of changes involving eating habits caused by the sporadic moving out of town today.

1. INTRODUCTION

We are examining the period from the middle of the last century up today. We are aiming to analyse the eating habits in connection with the changes in the housing structure and conditions. Some determining factors have to be underlined to get a full picture of the necessities created between town-dwellers and people who live on farmsteads.

These are the following:
- Important changes in housing conditions (moving to town, to a detached house, to a block of flats, or to a flat without a pantry from farmsteads)
- Statistic data concerning household utensils (for example, refrigerator)
- Infiltration of networks of chain of stores into the traditional shops
- Special eating habits in case of the youth and the intellectuals
- Change in eating habits generated by the growing number of the elderly.

What are we seeking the answer to? First of all, how did the above mentioned factors influence, alter the way of eating? Secondly, what is expected in our modern world from the protectors of the national traditions and customs?

2. MATERIAL AND METHOD

In our research work we were assisted by the surveys made by the City Council of Hódmezővásárhely, secondary specific literature and personal encounters; data collection was done in the empirical form.

3. THEORITICAL APPROACH OF THE MAIN SOCIAL-ECONOMIC CHANGES THAT HAVE AN EFFECT ON LIFESTYLE

Manner of life is the relatively constant system of people's everyday life which is shaped to fulfil their necessities and which involves:
1. the problem of „how do we live?" and
2. the one of „how should we live?".

These questions cannot be answered without recognising the way of living realized by the mass and types of „how do we live", but at the same time the present cannot be formed or altered if we do not know what direction to take, if we do not have a conception about „how to live". (Farkas 1977)

4. HOW DO WE LIVE? HOW SHOULD WE LIVE?

Customs, habits and ideals are of double-sided. Customs can be conservative conventions and positive traditions. Ideals also can carry positive energies and inactive desires to escape from present reality.

What has become a custom is a strong pillar of the everyday culture. If we did not have an ideal for the lifestyle, the present would easily remain alone closed into conventions and it could become a conservative force, without the model of „how to live".

The lifestyle model of „how to live" is not an abstract, future ideal. It is a type that influences present and it is imbued with the values of future. It realizes the present values, although not because of its wide-spread feature but because it has peculiarities referring to future tendencies. It is a special self-realization. The more it becomes useful for others, the more it becomes important for life.

In the present social-economic conditions the question of consumption model is very actual the importance of its examination has a growing tendency. In our everyday routine, in our environment examinations concerning consumption are getting more vivid.

When thorough changes are planned to be accomplished in the production structure, it concerns the consumption, too. There are tendencies in consumption which make production more dynamic. Dynamic feature of certain necessities motivates modernization which proves the mutual connection between production and consumption.

Where the standard of living has started to rise, the food consumption is increasing at a rapid pace until food requirements are fulfilled at a certain level.

Nowadays, examinations on the structure of consumption are highlighted, first of all, the ones on foods which are more valuable from the point of view of nourishment and physiology, while proportion of industrially processed foods, which contain additives and flavour-intensifiers, is increasing.

Analysing the structure of the Hungarian food consumption it can be said that positive changes have started in our country, composition of food demand is changing. Changes can be seen in Table 1. The year 1989 was chosen because it was the quantitative peak in

the Hungarian food consumption, then tendencies are shown with data of the year 2000, and finally data of the year 2004 are presented.

Table 1 Consumption of food and consumer goods in Hungary in three highlighted years
(Source: 'Élelmiszerek és tápanyagfogyasztás 2004', calculations based on statistic (KSH) data)

Name	Data on consumption			Changes (%)		
	1989.	2000.	2004.	2000/ 1989	2004/ 1989	2004/ 2000
Foodstuffs(kg/person/year)						
Meat products	78,2	70,2	68,8	89,8	88,0	98,0
Fish	2,8	3,0	3,4	107,1	121,4	113,3
Dairy products	189,6	160,6	155,2	84,7	81,8	96,6
Egg	20,2	15,3	16,7	75,7	82,7	109,2
Fats, oil	39,2	39,0	39,0	99,5	99,5	100,0
-animal	28,7	21,0	19,5	73,2	67,9	92,9
- vegetable	10,5	18,0	19,5	171,4	185,7	108,3
Cereals	112,2	94,1	89,2	83,9	79,5	94,8
Potato	55,2	64,0	68,0	115,9	123,2	106,3
Sugar	40,9	33,6	33,2	82,1	81,1	98,8
Vegetable, fruit	159,6	217,7	211,4	136,4	132,5	97,1
Consumer goods						
Wine, l	22,8	28,3	32,7	124,1	143,4	115,5
Beer, l	104,0	71,6	73,2	68,8	70,4	102,2
Spirits, l	5,0	3,2	3,6	64,0	72,0	112,5
Coffee, kg	2,6	2,8	2,7	107,7	103,8	96,4
Tea, dkg	12,6	20,3	31,9	161,1	253,2	157,1
Tobacco, kg	2,2	1,5	1,4	68,2	63,6	93,3

Between 1989 and 2004 positive changes have started in the food consumption structure of the Hungarian population. In this period intake of food moved toward the alimentary recommendations thus adjusting to the structure of consumption in the developed countries. We have to add that the solvent demand had an important role in this process. It can be established that consumption of vegetables, fruit, vegetable oil and potato have increased. Use of animal fats has significantly decreased but our country still shows the highest value among the European countries. Besides, consumption of sugar and certain consumer goods (beer, tobacco, and spirits) have considerably lessened. These improving tendencies are weakened by the essentially low consumption level of fish, dairy products and meat products (Panyor 2007).

Comparing data of the year 2004 to the consumption data of the year 2000, a stagnation of greater significance in improvement can be seen, so the positive tendency until 2000 seems to stop. There are economic factors in the background.

Comparing to other countries of the EU Hungary is among the last ones regarding consumption of fish, dairy products, vegetables and fruit. It is the first in the use of animal fats which is basically responsible for different metabolic diseases and insufficiency of nourishment.

The favourable life expectations of the inhabitants of the Scandinavian countries are in strict connection with the lifestyle, the clean environment and good eating habits. In the Mediterranean countries consumption of vegetable oil, fish, vegetables and fruit is high so positive eating habits are typical. Both regions can be set as examples for Hungary, this

way we can find a lot of positive examples to change the eating habits in our country (Szakály 2004).

In addition, it is important to mention that proportion of those who follow a healthy diet is fairly low. According to the data of GFK HUNGÁRIA (2006), only 13% of the population eats healthily.

5. THE MOST IMPORTANT FEATURES OF CHANGES IN THE EATING HABITS OF PEOPLE LIVING ON FARMSTEADS AND IN TOWN

If we shortly look back in time, about 7.000 farm numbers were allocated in Hódmezővásárhely until 1950. According to the data of the City's Register of Title Deeds, nowadays the number of farmsteads which still take part in the agricultural production hardly reaches 400. Enormous lands have become empty. Liquidation of farmsteads was started in the 1950's then it accelerated from the 1960's.

In the first part of the 20th century – according to certain opinions- the system of farms was a kind of surviving feudalism where not only developing model farmers lived but also smallholders, farm hands, landless agrarian workers whose number were constantly growing. In other opinions this form of settlement is nothing else than a certain way of living where housing, workplace, land and cattle rising coincided with each other. Some food was produced right around the house which then the farmers either sold in the marketplace or used for their own sake. The number of farms was decreased with collectivisation, their population moved to the nearby settlements, people who stayed produced for their own alimentation on the lands around their house.

In the inner city areas shortage of flats increased which was aimed to solve by building flats of small ground-space. Members of the co-operatives who lived in town were taken to their workplaces, to the surrounding lands, 10-20 km away from their homes.

There was such a dramatic and rapid change in the housing structure around the town that the farmer of Hódmezővásárhely had not imagined before. He had not thought that it could be possible to produce in other way than from the farmhouse built on the land itself where all the products, and equipment, tools can be found.

Table 2 Farmstead as home and workplace
(Source: Szenti 2005)

Number of outskirt districts	Number of dwellings in the outskirts	Number of people in the outskirts	Number of traditional farmsteads	Number of deserted farmsteads	Number of farmsteads inhabited periodically	Number of farmsteads where cattle is raised	Number of people who raise cattle
1.	66	137	63	16	2	38	113
2.	43	109	43	4	1	4	4
3.	84	223	80	1	-	-	-
4.	45	144	45	-	-	26	97
5.	59	185	59	-	-	19	53
6.	97	237	94	4	-	70	182
7.	55	118	55	11	2	-	-
8.	81	233	81	1	-	-	-
9.	118	303	117	19	1	-	-
10.	100	205	94	11	1	41	100
11.	59	154	59	3	-	-	-
Altogether	807	2048	790	70	7	198	549

Table 2 shows the data of the survey made by the City Council of Hódmezővásárhely. The outskirts of the town are divided into 11 districts where about 2000 inhabitants live. The number of deserted farmhouses is quite high, due to the above mentioned process. In most farms only as many cattle are raised as many are enough either to complement the lower salaries, aids, allowances or to meet their own needs. (Present essay does not examine the agricultural production of small businessmen, or agricultural stock corporations.)

Survey made by the rural constables in October, 2005 examined the everyday life of the inhabitants of the outskirts from a different aspect. The questionnaires were filled in by people who live in 650 farmhouses, official residences or closed lands. It can be seen in Table 3 that people in the outskirts live typically in farmhouses the number of which reaches 600. Proportion of those who live on farms out of necessity is fairly significant, besides, 12% of the inquired ones moved to the farms for agricultural reasons. Tradition is an important motivating factor: if parents and grandparents lived on farms the next generation choose this way of living, too. The number of those who cannot move to town because of bread-and-butter worries should be mentioned, as well. 65% of the inquired cultivate lands in properties in the outskirts but only 30% of them gain their living from the produced goods.

Table 3 Some characteristics regarding the way of choosing residence
(Source: Kószó 2004)

Type of the outskirt	Num ber of prope rties in the outsk irts	Live on farm out of necessity	Moved to farm by choice	Moved to farm to cultivate lands	Do not want to move to town / His/her parents, grandparents lived on farm	Cannot move to town	Live on the land / Can get along	Cannot get along
Farmstead	587	60	46	71	336	74	117	263
Official residence	38	16	1	-	19	2	2	15
Closed land	25	15	4	3	2	1	-	4
Altogether	650	91	51	74	357	77	119	282

In the 1950s people on farms had their grain milled, they baked their home-made bread in oven once a week. The housewife was proud of her nice, light bread, while town-dwellers bought their bread at the baker's. In the last half a century people both on farms and in towns buy their needs from a wide variety of bread at the baker's and in shops.

In the past pigs, poultry were raised in the yards of the houses both on farms and in towns. On farms families were independent regarding the meat, while in towns they were partly independent. They stuck and processed the pigs at home; a part of the meat got smoked, while the other part was preserved at the house. The wide-spread use of refrigerators from the mid-80's brought important changes which today means 100% degree of supply, what is more in most houses there are more fridges and deep freezers. The use of refrigerators together with moving to town reduced the consumption of smoked goods and meat fried in fat. Long time ago „mangalica" pigs and bacon pigs were stuck, too. From the 1960's it was impossible to get „mangalica" pigs and it was necessary to get permission to stick

sheep. Actually the private butchers had to close down. Only a little beef and no veal at all was available at shops.

Nowadays those who live in the detached houses of towns and even those who are somehow linked to the village or farmhouses do not stick pigs, they buy the fresh meat for cooking in shops, mainly in super- and hypermarkets.

Poultry (chicken, goose, duck, turkey, guinea-fowl) was raised on farms, a part of which was sold in markets. Chickens were raised in towns, too. Today poultry is bought in shops, mostly in the form of semi-processed or ready-made products.

The peasants, agricultural and industrial workers consumed more meat and bacon and less vegetables. Those who lived on farms could not imagine lunch without some soup; they could make more than twenty different kinds of it (Nagy 1975). They cooked as much as they could eat the very day because they could not store it.

They had bacon, milk, cottage cheese, eggs and cheese for breakfast and dinner with radishes and chives. They said that 'there are more days than sausages' so they eat them very rarely. Today these eating habits are typical to the older generation. The new generations, the intellectuals who live in towns have more vegetables, cold dishes, grilled food, pizzas, hamburgers and different cold cuts, while they need less and less soup and stew.

The number of those who buy fresh milk directly from the houses is quite low, the majority of the population consumes products made in factories and sold in trade. There is a wide range of cheese, yoghurt, butter, margarine, though we buy less of them than it should be necessary for the healthy diet.

Today housewives do not knead paste; lots of different kinds of ready-made pastas can be bought which are produced in factories. Bakery products are widely sold everywhere, too, and pastry-making has improved a lot. These products are more and more popular with the youth who live in towns thus pressing back the home-made, original and traditional cakes.

Consumption of mineral water (still or soda water) and soft drinks has spread, as well, the majority of which contain more artificial and additive materials. Some decades ago it was not typical in case of people living on farms to drink either soda water or soft drinks. They consumed natural water and fruit syrups made at home.

There is an important change even in case of vegetable crops, too. Who has a garden is fully or partly independent today. However, the majority of population either in town or on farm does not often have a kitchen garden. They buy the vegetables in marketplace, in shopping centres or at the greengrocer's. Long ago it was impossible to get first-fruits in winter, today vegetable supply is continuous. In supermarkets vegetables are always available for the population. It is a typical tendency that vegetable and fruit consumption is growing among town-dwellers, the youth and the intellectuals while it is less typical in case of people who live on farms.

Long ago it was natural to preserve fruits, vegetables for winter, it is out-of-date today. Only elder grandmothers do it and it remained important for those who prefer natural, home-like flavours to the ones of uncertain origin made in factories.

It was natural to make home-made pickled cabbage on farms; it was consumed throughout the winter. Today it is made in factories and bought in the form of conserves or at the greengrocer's.

By the 1960s factory canteens had been developed both in industrial and agricultural firms so workers could have cooked dishes at their workplaces. Today it is taken over by enterprises in some places but only few people can get this service.

Network of catering children has been developed which provides children with cooked meals – according to their age- in kindergartens, elementary and secondary schools. This task is managed by different enterprises.

A lot of private catering units have been established, each of them offer customers weekly menu bars which can be consumed locally or delivered to the house, and at weekends the guests can help themselves as much as they want to for a fixed price.

Meals made in oven or in stew-pots, barbecue, vegetarian dishes and dietary kitchen are reviving now. In case of certain costumer groups consumption of „mangalica" pig, grey cattle, veal and sheep can be experienced.

Lifestyle has significantly changed the essence of which is to promote conditions of healthy way of living by realizing a modern structure of consumption. It is aimed to stop overfeeding and the high level of consumption of alcohol. Diffusion of modern hygienic conditions and habits, formation of health behaviour adequate to the modern health culture belong to this field of interest, too.

6. SUMMARY

The Hungarian cuisine was formed by people who work hard, who live carefully but when they celebrate something these people make a sacrifice preserving traditions and motivating boldly (Szakál 1985). Nowadays more modern, more conscious eating habits have an important role in forces which form new prospective and in the everyday routine of the scientific-technical revolution.

During the last fifty years the world changed a lot, there were changes in consumption, as we have shown, indicating the formation of a more modern way of living which is much debated regarding preservation of health.

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INNOVATION – THE ACCEPTANCE OF NOVEL FOOD TECHNOLOGIES BY UNIVERSITY STUDENTS

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ABSTRACT

The aim of the study was to examine the attitude of Hungarian students toward novel food processing technologies. A questionnaire survey was made with sample N=212. Three novel (PEF - pulsed electric field, HPP - high pressure processing and nanotechnology) and two traditional (pasteurization, fortification) technologies were studied. The respondents got a technical definition of these technologies. Based on the description, the respondents evaluated three statements (whether the technologies were extremely good or extremely bad, unreasonable or reasonable and how much do they agree with or oppose the use of these technologies) on a 1-7 point Likert scale.

According to the results respondents have the most positive attitude toward HPP and pasteurization and accept the nanotechnology the least. The rationality of the technologies got the highest scores but respondents supported the application of the technologies the least. This suggests the negative emotional acceptance of the technologies.

The K-means cluster analysis was used for grouping the respondents. We could define four clusters based on the acceptance of the technologies. The *"Slightly differentiating accepting group"* (N=64) judged the technologies nearly as equal, except nanotechnology. They had the most positive attitude toward fortification of foods. The acceptance of nanotechnology was also the highest within this group. The *"Open for novel technologies group"* (N=37) evaluated all the technologies between 4.0-5.5 except pasteurization, to which the lowest preference level was attached. This group mostly preferred fortification and PEF. The *"Traditional technologies supporting group"* (N=59) opposed nanotechnology the most. The highest preference was attached to the well known fortification and pasteurization. *"Naturalness expecting group"* (N=56) mostly preferred the HPP and pasteurization and they were mainly against fortification and nanotechnology. The considerable differences between the groups were primarily caused by the different judgement of the well-known fortification and the less known nanotechnology.

This study was carried out in the framework of the NovelQ EU FP6 project.

1. INTRODUCTION

The new food processing methods provide several benefits (e.g. longer shelf life, less energy and water use, better preservation of vitamins). However, the benefits of the new technologies could only be realized on the market, if suitable demand comes forward for the products produced by these technologies. This makes the examination of consumer attitudes toward these technologies important. The aim of the study was to examine the attitude of Hungarian students toward novel food processing technologies. This study was carried out in the framework of the NovelQ EU FP6 project, which aims at the investigation of novel minimal processing technologies (HPP and PEF).

2. PREVIOUS STUDIES ON NOVEL TECHNOLOGIES

Several researches were made on the consumer acceptance of novel technologies.

Cardello (2003) examines the opinion of 88 respondents about novel technologies. The respondents were between 18 and 64 years and the study was carried out in the US Army Natick Soldier Center. 41% of the respondents had concern of PEF technology, and 29% had concern of HPP technology. The fewest respondents (18%) felt concern of pasteurization. At Central Food Research Institute in Budapest a conjoint analysis was made to examine the consumer acceptance of apple juices made of novel (HPP and PEF) and traditional technologies (pasteurization, untreated products). The study was made with the involvement of 150 Hungarian and 150 Slovakian respondents. The results showed that respondents mostly preferred untreated juices. From among the technologies respondents accept HPP technology the most and those consumers preferred HPP, who rejected pasteurization (Bánáti et al., 2010). Results of Cardello, (2003) and Deliza et al. (2003, 2005) showed the acceptability of application of HPP, too. A study was carried out with 96 fruit juice consumers in Rio de Janeiro. The aim of the conjoint study was to quantify the impact of package attributes (brand, price, production type, product definition and technology information) on consumer intention to purchase. Technology information had three levels: technology with some explanation; technology without explanation and without information about the technology. The information about the technology applied to the fruit juice production had a significant effect ($p < 0.05$) on the consumer intention to purchase. The relative importance of the technology was 11% in the intention of purchase. Information about the benefits of HPP technology had positive contribution on purchase intention, while the information about the technology without additional explanation led to a negative impact on consumer purchase intention (Abadio, 2003). According to Deliza et al. (2003) explanation of the meaning and advantages of high pressure technology may lead to higher product satisfaction and contributing to the market introduction of the juice that was processed with non conventional technologies.

3. METHOD

In our survey three novel (PEF - pulsed electric field, HPP - high pressure processing, nanotechnology) and two traditional (pasteurization, fortification) technologies were studied.

Our survey was made with standardized questionnaires. The respondents were chosen from among the students of four universities in Budapest and near to Budapest. 226 students filled the questionnaires. Respondents evaluated the five technologies on a 1-7 Likert scale. The questions concerned the affective, cognitive and conative aspects of the attitude. Respondents had to evaluate the goodness, reasonableness of the technologies, and the agreement of the application with the technologies. The students had not previous knowledge about the technologies, they got short descriptions, which helped them to evaluate the technologies. The descriptions of the technologies were the following:

- **HPP - High Pressure Processing:** High pressure is a technology that preserves food products and extends shelf life of fresh products through application of pressures. High pressure has limited effects on the fresh characteristics and usually maintains colour, taste, texture and nutritional value without using additives. HPP is using limited energy and water compared to conventional technologies.
- **PEF - Pulsed Electric Filed:** Pulsed Electric Field, a mild processing technology is a method that uses short electric impulses to preserve food products. The application of this technology extends shelf life of fresh products. This processing method operates at room temperature, so food quality and several healthy heat-sensitive vitamins are better preserved in the treated products. Using Pulsed

Electric Field technology saves the energy of heating up and cooling down food products.

- **Nanotechnology:** Nanotechnology deals with the production and utilization of particles <100 nanometres (nm) or even smaller in size. Nanoparticles used as vehicle substances make possible to enhance and adjust the colour, flavour or nutrient content of foodstuffs to meet special consumers or health needs.
- **Fortification:** Fortified foods are food products which in the industrial processing are enriched with substances such as vitamins, minerals, fiber and plant extracts in order to increase the health effects of the conventional, basic product.
- **Pasteurization:** Pasteurization is a process where food products are heated up and subsequently cooled down. This process slows microbial growth in food and extends the shelf life of the product.

4. RESULTS OF THE SURVEY

According to the results, respondents have the most positive attitude toward HPP and pasteurization. The judgement of PEF was better, than fortification concerning all three examined attributes. The most unfavourable technology was nanotechnology. The reasonableness of the technologies got the highest scores but respondents supported the application of the technologies the least. It may indicate the low confidence of consumers and the low purchase intention of the products made of food technologies.

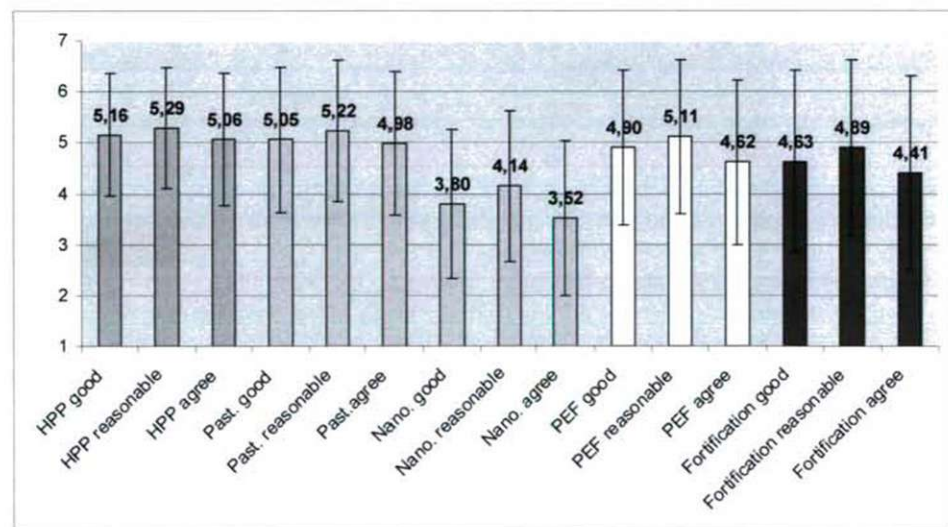*Figure 1. The evaluation of the technologies (N=216)*

As the chart (Figure 1.) shows there are relatively high standard deviations, which indicate that consumers are divided in terms of their views of the technologies. For this reason it was needed to examine the separable consumer groups concerning the judgement of the technologies. With the use of K-means cluster analysis four consumer groups were separated.

1. The *"Slightly differentiating accepting group"* (N=64) gave the highest values for all the technologies from among the consumer groups. They judged the technologies nearly as equal, except nanotechnology which got the lowest scores. They had the most positive attitude toward the fortification of foods.
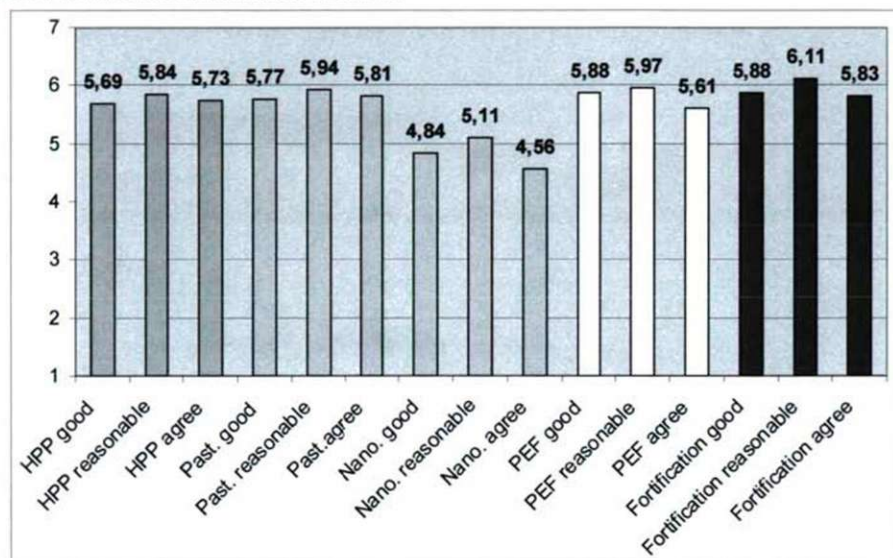
Figure 2. „Slightly differentiating accepting group" (N=64)

2. The *"Open for novel technologies group"* (N=37) evaluated all the technologies rationality between 4.0-5.5 points, except the well-known traditional technology, pasteurization, to which the lowest preference level was attached. This group mostly preferred fortification and PEF. 28 respondents from the 37 are female in this opened group.
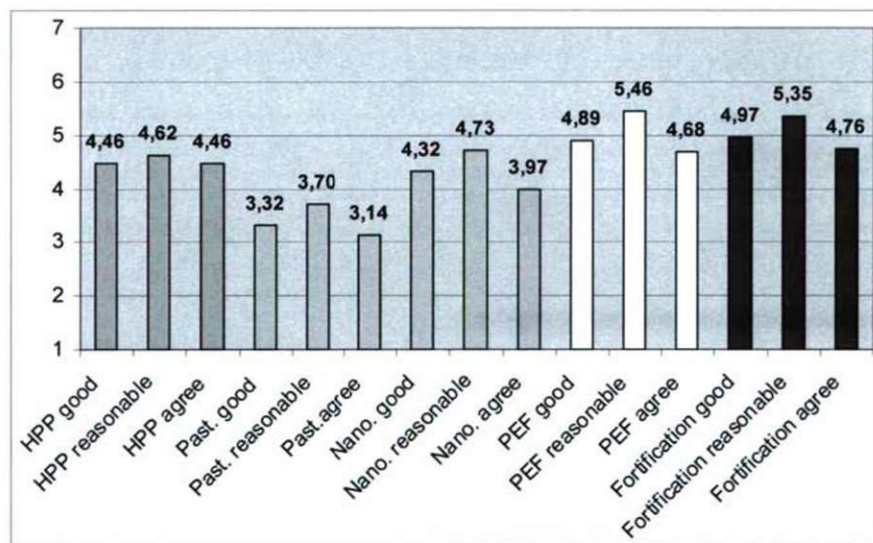
Figure 3. "Open for novel technologies group" (N=37)

3. *"Traditional technologies supporting group"* (N=59) opposed the nanotechnology mostly. The highest preference was attached to the well known fortification and pasteurization.
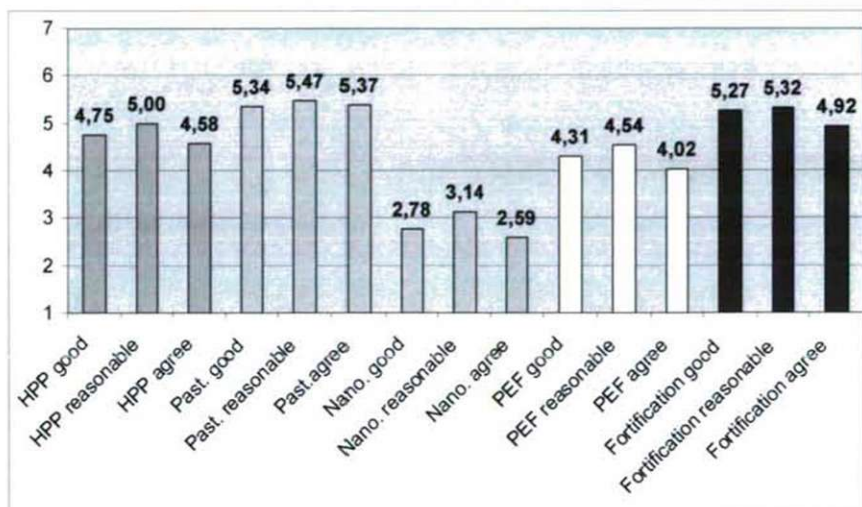
Figure 4. *"Traditional technologies supporting group"(N=59)*

4. *"Naturalness expecting group"* (N=56) mostly preferred the HPP and pasteurization and they were mainly against fortification and nanotechnology.

Figure 5. *"Naturalness expecting group" (N=56)*

5. CONCLUSIONS

30% of the respondents were not influenced dominantly by their previous experiences. Among them, the judgement of the novel and the traditional technologies – except nanotechnology – was approximately similar.

Most of the young adult age group had a strong opinion about the unknown novel technologies. There were remarkable differences in the acceptance of new technologies among the students, which sample was supposed to be open for novelties because of their young age and their experiences.
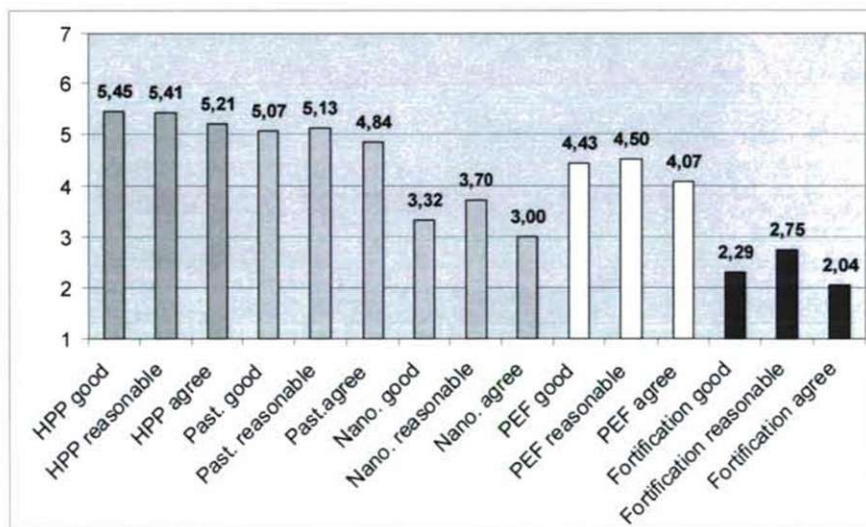
The *"Open for novel technologies group"* (17%) formed their judgement on the technologies rationally. They preferred physical technologies without heat treatment. 76% of this segment are female.

The judgement of the new technologies fitted to the respondent's existing preferences in case of the *"Traditional technologies supporting group"* (27%) and *"Naturalness expecting group"* (26%). The *"Traditional technologies supporting group"* accepted HPP the most from among the new technologies, presumably because of the favourable associations (freezing, like traditional technology). They rejected nanotechnology, and the acceptance of the PEF was moderate. The most preferred technology among this segment was the well known pasteurization and the fortification.

The *"Naturalness expecting group"* preferred HPP more, than pasteurization. The most rejected technology was the fortification, they judged it unnatural.

According to the survey most of the respondents form their point of view according to their existing expectations and information about the technologies. The results show openness toward novel technologies, particularly the HPP technology. The most unaccepted technology is the nanotechnology.

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THE USE OF LOCAL VALUES FOR TOURISM AND RURAL DEVELOPMENT

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ABSTRACT

After the change of the political-economic regime, since the 1990s, economic restructuring and subsequent crisis in agriculture have reduced the economic opportunities of rural communities. These - mostly negative - changes have limited rural communities' economic development options, making former development strategies less viable and forcing them to look for new ways to sustain themselves. One of the most popular, non-traditional rural development strategies has been tourism and its associated entrepreneurship/partnership opportunities because of tourism's ability to bring in money and to generate jobs and support economic growth. The purpose of this study is to identify and examine those factors that have helped or could still help rural communities to develop tourism.

A research work (with the help of surveys) was conducted with the participants of the tourism market. The results clearly demonstrate the importance of the community approach to tourism development and that rural tourism development and entrepreneurship cannot work without the participation and collaboration of the different partners (e.g. businesspeople, local governments, NGO-s, local people) directly and indirectly involved in tourism.

This paper also reviews, how the principles of sustainable tourism have special relevance to the development of rural tourism, and examines how those principles can be put into practice. It considers the advantages of this approach, and offers guide-lines for future practitioners.

Rural tourism is increasingly viewed as a panacea, increasing the economic viability of marginalised areas, stimulating social regeneration and improving the living conditions of rural settlements. Less developed areas, afflicted by debilitating rural poverty, have considerable potential in attracting tourists in search of new, authentic experiences in areas of unexploited natural and cultural riches. This paper proves – the above mentioned statement - that the clustering of activities and attractions, and the development of rural tourism routes, stimulates co-operation and partnerships between local people, institutions and mostly the neighbouring areas. The other aim of this paper is trying to outline the complexity of rural development processes that specifically relate to the phenomenon of multifunctionality.

Conclusions:
- local people were active in giving information about their work and plans
- they need help (e.g. EU support, education) in participating in the tourism market
- there are local values of the settlements that have not been utilized yet but can be developed into a tourism supply
- the surroundings (e.g. road infrastructure) of the settlements are very important

Aims:
- organise an attitude-shaping complex communication campaign serving the conceptual and framework system of sustainable tourism (e.g. to inform farmers or local people about how to start an agro-tourism business)
- compile a specific appeals register for the settlements/sub-regions
- design a leaflet with the most important information for tourists (Slovak example)

- organise and implement a profession-specific tourist cluster or Tourism Destination Management organisation (to strengthen co-operation).

1. INTRODUCTION

After the change of the political-economic regime, since the 1990s, economic restructuring and subsequent crisis in agriculture have reduced the economic opportunities of rural communities. These - mostly negative - changes have limited rural communities' economic development options, making former development strategies less viable and forcing them to look for new ways to sustain themselves. One of the most popular, non-traditional rural development strategies has been tourism and its associated entrepreneurship/partnership opportunities because of tourism's ability to bring in additional money and to generate jobs and support economic growth. The purpose of this study is to identify and examine those factors that have helped or could still help rural communities to develop tourism.

This paper also reviews how the principles of sustainable tourism have special relevance to the development of rural tourism (especially agro tourism), and examines how those principles can be put into practice. It considers the advantages of this approach and offers guidelines for future practitioners.

2. MATERIAL PERUSED

2.1 International examples proving the connection between rural development and rural tourism

Especially during the last decades, many countries considered tourism as a real and sustainable support for their economic development. Tourism was considered a real opportunity for Romania as well. Despite this, the contribution of travel and tourism economy to Romanian GDP varied around 2% in the period of the years between 1997 and 2007. Due to an underdeveloped and neglected road infrastructure, to the lack of financing sources and to the lack of interest on behalf of local and central authorities for tourism development, regions otherwise fit for ecotourism and rural tourism - like Maramures - failed to attract tourist, neither foreign, nor Romanian. The situation improved slowly since 1996, after the decision of the European Community to finance rural development (including rural tourism) in Romania through PHARE programs and - by the end of 1990s - through SAPARD programs. (Negrusa-Cosma-Bota, 2007)

Farm recreation simply includes any recreational activity enjoyed by guests for a few hours or a few days, while staying on a farm or ranch. It was first legally defined in the U.S. by the Wyoming Department of Public Health as "a ranch/farm facility containing or having under use agreement 160 acres or more which may for a charge to the public provide activities for not more than a daily average of 8 persons in any given 30 day period or may include sleeping facilities in not more than 4 sleeping units along with accompanying meals. Meals and lodging shall be considered an adjunct to the activities which take place on the farm and are not available to 'non-registered guests'. Recreation offered by a farmer or a rancher is a secondary activity to generate supplemental income. The activities offered are limited only by the imagination or resources available. These activities help the farm/ranch recreation industry to fit nicely into the travel industry's definitions of adventure travel, ecotourism, heritage or cultural travel and are generally thought of as a destination vacation. Space, aesthetics, new learning experiences, adventure, and the

opportunity for recreationists to do their own thing with a rural American family, away from crowds, are valuable resources and services which can be provided by farmers or ranchers. For potential guests in stressful jobs, and those wanting to get back to nature, rural recreation can provide a measure of wellness in today's health-conscious society." (Daniels-Powell-Rottman, 2001)

Another useful possibility for developing especially rural tourism - practiced by Slovakia – is to inform guests about the tourism supply of a settlement/region in printed leaflets (one side written in the home language and the other in English) with the following contents:

- General information
- History
- Ethnography
- Religion
- Economy
- Transportation infrastructure
- Natural features and protected areas
- UNESCO cultural and natural heritage sites
- Special places of interest (www.vupco.sk)

2.2. Area description

We suppose that education - especially higher education - can help in developing rural areas through rural tourism. Szolnok University College in Hungary represents one of those institutions that involve students in different research activities and in working out projects for different applications, related to tourism. The College offers eight first degree programmes, including Tourism & Catering, Commerce & Marketing and Economic & Rural Development Management.

The surroundings of the College are typically 'rural', with the town of Szolnok situated by the Tisza River at the heart of the Great Hungarian Plain, 100 km east of the capital, Budapest. From a largely agricultural community in the 18th century, Szolnok, due to its advantageous location and excellent road and rail links, by now it has developed into a tourism hub and a thriving commercial centre. The surrounding region is blessed with remarkable natural endowments: fertile soil, plenty of thermal water and a high number of sunny hours. Though largely agricultural, with the unique landscape of the Great Plain and the picturesque Tisza and Zagyva Rivers, it boasts many thermal and medicinal spas underpinning a growing tourism industry.

Two years ago a research project (with the help of surveys) was conducted with the participation of our students, with the aim of getting information on the activities and opinion of the hosts living in settlements our students came from; mostly in the eastern part of Hungary. (Thus the findings were not representative but gave useful information for students and for teachers alike about the way of thinking of the participants of the tourism market, as well.)

2.3. Findings of the research project

This paper highlights only some of the questions that are primarily related to the above-mentioned aim. The hosts (39 people) were asked whether they could mention some reasons that made their settlements and its surroundings attractive. Results show that (in most cases the rural) settlements and their environment (12.7%), the traditions (11.3%) and the existing tourist centres (10.0%) can be mentioned as the main elements of a desirable tourist supply. It is obvious that a various range of the natural environment and traditional

activities, existing even in our days, could be involved in the tourism supply in the eastern part of Hungary.

The hosts, who participate in the field of rural tourism, answered that only one-fifth of the houses were traditional peasants' homes. 67.7% of the houses have separate entrance but the kitchens are mostly (57.9%) used together with other guests or with the host family. They have been asked whether they could provide meals for the guests or not.Table 1. below shows the results.

Table 1.Types of meals provided by the hosts

Type of the meal	(%)
Only breakfast	5.1
Breakfast and dinner	10.3
Breakfast, lunch and dinner	51.3
No meal provided	33.3
Altogether	**100.0**

Resource: surveys

It is good to note that about half the hosts can provide full board but we consider a handicap that one-third of them offer only accommodation. From the point of view of developing rural areas through rural tourism it is distressing that 93.2% of them purchase the raw materials necessary for making food and only 6.8% can use their own products for this service.

Another important expectation of tourism development is the ability to provide guests with more and more services (Table 2.) As the table below shows, the number of services is quite good and the tourism values and programmes of the surrounding settlements or regions are not being involved.

Table2. Types of services provided by the hosts

Type of the service	(%)
Telephone	43.6
TV, radio	97.4
Washing machine	56.4
Refrigerator	97.4
Bedclothes	94.8
Bathing pool	12.8
Garden	76.9
Playground for children	46.1
Other (e.g. (Internet)	2.5

Resource: surveys

Another important issue is to know the sources of intermediaries from where tourists can have information on the tourism supply of a region. It seems obvious that getting information with the help of former guests, friends or relatives was found the most common. We consider surprising the low level of Internet use as a source of information. (Figure 1.)
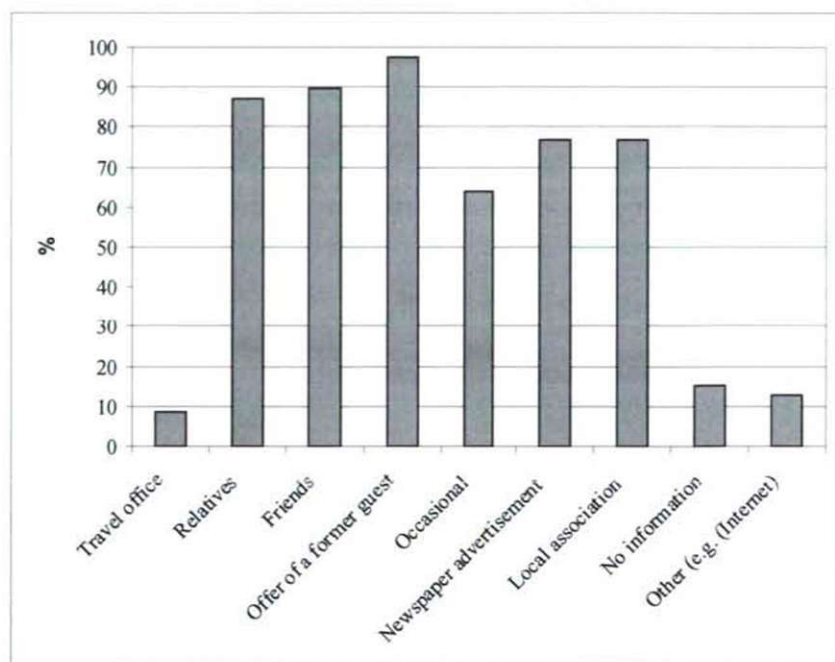
Figure 1. Type of the source of information

We wanted to get some information on the activities that they need help in. We got the list of the most common answers, like learning about the experiences of others working in the given field, market research, organising programmes, co-operation with others, etc. The findings to this question prove the importance of networking and taking part in different training programmes (like getting the latest information on the legal regulations, best practices, tenders, etc.) in the future.

2.3. Conclusions

The results clearly demonstrate the importance of the community approach to tourism development and that rural tourism development and entrepreneurship cannot work without the participation and collaboration of the different partners (e.g. businesspeople, local governments, NGO-s, local people) directly and indirectly involved in tourism.

The other aim of this paper is trying to outline the complexity of rural development processes that specifically relate to the phenomenon of multifunctionality. Multifunctionality is introduced as a means for visualizing the complex inter-relationships in rural development processes and to highlight the functional relationships in the use of local resources such as land, labour, knowledge, traditions and nature.

Conclusions:

- local people were active in giving information about their work and plans
- they need help (e.g. EU support, education) in participating in the tourism market
- there are local values of the settlements that have not been utilized yet but can be developed into a tourism supply

- the surroundings (e.g. road infrastructure) of the settlements are very important
- the necessity of developing agro-tourism in rural regions.

3. RECOMMEDATIONS

Drawning on the information from trade literature and the findings of the surveys we can conclude that it would be advisable to develop agro tourism first. In spite of the favourable conditions (good soil, the high number of sunny hours, indigenous plants and animals, traditions of agricultural production and food-processing) agro tourism in Hungary is not so well-known and developed as in Germany or in the U.S.

We must not forget that agro tourism is a commercial enterprise at a working farm, ranch, or agricultural plant conducted for the enjoyment of visitors that generates supplemental income for the owner. It is advisable to develop this form of tourism, because agro tourism enterprises might offer:

- Outdoor recreation (hunting, wildlife study, horseback riding).
- Educational experiences (cannery tours, cooking classes).
- Entertainment (harvest festivals or barn dances).
- Hospitality services (farm stays, guided tours or outfitter services).
- On-farm direct sales (u-pick operations or roadside stands).

Thus agro tourism constitutes subset of a larger industry called rural tourism that includes resorts, off-site farmers' markets, non-profit agricultural tours, and other leisure and hospitality businesses that attract visitors to the countryside. (Jolly, 2009)

First of all you have to find out whether the settlement or the region has a list about the unique tourism values, if not, it is advisable to compile a specific appeals register.

If one would like to enter the agro-tourism market, it is important to know how to get started from the idea, so an inventory must be taken as a first step:

- Check local and state laws
- Check insurance rates
- Set short and long-term goals
- Visit an existing farm, dealing with agro tourism
- Draw up a business/marketing plan
- Ask for advise (other operators and professionals)
- Using your business/marketing plan and with the help of appropriate professionals,
- Start your tourism/recreation business. (Daniels, Powell, Rottman, 2001)

Besides this useful advice you cannot avoid marketing and community partnerships in your region because establishing relationships and cooperative alliances with your community is a key element of long-term success. You can read the short summary of starting your own business and building partnerships in your neighbourhood. (Jolly,2009)

- Speak about your project early with neighbours, family, and local businesses. Share your ideas. Listen to their concerns and feedback. Address any problems early in the development of the project.
- Develop a comfortable level of public presentation. Have a clear focus of your mission and expected outcomes. Do not let yourself become overburdened by the

administrative aspects, the rules and procedures of your project. Keep your eye on the outcomes.

- Speak about your project at association meetings, and other gatherings. Get feedback and modify your presentation.
- See your shortcomings or weaknesses as future partnerships. Inventory your community and seek out those who have what you need to complete your goals. Return the favour.
- Define who shares potential customers with you. Align yourself with other businesses and attractions and openly discuss potential customers. Develop exchange promotions and track the source of your leads.
- Be innovative. The greatest achievements happen outside the "system." Don't break laws or burn bridges, just be creative.
- Regarding local ordinances: the government listens to commitments, not complaints, and so do your neighbours. If you cannot turn a negative situation into a positive passion, let it go. Work through compliance issues as required by law and in the spirit of cooperation with surrounding properties and interests.
- Engage any adversaries. Most people simply want to be heard or are afraid of the unknown impacts. Sit down with them one-on-one and listen. Address the concerns and do not whitewash them.
- Keep your business plan and marketing plan in the daylight. Make them work for you. If they are not working for you, then change them. Use your plans to support your actions and efforts.
- Work to foster a sense of community and personal responsibility among citizens.
- Manage physical growth of your operation to ensure quality of life for all citizens affected.
- Work with other businesses to encourage small town character and support of locally owned businesses.
- Build on the agricultural, timber and other resource based assets in the area.
- Maintain and enhance historic structures.

The above mentioned activities could serve as the beginnings of organising and implementing an up-to-date form of co-operation, namely a profession-specific tourist cluster. This form of the common work can help to use a qualifying and benchmarking system that is the key element of the good tourism supply. In the framework of each type of co-operation it is much easier to work out an education material with currently missing information for the members. If tourism organisations, local communities, individual experts, NGO-s, local entrepreneurs and residents join the cluster it can work effectively, taking the common interest of the members into consideration. Another form of co-operation that can be offered is organising a Tourism Destination Management organisation.

4. FINAL CONCLUSION

In case of Hungary it is advisable to make use of the local natural-, human resources and traditions for the development of rural (e.g. agro tourism). Rural tourism is increasingly viewed as a panacea, increasing the economic viability of marginalised areas, stimulating social regeneration and improving the living conditions of rural settlements. Less developed areas, afflicted by debilitating rural poverty, have considerable potential in attracting tourists in search of new, authentic experiences in areas of unexploited natural and cultural riches. This paper proves – the above mentioned statement - that the clustering

of activities and attractions, and the development of rural tourism routes, stimulates co-operation and partnerships between local people, institutions and mostly the neighbouring areas. Such meaningful community participation, together with public sector support, presents opportunities for the development of small-scale indigenous tourism projects in less developed areas.

We are convinced that this form of tourism – enjoying state or EU support - can at the same time contribute to the agricultural and rural development of the given settlement/region. From the point of view of all these activities developing transport infrastructure has a great importance. So as to implement all the above mentioned recommendations the following tasks are necessary to do:

- organise an attitude-shaping complex communication campaign serving the conceptual and framework system of sustainable tourism (e.g. to inform farmers or local people about how to start an agro-tourism business)
- compile a specific appeals register for the settlements/sub-regions
- design a leaflet with the most important information for tourists (Slovak example)
- work out an education material with currently missing information
- employ a qualifying and benchmarking system
- organise and implement a profession-specific tourist cluster or Tourism Destination Management organisation (to strengthen co-operation).

This paper also reviews how the principles of sustainable tourism have special relevance to the development of rural tourism, and examines how those principles can be put into practice. It considers the advantages of this approach and offers guidelines (using leaflets, giving advice how to improve infrastructure with the help of external - e.g. EU - funds and how to start an agro tourism business) for future practitioners.

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THE EFFECT OF GRAIN SIZE ON THE COLOUR CHARACTERISTICS OF DURUM SEMOLINAS

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ABSTRACT

Pastas made of durum flour are becoming more prevalent also in our country, no eggs are needed for their preparation. The colour of the pasta produced this way is determined essentially by the colour of the durum semolina. Also in industrial practices instrumental colour analysis is applied for the colour qualification of durum semolina.

In our work we examined how the grain size influences the colour characteristics and ash content of durum wheat grindings. The correspondence between the ash content and the colour characteristics was also analysed.

Durum semolina from 12 different production units were used for our measurements. The semolina were produced from the yields of 2007 and 2008. The grindings were separated into different grain-size fractions by screening. The L*, a* , b* colour coordinates defined in the CIELab colour space were applied for the colour characterization. The measurements were carried out using a Hunter Miniscan colour analyser. The data was analysed applying variance analysis and regression analysis.

On the basis of the obtained results we can establish that the grain size significantly influences (p<0.05) the L* lightness the a* redness and the b* yellowness coordinate as well as the variation of the YI yellowness index. When the grain size increases, the L* lightness coordinate decreases. The difference is the biggest between the means of the 0-160 μm and the 160 μm -250 μm fractions though even in the other cases the difference is at least 1 unit. Hence the bigger grains are darker. The a* redness coordinate, the b* yellowness coordinate and the YI yellowness index increases when the grain size increases. On the average the a* coordinate increases by 0.4 unit, the b*coordinate by 3-4 units while the YI yellowness index by 5 units. Thus the colour of bigger grains is slightly redder and significantly yellower.

The ash content decreases with the increase of the grain size. The mean ash content varied between 0.7-1.1%. The ash content of the whole grinding is equal to that of the 315 μm -500 μm fraction. The difference between the ash content of the subsequent grain size fractions is 0.1% on the average.

Also the results have shown that there's a significant linear correlation between the ash content and each colour characteristic. (p<0.01).

KEYWORDS: durum grist, colour coordinates, grain size

1. INTRODUCTION

Wheat grindings are one of the most important and most frequently used raw materials. As for every alimentary product, also for the wheat grindings the colour is an important parameter, which gives a primary image of it. Especially for the durum wheat pasta, since they do not contain eggs. This explains the fact that instrumental colour measurements are applied on durum semolina also in industrial practice. In the literature various research results report on colour measurements of wheat grindings.

Oliver et al. (1993) already in 1993 showed during the qualification, that the ash-content influences the colour of the flours. Further research on this topic Horváth et al. (2004) proved that flours prepared from harder grain have lower L* coordinate and higher a* coordinate thus they are darker and have browner tone, besides the L* lightness coordinate shows good correspondence with the whiteness index of the flours.

Halászné et al.(1995) proposed a qualification system based on the colour measurements of durum semolina.

D'egido and Pagani (1997) compared the colour characteristics of pasta made of durum flours obtained by different grinding procedures.

During the product manufacturing the colour characteristics were mainly used to determine the appropriate roastedness (Hotti et al., 2000)

Humphries et al. (2004) found a correlation between CIE b* and lutein concentration of wheat. Konopka et al. (2004) established a relation between the colour characteristics of the flours and their lipid and colorant content. Gökmen and Senyuva (2006) investigated the effect of heating on the colour parameters of wheat flour. László et. al. (2008) examined effects of ozone, UV and combined ozone/UV treatment on the colour of wheat flour. Lamsal and Faubion (2009) studied effect of an enzyme preparation on wheat flour and dough colour and depicted, that enzyme preparation did not improve lightness (L*) and yellowness (b*) of flour system, but benzoyl peroxide sharply reduced b*.

In our work we examined how the grain size affects the durum semolina's instrumentally measured colour characteristics. The correspondence between the colour characteristics and ash content of the durum semolina was also investigated.

2. MATERIALS AND METHODS

2.1. Examined materials

Durum semolina from 12 different production units were used for our measurements. From these 5 were form yield of 2007 and 7 form the yield of 2008. The grindings were separated into different grain-size fractions by screening.

The samples which were of 0-700 μm grain size were divided into the following fractions:

- o 0-160 μm
- o 160 μm – 250 μm
- o 250 μm -315 μm
- o 315 μm – 500 μm
- o above 500 μm

500 grams of each sample were separated into the above mentioned grain size fractions using a screening machine. Consequently colour measurements were performed on each fraction of the semolina and the whole grinding also.

2.2. Analysis Methods

The colour measurement was carried out using a Hunter Miniscan spectrum based colour-analyzer.

For the colour characterization we applied the CIELab colour-system that is described in figure 1 For the colour description the L* lightness-, the a* redness-, the b* yellowness coordinates and the YI yellowness index were applied (Hunter, 1987).

Figure 1. The CIELab colour-space

The determination of the ash content was carried out following the MSZ 6369/3-87 standard (Flour analysis methods, Ash- and Sand-Content Determination).
The data was evaluated by regression analysis and variance analysis. The calculations were performed with the help of the STATISTICA 7.0 software.

3. RESULTS AND DISCUSSION

3.1. Influence of the grain size on the colour characteristics

To establish weather the grain size influences the colour-characteristics one-way analysis of variance (ANOVA) was performed. The result of the Bartlett and Cochran-probe confirmed the homogeneity of the variances, the Shapiro-Wilk test was applied to control the normality.
Table 1 shows the results of the variance analysis.
The significance-level values in the table suggest that the grain size has significant effect on the value of the L*, a*, b* colour coordinates and that of the YI yellowness index.

Table 1. Results of the variance analysis performed to determine the colour characteristics of the different grain-size fractions

Colour Characteristic	F -value	Significance level
L*	88.25	0.0001
a*	264.5	0.0001
b*	160.6	0.0001
YI	173.2	0.0001

In figure 2 and 3 mean values of the colour-characteristics measured on the different grain-size fractions with the confidence interval of 95% reliability are shown.
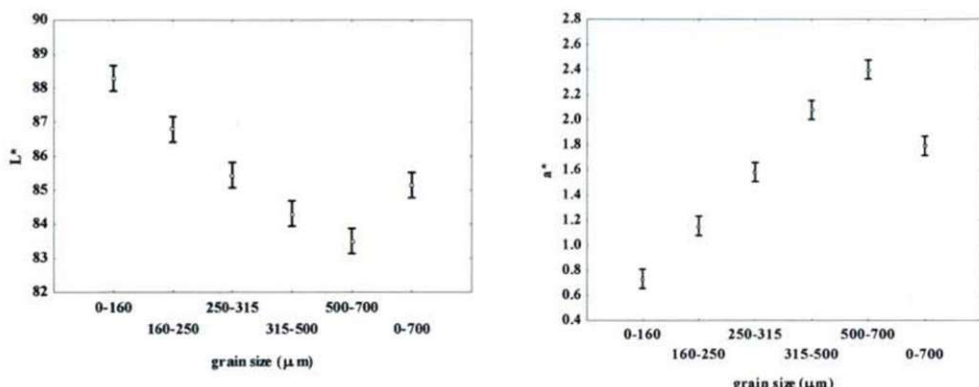

Figure 2. Effect of grain size on the L* and a* colour coordinates (mean values with the confidence interval of 95% reliability)
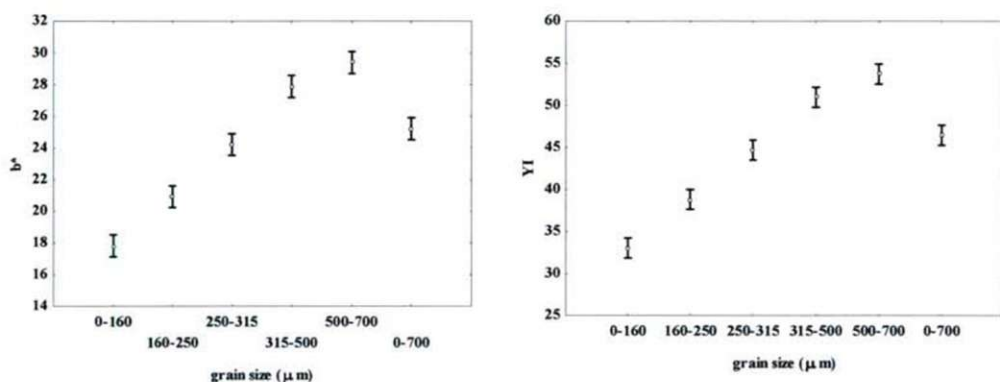

Figure 3. Effect of grain size on the b* colour coordinate and the YI colour index (mean values with the confidence interval of 95% reliability)

In figure 2 it can be observed that the L* lightness coordinate decreases with the increase of the grain size. The difference is the most significant between the mean of the 0-160μm and that of the 160 μm -250 μm fractions, although the difference is at least 1 unit also in the other cases. Thus the bigger grains are darker.

Figures 2 and 3 show that the a* redness and the b* yellowness coordinate and the YI yellowness index increases with the increasing grain size. On the average the a* coordinate increases by 0.5 unit, the b* coordinate by 3-4 units and the YI yellowness index by 5 units. That is to say that the colour of the bigger grains is slightly redder and yellower.

3.2. Variation of the ash content of different grain sized semolinas

The influence of the grain size on the ash content was valued using a one-way variance analysis. Table 2 contains the results of the evaluation. The significance value of the table shows that the grain size significantly influences the ash content. For a detailed analysis we can see the mean ash content values of each fraction of the different samples, with the confidence interval of 95% reliability.

Table 2. Results of the variance analysis performed to evaluate the ash content of the different grain size fractions

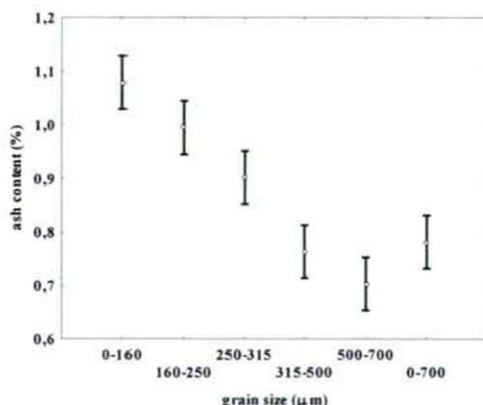|	F –value	Significance level
Ash content	35.73	0.0001

Figure 4. Effect of grain size on the ash content (mean values with the confidence interval of 95% reliability)

Figure 4. shows that the ash content decreases when the grain size increases. The mean ash content varied from 0.7% to 1.1%. The ash content of the whole grinding is equal to that of the 315μm-500μm fraction. The difference between the ash content of the subsequent grain size fractions is of 0.1%.

3.3. The relationship between the colour characteristics and the ash content

We examined weather there is a connexion between the ash content of the semolinas and the single colour characteristics.
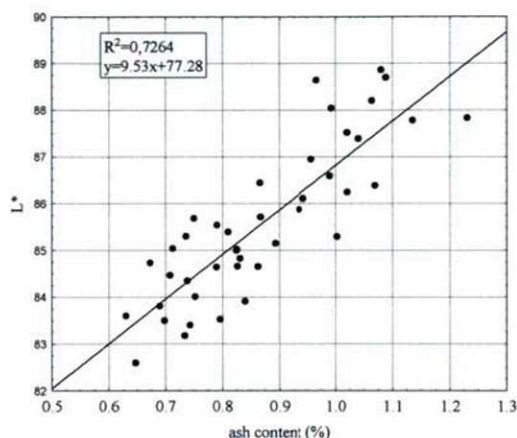
Figure 5. The L* lightness coordinate in function of the ash content

In figure 5 we can see the L* lightness coordinate measured in function of the ash content. In the figure the equation of the regression line and the determination coefficient is presented.

We can establish that there is a significant linear correlation between the ash content and the L* lightness coordinate (p<0.01). The L* lightness coordinate increases when the ash content increases, so the semolina with higher ash content are lighter.

In figure 6. we can observe the a* redness coordinate measured on the different samples in function of the ash content. In the figure the equation of the regression line and the determination coefficient is presented.

Figure 6. The a* redness coordinate in function of the ash-content

We can establish that there is a significant linear correlation between the ash content and the a* redness coordinate (p<0.01). When the ash content increases the a* redness coordinate decreases thus the semolina with higher ash content are less red toned. In figure 7. we can observe the b* coordinates measured on the different samples in function of the ash content. In the figure the equation of the regression line and the determination coefficient is presented. We can establish that there is a significant linear correlation between the ash content and the b* yellowness coordinate (p<0.01). The b* yellowness

coordinate decreases with the increase of the ash content, consequently the semolina with higher ash content are less yellow.
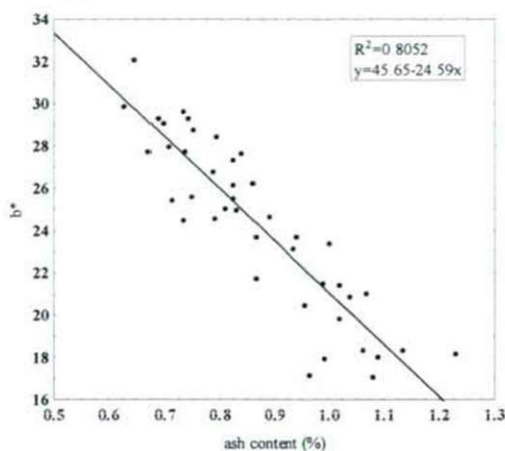
Figure 7. The b* yellowness coordinate in function of the ash content

In figure 8 we can observe the YI yellowness index measured on the different samples in function of the ash content. In the figure the equation of the regression line and the determination coefficient is presented.
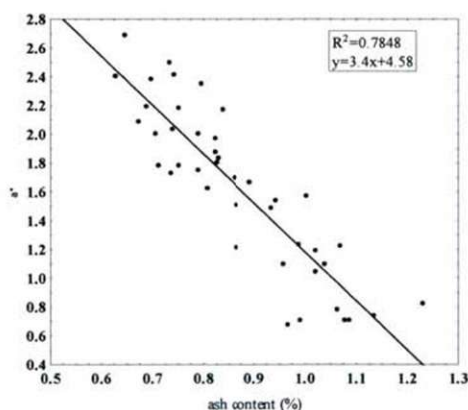

Figure 8. The YI yellowness index in function of the ash content

We can establish that there is a significant linear correlation between the ash content and the YI yellowness index similar to the one between the ash content and the yellowness coordinate ($p < 0.01$). With the increase of the ash content the YI yellowness index decreases accordingly the semolina with higher ash content are less yellow.

4. CONCLUSIONS

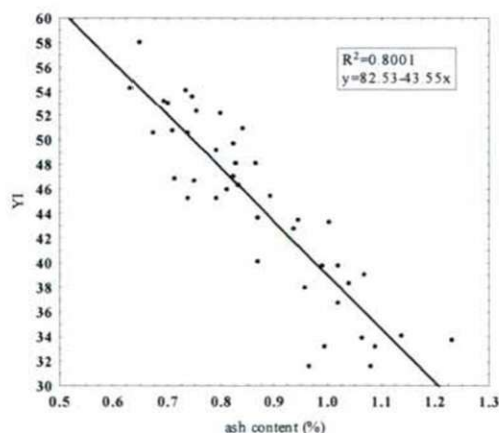In the pursuance of our investigations we analysed the instrumentally measured colour coordinates and ash content of the different grain size fractions of 12 durum semolina samples. On the basis of the statistical analysis we found the following.

- The grain size significantly influences the L* lightness the a* redness and the b* yellowness coordinate as well as the YI yellowness index.
- The ash content is lower when the grain size is smaller. The mean ash content varied between 0.7% and 1.1%. The ash content of the whole grinding is equal to that of the 315 μm -500 μm grain size fraction. The average difference between the ash content of the subsequent grain size fractions is of 0.1%.
- There's a significant correlation between the ash content and every single colour coordinate.

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CONSIDERATIONS ABOUT FOOD SAFETY MANAGEMENT SYSTEM'S AUDITING

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ABSTRACT

A food safety assurance program often used by the food processing industry is the Hazard Analysis Critical Control Point (HACCP) system with the goal to identify the major risks in the food chain to identify the critical control points. Most agree that comprehensive risk assessment is increasingly important for success (or even survival) of an entity, but how to go about it systematically is open to debate. Through audit, regulators can look at records of what has been happening within the food business, a day-to-day history of compliance, and not just the "snapshot in time" of current inspection methods. This method gives regulators and the community increased confidence that food safety is being maintained by food businesses on a continuing basis.
To help the implementation and improvement of an adequate food safety management system the paper synthetize the role of the audit process in the risk management, propose some criteria's which can be used in the preparation of the audit process and illustrate the application of the proposed criteria's and principles with a food safety audit checklist.

1. INTRODUCTION

The most effective food safety management systems are established, operated and updated within the framework of a structured management system and incorporated into the overall management activities of the organization.

Part of the problem is the difficulty of identification and measurement of the threats or risks. For example, quantifying past events is relatively easy compared to quantifying threats to expected future events. Threats are possibilities, and at any point in time there are many possibilities (and combinations of possibilities) leading to problems in assessing and reporting on ranges of possible outcomes.

A second problem is risks can change rapidly and possible changes must be identified before they can be measured. Third, threats can't be fully evaluated even after the passage of time because some don't materialize and others arise but are prevented or mitigated by control activities. Finally, there is no natural measurement process and point in time for risk measurement as there is in measuring a sale, the purchase of an asset, or incurrence of liability or expense. By its nature, risk involves more than one possible real-wold condition or event that has occurred or might occur in the future. Thus, numbers, categories, or labels to represent risk assessments are different from business process measures of a single condition at a point in time. This means that there is no single answer that can be determined to be correct in measuring or auditing risk assessments. There is inherently more uncertainty in auditing risk assessments than auditing the current cash or inventory balance. The multiple possibilities for joint occurrence of risks greatly complicate measurement of and auditing risk assessments and processes. Furthermore, the evaluation of risk management performance is hindered by the difficulty of determining whether occurrence of an undesired event is due to bad event identification, bad risk assessment, bad information, bad modeling, bad strategy or bad implementation.

2. PERFORMANT RISK MANAGEMENT AND THE AUDIT

Determination of business objectives and strategies to achieve them is beyond the scope of risk management. However, assessments of all potentially serious risks inherent in strategies and business processes must be part of internal or external control (ensured by internal or external audits) and are essential for evaluating the relevance and reliability of information and its context.

In developing a comprehensive evaluation method, business risks can be classified in many ways. One useful way may be:

a) External Environment Risks: threats from broad factors external to the business including substitute products, catastrophic hazard loss, and changes in customers' tastes and preferences, competitors, political environment, laws/regulations, and capital and labor availability.

The external environmental category includes longer-term factors external to the firm that are largely beyond management's control.

Catastrophic natural events (sometimes called hazard risks) are not controllable by management, yet management can limit the enterprise's exposure to their effects. Similarly, management can influence environmental change to some degree through research and development of technology, advertising, and lobbying of governments.

b) Business Process and Asset Loss Risks: threats from ineffective or inefficient business processes for acquiring, financing, transforming, and marketing goods and services, and threats of loss of firm assets including its reputation.

c) Information Risks: threats from poor-quality information for decision-making within the business (the risk of being misinformed about real-world conditions due to using measurement methods that are not relevant, from careless or biased application of measurement methods or their display, or from incomplete information).

Information risk also applies to the risk of providing erroneous or misleading information to outsiders.

Risk management may be defined as a process, implemented by an entity's board of directors, management, and other personnel, comprising internal controls applied in strategy and across the enterprise, designed to provide reasonable assurance regarding the achievement of objectives in the following categories:

- Effectiveness and efficiency of operations and processes;
- Reliability of financial reporting;
- Compliance with applicable laws and regulations.

The audit process outlines the role and responsibilities of food safety auditors and describes an audit methodology based on international standards. Models have been developed for determining appropriate audit frequencies, for reporting nonconformance and for moving within audit frequency ranges.

The management systems are based on international standards and involves the development of policies and procedures to ensure the integrity of the audit system. It covers areas relating to auditing personnel, conflict of interest and commercial confidentiality.

The author considers auditing basic role with regard to risk management is to provide objective assurance to the board on the effectiveness of an organization's activities to help ensure key business risks and the above presented objectives are being managed appropriately and that the system of internal control is operating effectively.

Audit functions (AF) in the risk management and management decisions are illustrated in Figure. 1.

Fig 1. Audit Functions (AF) in the risk management and management decisions

To achieve these audit functions it may be useful to apply some recommendations and criteria's in the risk management and auditing process.

3. THE PROPOSED RECOMMENDATIONS AND CRITERIA'S. EXAMPLE

All food production procedures involve risk. All operations require decisions that include risk assessment as well as risk management. Supervisors in food production from the farm to the fork, along with every individual, are responsible for identifying potential risk and adjusting or compensating appropriately. Risk should be identified using disciplined, organized, and logical thought-processes that ensure the best food safety and security possible.

Good risk management from the farm to retail can provide many benefits to overall food safety and security, for this it recommended to taking account of the following proposed risk management recommendations (R):

R1. Accept no unnecessary risk. Unnecessary risk comes without a commensurate return in terms of real benefits or available opportunities;

R2. Make Risk Decisions at the Appropriate Level. Making risk decisions at the appropriate level establishes clear accountability. Those accountable for the success or failure of the product must be included in the risk decision process;

R3. Accept Risk When Benefits Outweigh the costs. All identified benefits should be compared to all identified costs;

R4. Integrate the risk management into Planning at all Levels; to effectively apply the risk management, managers must dedicate time and resources to incorporate the risk management principles into the planning processes. The making of important risk decisions should be preplanned whenever possible.

The implementation of an efficient risk management should be made in several steps, which may be:

1) Identify the hazards;
2) Asses the risk;
3) Analyze risk control measures
4) Make control decisions;
5) Implement risk controls;
6) Supervise and review.

Taking account to the above presented aspects the risk management may be defined as: Analyze food safety and security risks and implement risk control decisions (steps 3, 4 and 5). It is recommended to conduct a risk assessment after controls are in place to ensure risks are reduced.

Due of this specific activity's we can synthesize the role of the audit process in the risk management as follows:

1) Auditing basic roles in regard to the risk management:
- Giving assurance on risk management processes;
- Giving assurance that risks are correctly evaluated;
- Evaluating risk management processes;
- Evaluating the reporting of key risks;
- Reviewing the management of key risks.

2) Legitimate internal auditing roles with safeguards:
- Facilitating identification and evaluation of risks;
- Coaching management in responding to risks;
- Coordinating risk management activities;
- Consolidating the reporting on risks;
- Maintaining and developing the risk management framework;
- Developing risk management strategy for board approval

3) Roles which auditing should not undertake:
- Setting the risk appetite;
- Imposing risk management processes;
- Management assurance on risks;
- Taking decisions on risk responses;
- Implementing risk responses on management's behalf;
- Accountability for risk management.

The audit process must be prepared in time and the obtained results must be documented. In the first phase it is recommended to make a check list with questions which must be answered by the audited part during the audit.

The second phase of the audit is the preparation of the audit report by the audit team taking account to the used check list and the obtained responses.

The audit check list should be prepared by the auditors, based on specific audit criteria's. In opinion of the author in the food safety management system's auditing these basically auditing criteria's may be the following (Table 1):

Table 1. Food safety management system's auditing criteria's

1) Existing of a food safety team;	8) Corrective actions (principle 5)
2) Product description and identification;	9) Verification procedures (principle 6)
3) Flow diagrams;	10) Record keeping (principle 7)
4) Hazard analysis (principle 1)	11) Measurement equipment status
5) Critical control points (principle 2)	12) God hygiene practice
6) Critical limits (principle 3)	13) Documentation system
7) Monitoring procedures (principle 4)	14) Trainings

Using these proposed criteria's we can establish questions for each auditing criteria and realize an audit check list with the structure proposed in Table 2:

Table 2. Food safety audit check list structure

Audited by:	Date of Audit:
Criteria * / Requirement:	Results:
Food Safety TEAM Has a Food Safety co-ordinator been appointed?	
PRODUCT DESCRIPTION Has a product description/product specification been prepared for each product?	
FLOW DIAGRAM Has a flow diagram been prepared for each product (Y/N)	
PRINCIPLE 1 - HAZARD ANALYSIS Have all reasonable biological, chemical or physical hazards been identified at each step?	
PRINCIPLE 2 - CRITICAL CONTROL POINTS Have the Critical Control Points for each significant hazard been identified and transferred to the Hazard Audit Table?	
PRINCIPLE 3 - CRITICAL LIMITS Have Critical Limits been established for each Critical Control Point?	
PRINCIPLE 4 - MONITORING PROCEDURES Do the monitoring procedures specify what, when, how, where and who?	
PRINCIPLE 5 - CORRECTIVE ACTION Do the corrective actions ensure that the critical control point is brought under control?	
PRINCIPLE 6 - VERIFICATION PROCEDURES Do the verification activities demonstrate that the Critical Control Points are under control?	
PRINCIPLE 7 - RECORD KEEPING Have records been maintained for all monitoring procedures?	
MEASUREMENT EQUIPMENT STATUS Are there documented procedures for calibration?	
GOOD HYGIENE PRACTICES (GHP) Are personal hygiene procedures practiced / monitored?	
DOCUMENTATION Is the Food Safety Program Manual and relevant forms and procedures up-to-date?	
TRAINING Is there a training plan to provide identified training needs?	

4. CONCLUSIONS

A food safety program is based on the Hazard Analysis and Critical Control Point (HACCP) principles and is a documented program that systematically identifies critical points in food handling operations that, if not controlled, may lead to preparation of unsafe food. Food Safety Programs are based on requirements imposed by standard. The standard requires documenting and implementing a food safety program based on the seven basic HACCP principles.

Through audit, regulators can look at records of what has been happening within the food business. This method gives regulators and the community increased confidence that food safety is being maintained by food businesses on a continuing basis.

To help the implementation and improvement of an adequate food safety management system the paper synthesize the role of the audit process in the risk management, propose some criteria's which can be used in the preparation of the audit process and illustrate the application of the proposed criteria's and principles with a food safety audit checklist.

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THE OPTIMIZATION OF ENERGY CONSUMPTION IN WATER SUPPLY SYSTEMS

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ABSTRACT

The present paper shows a few solutions of increasing the efficiency of water supply systems, by reducing the electrical energy consumption, which should also be correlated with the implications of the investment and exploitation costs, the extent of used surfaces, the volume and the quality of the built surfaces, taking into account that both the equipments and the surfaces built need a lot of energy for their construction.

1. INTRODUCTION

Each m^3 of water insured for the consumption includes a huge quantity of electrical energy necessary for the transportation, treatment, distribution, different internal technological processes of the water supply system. [1,2].

The practice in water supply systems shows that for 1.000 m^3 of treated water and delivered for human consumption are used 60 up to 600 kW. The very large limits of the interval mentioned (1 to 10) show the huge availabilities existent in the projection of water supply systems, regarding the insurance of a minimum of electrical energy consumption.

Finally, the electrical energy expenditure depends on the specific character of the area, the specific character of the water supply source, the treatment technology used, the means by which the water is transported to the consumer.

Next we will show some solutions which should be taken into consideration in establishing the projecting the water supply system stages in order to obtain a minimum of energy consumption.

The solutions will be displayed in the following stages:

> The elaboration of the water supply system scheme, according to the character of the area and the source;
> The implementation of some treatment technologies with low energy expenditure;
> Bad water management to the consumer.

2. THE ELABORATION OF WATER SUPPLY SYSTEM SCHEME

It is known the fact that huge quantities of electrical energy, used in water supply systems, are spent during the pumping phases.

In this way, when the consumption – per system – is around 500 - 600 kW/1.000 m^3 of delivered water, approx. 200 - 300 kW/1 000 m^3 are used for the treatment station, the rest are used for the pumping. If we take into consideration that in a treatment station, the consumption is due to pumping (reagents pumping, water for washing, etc.), we realize that in a water supply system the energy consumption used for pumping is substantial. On the other hand, there are certain water supply systems, having as sources storage basins, for which the energy consumption has reached 50-60 kW/1.000 m^3 for the water delivered to human consumption. Hence the huge energetic advantage the complex water arrangement

presents, with all the storage basins and their use as water supply source. Besides other pumping phases, there are also other advantages:
- ➤ Increasing the degree of insuring the discharge;
- ➤ The possibility of employing a more sophisticated treatment scheme;
- ➤ A simpler exploitation.

The storage basins – used as a water supply source – have a well established character from this point of view.

3. THE IMPLEMENTATION OF SOME TREATMENT TECHNOLOGIES WITH LOW ENERGY EXPENDITURE

The water treatment problem is directly connected with the quality of surface or underground waters, from which sampling is taken. The better the quality of water (I class category, according to STAS 4706-74), the easier the treatment, thus the electrical energy consumption is lower.

For lower quality waters category, the treatment is more difficult (in many stages) and, therefore the energy consumption is higher. Maintaining a correspondent water quality is a desideratum wished by water management authorities, through the measures of intensifying the rhythm of achieving and operating the waste water treatment plants, water coming form industrial sources and urban zones.

Without going too much into detail we will try to illustrate a few ways, which introduced into today's projecting technology, could lead to direct and indirect methods of saving the energy.

Such a method would consist in using some materials or treatment reagents, which have similar proprieties or which allow appreciable reductions of the classical materials and reagents.

These would be:

- ➤ Coarse sand – secondary product from the exploitation of some cyanide deposits, instead of classic quartz sand;
- ➤ The use of some adjuvant polyacrylamides type (med sol produced by ICPAO – Mediaş or "Petru Poni" – Iaşi), which used in very small quantities – $0,1 \div 0,3$ mg/l – allow reductions of coagulation reagents doses (aluminum sulfate) of the order of ten mg/l;
- ➤ The use of some substances with superior treating proprieties as the ozone, powder or granulated activated charcoal, which allow being used as sources of water supply and natural waters with a high degree of pollution. Although the substances mentioned above entail electric energy consumption, sometimes – even substantial, the total energetic balance can be in their favor, especially in the areas where there is no other source of water.

Another method of reducing the electrical energy consumption in treatment plants consists in adopting some treatment technologies or methods of exploiting appropriate for the final purpose, for example:

- ➤ The use of suspension decanters by the recirculation of the suspension layer with the help of some hydro-ejectors with reduced load loss (ICPGA or ICB type); this installation type concentrates the mix, reaction and clearing in a sole installation, eliminating the rapid or slow propeller stirrer necessary in usual situations;

➢ Providing a decanter by-pass pipe and treating the water directly through filters; it can be applied almost all year round, for many water streams in our country; in this way the coagulation reagents consumption are reduced, thus indirect energetic savings are achieved;

➢ The use of technologies which involve stages of biological treatment, able to replace the stages of high energetic consumption (ozonization, ultra-violet treatment etc.)

4. JUDICIOUS MANAGEMENT OF WATER FOR CONSUMPTION

This is considered to be the area in which there's a need to insist on a change of mentality regarding the way water is perceived. Water must be considered a raw resource that includes a large quantity of energy and that must be managed with the same care the other energy-rich raw materials are managed with: iron, wood, cement etc. [3,6,7,9]

The following are needed to this end:
➢ Improvements to the way reinforcements, sanitary installations and water distribution networks are built, in order to reduce water loss; presently, in some cities or farms, the loss percentage is as high as $20 \div 25\%$, and even higher in some cases;

➢ On industrial plants and agricultural and zoo-technical centers a large scale implementation of not only recirculation, but methods of successive use of water, starting with the technological processes that are more demanding with regard to water quality and on to the technological processes that have less rigorous water quality limits.

Maybe, in a not so distant future, modifying the industrial technological processes in order to reduce water consumption on one hand and the pollution level in waste water on the other – in other words, developing "Dry technologies" for different technological processes – will also become a subject of discussion.

In this way, the effect will be more complex, resulting in direct energy savings as well as indirect savings, by protecting the quality of the water sources that will be assumed by the consumers downriver.

5. MEANS OF REDUCING ELECTRICAL ENERGY CONSUMPTION

In order to use electrical energy more efficiently, there are methods that can be applied in the design phase of a water supply system as well as in the case of already operating targets [1,5,7,8,9].

The main means for reducing electrical energy consumption are:
➢ Choosing the unit power and number in such way as to avoid a close ratio between the unit powers and the total electrical power absorbed by the water supply system; otherwise an over-sizing of the electrical energy supply system occurs in order to provide enough energy for starting the electrical engines, an over-sizing that leads to additional electrical energy loss; also, the units that function simultaneously musts me established in a precise manner;

➢ Choosing the adequate electrical tension (0,4 or 6 kV) for the pumping mechanisms engines (the 160-315KW range permits options), in relation to the total power absorbed by the target system, taking into account that higher tensions lead to less energy losses in the energy transport system, at the same level of power consumption;
➢ Using the variable rotation speed of the pumping mechanisms, in the water supply systems that don't have buffer-accumulations;
➢ Placing electrical energy delivery and distribution facilities (including substations) in the load centers of the energy consumers; the number and size of the distribution points is also correlated to these load centers;
➢ Using local reactive energy compensation systems (improving the power factor;
➢ Establishing technological measurements in the water supply system in such way as to reduce – or even eliminate – electrical energy consumption, at peak load times in the power system, when the quality parameters of the supplied electrical energy are low, due to strain;
➢ Partial or total automation of the technological processes involved in water supply;
➢ Adequate training for the staff handling the exploitation of the water supply system;
➢ Eliminating water losses within the water supply system, including consumer premises.

The means for reducing electrical energy consumption must be correlated to the effects on investment and exploitation costs, extent of used surfaces, the volume and quality of the constructions, taking into account that the equipments as well as the constructed buildings involve consumption of energy.

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BROILER CHICKEN: THE COMPARATIVE-EVALUATIVE ANALYSIS OF THE MANUAL SLICING TECHNOLOGY

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ABSTRACT

The production of poultry meat of the world rises dynamically with 3-4 per cent annually. The reason of this fact is the growth of population and the changing of the customers' habit. It is because of the fact that in the relatively affordable price of poultry meat on the other hand in the changes in the society. Manual cut techniques already are not able to fulfil the requirements at the higher market demands. In the 1980s the volume of poultry cuts has grown considerably due to the development of automatic cutting machines.

In our essay we compared the manual tapered cut and the STORK ACM MX NT cut up system. The aim was to focus on the conformation of main products, parallel products and the wastage of cut.

1. INTRODUCTION

In recent years the demand for cut meat products of all poultry species has increased sharply due to the change of consumer needs and attitudes. This significant trend has occurred both in the export product choice and the domestic demand.

The productivity of the portioning lines - due to the fact that manual slicing was the exclusively applied method - was very small until the beginning of the 1980s. The introduction of mechanical slicing allowed us to meet the domestic and export demand for cut meat products. Today, cut meat products are a significant proportion of the product structure at the majority of poultry processing plants.

By slicing we generally mean the separation of the poultry into anatomical body parts (leg, breast, etc.). The exclusive application of manual operations is rather tiring, long and hard physical work, therefore its mechanization has become necessary in recent years. Nowadays, up-to-date machines, equipment, even complete lines are used by the industry for slicing different kinds of meat but mostly poultry.

During our experiments we compared two slicing techniques or technologies with regard to the economic yield of the principal products mostly, and at the same time we evaluated the quantitative development of the resulting parallel products, too.

2. MATERIALS AND METHODS

During our experiments we compared the principal and parallel product yield of poultries sliced with a traditional manual technology plus a cone line feeder and by a STORK (Dutch) ACM MX NT portioning equipment. We certainly examined the development of the resulting losses as well.

We made the measurements on Ross 208 type poultry species belonging to the three weight classes most frequently needed by consumers: poultries of 1200, 1300 and 1400 g. We used variation analysis statistical method to examine the effect of the slicing method on the yield. We made the calculations using the ANOVA menu item of the Statistica 8.0 programme suite. On Fig. 1., 2., 3. and 4. we show in grams the mean values of yield for

the leg, breast, wing and backs body parts of poultries with 1200-1400 g grill weight, and with significant difference values belonging to the significance level p=0.005. On Fig. 5., 6. and 7. we show the yield percentage of the same body parts for the two slicing methods in terms of the grill weight.

3. RESULTS AND DISCUSSION

We used the variation analysis statistical method to examine the effect of the slicing method on yield. We made the calculations using the ANOVA menu item of the Statistica 8.0 programme suite. On Fig. 1., 3., 5. and 7. - for the detailed examination of the variation analysis results - we show in grams the mean values of yield for the leg, breast, wing and backs body parts of poultries with 1200-1400 g grill weight, and with significant difference values belonging to the significance level p=0.005. On Fig. 2., 4., 6. and 8. we show the yield percentage of the same body parts for the two slicing methods in terms of the grill weight.
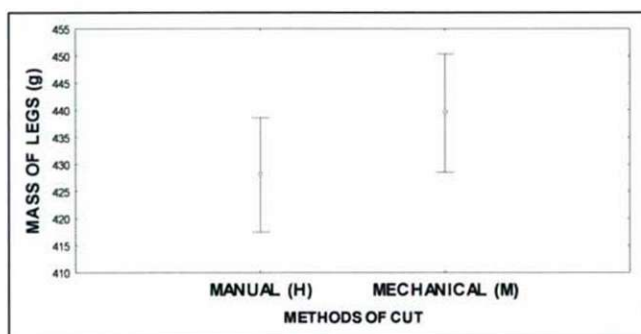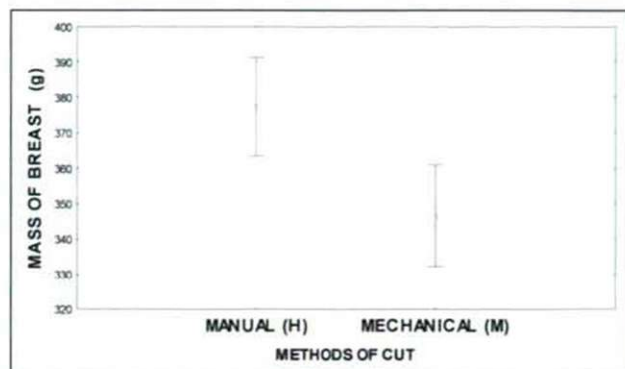

Fig. 1. The effect of the slicing method on the leg mass yield

Fig. 1. shows that with mechanical slicing we obtained a leg mass with plus 13 grams on average, however, according to the results of the variation analysis this difference is not significant (p=0.13). The same is true for the leg mass yield expressed as a percentage (Fig. 2.).
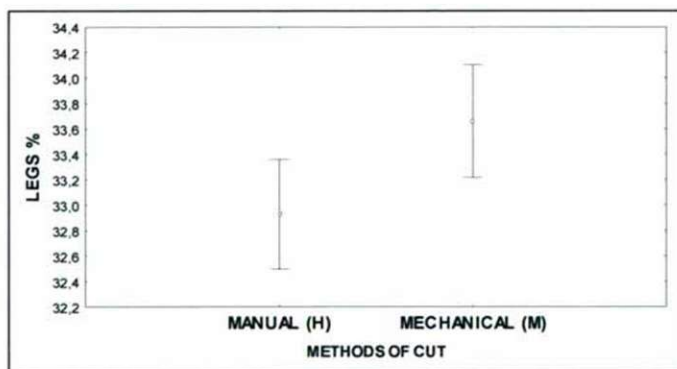
Fig. 2. The effect of the slicing method on the leg mass yield percentage
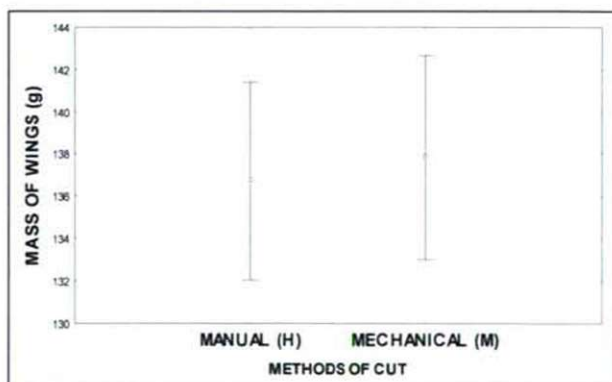
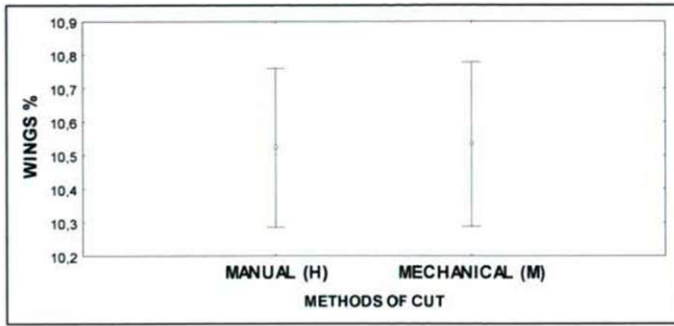*Fig. 3. The effect of the slicing method on the breast mass yield*
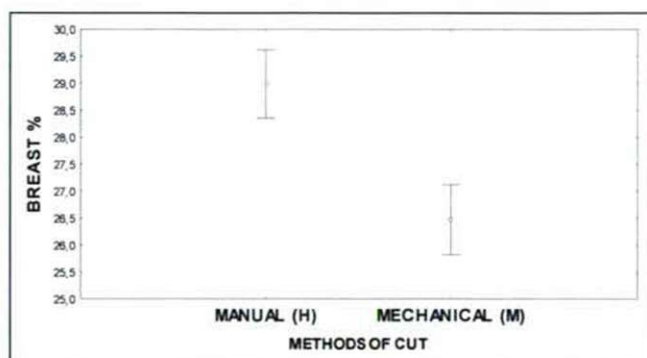
Fig. 4. The effect of the slicing method on the breast mass yield percentage

The results on Fig. 3. and 4. show that the mechanical slicing method produces a breast yield that is significantly smaller, with 30 grams (2.5%) on average, in comparison to manual slicing.

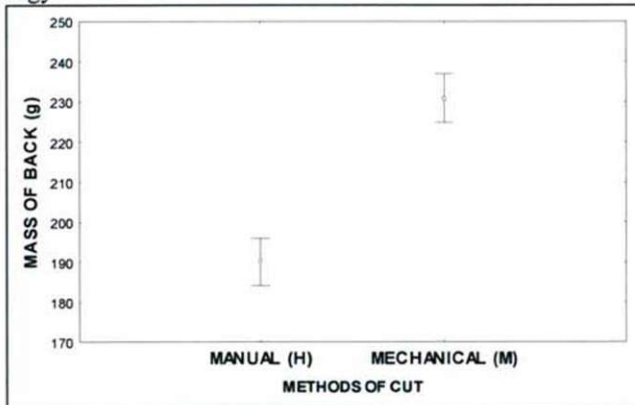*Fig. 5. The effect of the slicing method on the wing mass yield*

Fig. 6. The effect of the slicing method on the wing mass yield percentage

Fig. 5. and 6. show that the wing mass yield is not affected by the slicing method. There is no significant difference between the average values of wing mass obtained using the two methods.

On Fig. 7. 8. we can see the comparison of the backs yield obtained by the manual and the mechanical technology.

Fig. 7. The effect of the slicing method on the backs mass yield
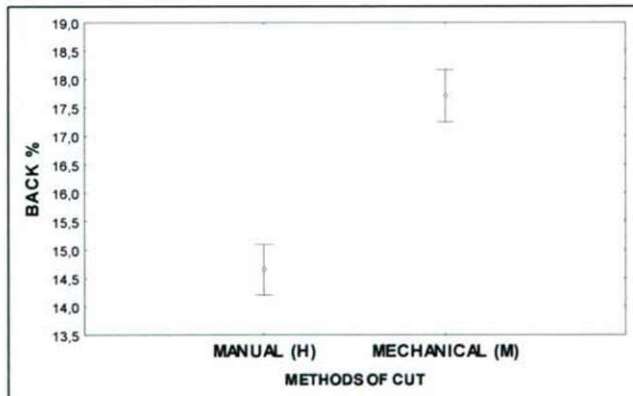
Fig. 8. The effect of the slicing method on the backs mass yield percentage

The result of the variation analysis shows that the backs yield is significantly greater with the mechanical slicing method than with the manual one. We obtained a backs mass yield that was greater, with 40 grams or 3% on average, when we applied the mechanical slicing method.

The backs mass surplus we had with mechanical slicing was parallel to the breast mass shortage we had with the same method.

We examined in detail the effect of the manual and mechanical slicing on yield establishing grill weight categories. Fig. 9.-10. show the effect of the slicing method on the mass yield percentage of the different body parts for chickens of 1200, 1300 and 1400 g grill weight by weight category.

Fig. 9. The effect of the slicing method on the leg mass yield by grill weight category

Fig. 10. The effect of the slicing method on the leg mass yield percentage by grill weight category

Fig. 8. and 9. show that in case of the 1220 g grill weight, mechanical slicing produces a significantly greater leg mass yield, plus 20 grams or 1,5%, than manual slicing. There is no significant difference of the leg mass yield in case of the bigger, 1300 and 1400 g grill weight categories with regard to the slicing method.

Fig. 11. The effect of the slicing method on the breast mass yield by grill weight category
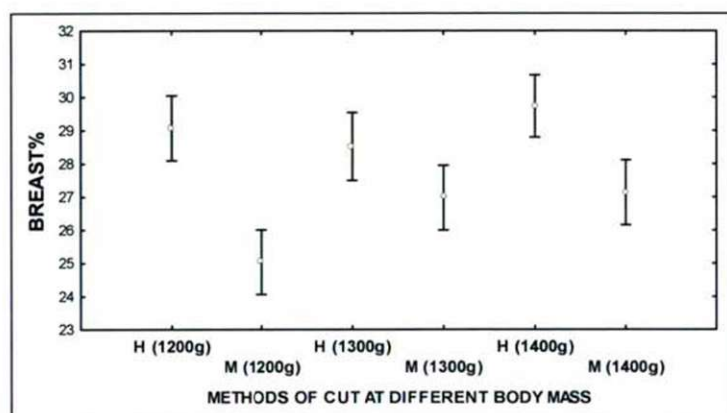
Fig. 12. The effect of the slicing method on the wing mass yield percentage by grill weight category

Fig. 11. and 12. indicate that the breast mass yield is significantly smaller with mechanical slicing than with the manual method in all three grill weight categories. We can also see that with the same slicing method (manual or mechanical) the breast mass yield is significantly greater in the bigger grill weight categories.
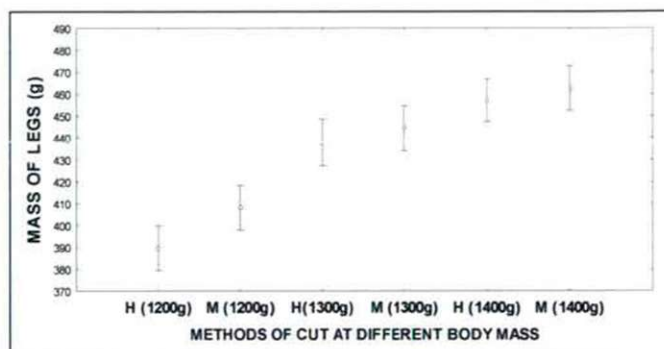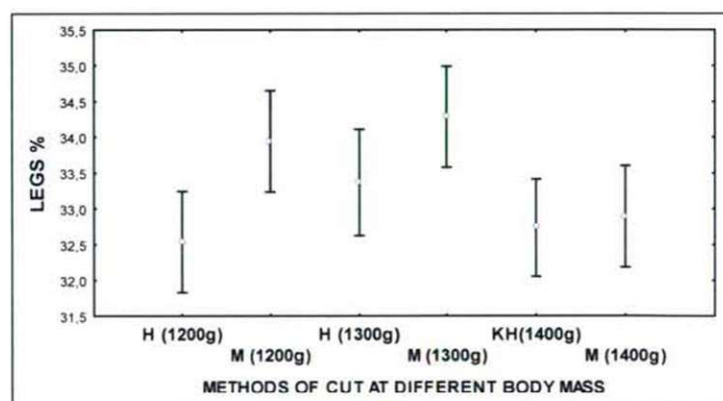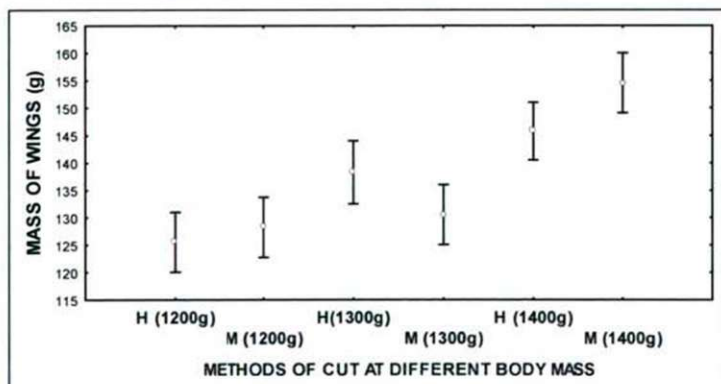

13. The effect of the slicing method on the wing mass yield by grill weight category

Fig. 14. The effect of the slicing method on the wing mass yield by grill weight category

Fig. 13. and 14. show that the slicing method has no significant effect on the wing yield at any of the grill weight categories.
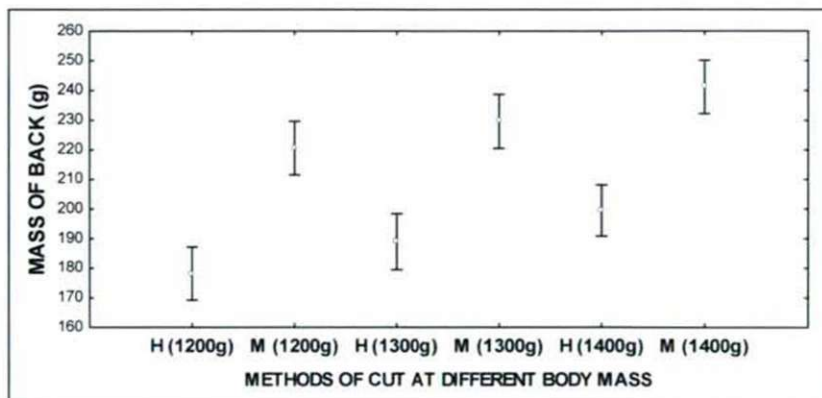
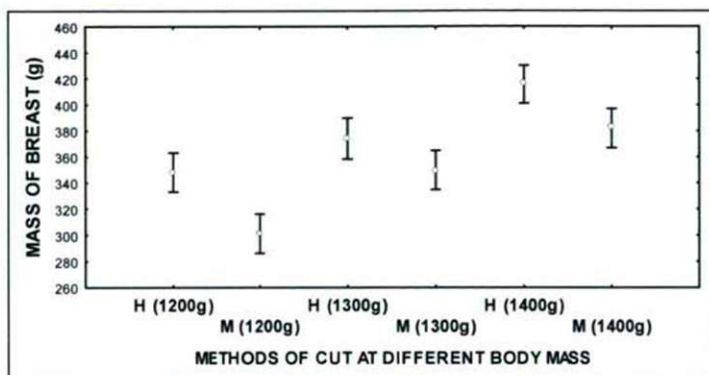*Fig. 15. The effect of the slicing method on the backs yield by grill weight category*

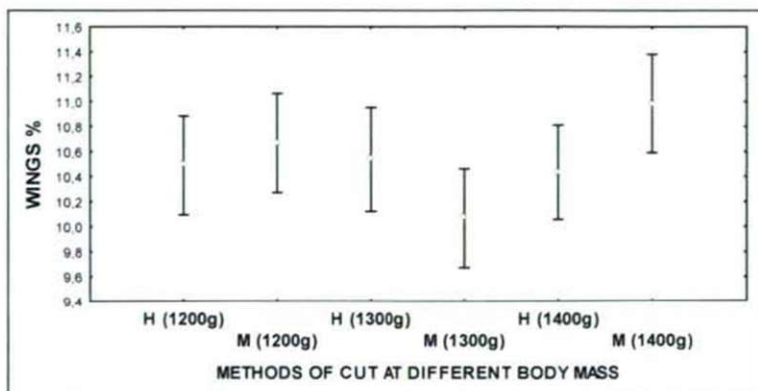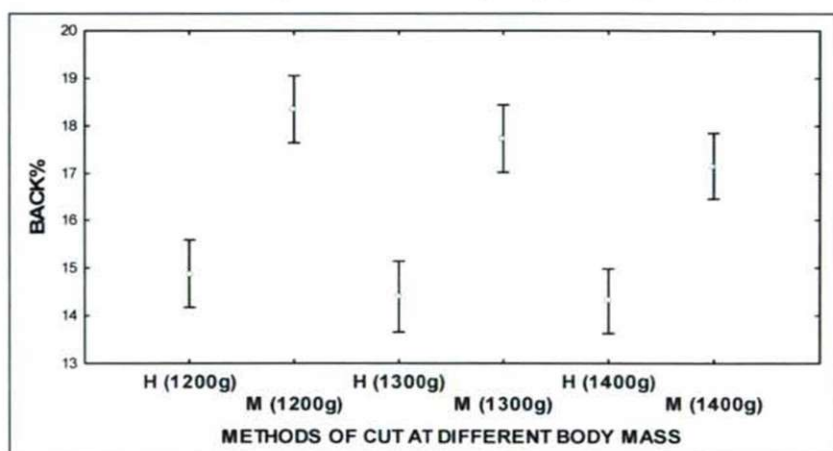*Fig. 15. The effect of the slicing method on the backs yield percentage by grill weight category*

The results of the variation analysis show that (Fig. 15., 16.) mechanical slicing produces a significantly greater backs yield at all grill weight categories.

4. CONCLUSION

In conclusion, we can say that the variation analysis showed us that - with respect to the method of slicing - we can obtain a greater leg yield percentage if we apply mechanical slicing. Unfortunately, however, in case of the breast part we have to make an opposite finding: according to this, mechanical slicing produced a significantly smaller breast yield percentage. It is probable that in this case the quantity missing from the breast was cut to the backs part by the slicing machine, which can mean a significant loss to the processing plant due to its lower price.

In this case it is probable that the machine has adjusting problems, which has to be corrected by the technicians by all means. Anyway, this slicing problem occurred in all three weight categories.

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ENERGY NATURALLY – BIOGAS AND BIODIESEL

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ABSTRACT

After our joining to EU the sustainable agricultural development, increasing the rate of renewable energy sources have become an actual economical problem. In the present economical environments the private sector from own sources can not solve in its complexity the environment protection and energetic problems.

We made different tests on renewable energy in frame of some project at Szolnok University College. In this paper we deal with the biomass, but also the biogas and biodiesel also because producing and utilization of biogas and biodiesel as energy source helps realization of strategic purpose and objects in the energy policy and the environment policy, too. Actually, our environmental obligations and supported tasks of renewable energy production came into view after our joining to the EU. In the European Union the share of renewable energy must reach 20 % till 2020. So we have to take advantage of prospects more and more in the renewable energy.

This paper introduces the realization and application of an energetically-based producing and utilizing model of renewable energy systems. The solution is realized in experimental conditions in scientific researches of bio-energy engineering processes. The European Union focuses on the promotion of renewable energy sources through its energy policy. In Hungary the total quantity of biomass is ~350-360 Mt which ~105-110 Mt reproduce annually. The biggest biomass producer is the agriculture that produces ~50-60 Mt a year. The quantity of biomass used for energetic purposes in form of biogas and biodiesel in internal combustion engines. Actually, the idea of the bio-fuels is as old as the engine itself.

1. INTRODUCTION

Application of renewable energy resources is both a need and a possibility in Hungary. It is necessary to find the most suitable solution in terms of environment protection, energy policy, agricultural, EU integration and national economic perspectives in order to decrease the overuse of fossil energies and Hungary's import dependence. Such a solution could be – together with increasing the energy's economy and efficiency – to increase the use of renewable energies. Our country has excellent agro-ecologic capabilities for producing biomass for energetic purposes.

2. EFFECTS OF BIOGAS OPERATION

In the surroundings of the biogas-works – that will be established – the available biomass potential can be more or less various and differing composition in the works. This fact also justifies that it is necessary to make increased scales experiments represented work conditions for to determination the optimal work technological parameters and recipes in every case. So there is a real demand of market to develop an instrument which is closer to work conditions, mobile, suitable to make representative, comparative experiments. In the

frame of an R&D project (EA_KFI_07-bioreakt) we worked the technical requirements of mobile bioreactor and measuring system development for technological experiments of biogas production on the spot.

We made emission tests on 24.6 kW power, 4 cylinder Wiscon Total TM27 type gas engine at Budapest University of Technology and Economics Department of Energy Engineering with biogases. Biogas was produced at Szolnok University College by a such instrument which is closer to work conditions, can be installed on the spot of the biogas plants, is suitable to make representative, comparative experiments with available sort of biomass.

In *Figure 1* it can be seen that in case of $\lambda > 1.1$ air access coefficients the cooling effect of the surplus air results lower NO_x emission, however, NO_x formation depends on the temperature. The engine operation with increasing carbon-dioxide content of gas mixture – by reason of drawing-off of combustion and cooling effect of carbon-dioxide – results further decreasing.
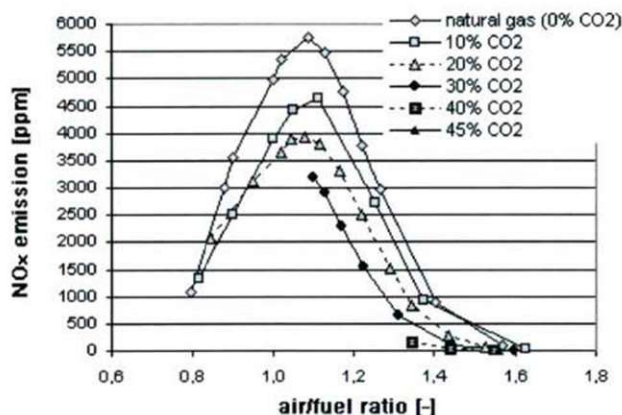
Figure 1. NO_x emission [Meggyes – Nagy, 2009]

With increasing of carbon-dioxide rate of the applied energy-carrier, the circumstances of the combustion are getting worse which result increasing CO emission and higher quantity of unburnt hydro-carbons. *Figure 2* illustrates the CO emission plotted against the air access coefficient. In case of $\lambda < 1.0$ air access coefficients CO emission increases by leaps and bounds, which can be explained by the increase of adiabatic flame temperature and production of getting rich mixture. However, in range of $\lambda = 1.1$-1.4 air access coefficients CO emissions – independently of carbon-dioxide content of gas mixture-stabilized on lower values. In the case of $\lambda > 1.4$ air access factors the dragging-on of combustion results increasing CO emission. In terms of CO emission, unambiguously, it can be determined that the traditional gas engine is operated with gas mixture with low methane content, there is no effect on CO emission if the gas engine operates permanently in range of $\lambda = 1.1$-14 air access factors.
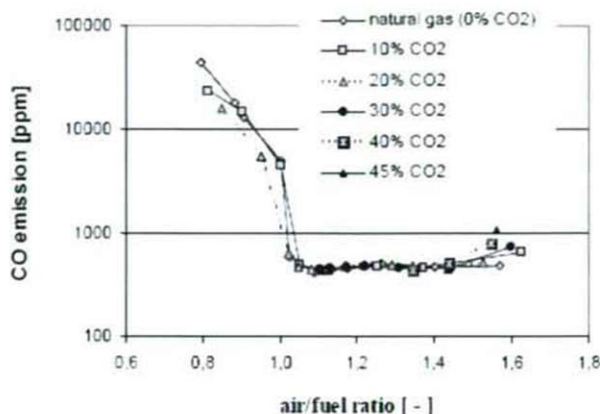
Figure 2. CO emission [Meggyes – Nagy, 2009]

Measuring of the methane content in the exhaust gas can give points of reference on the goodness of combustion process. Increasing the air absence and dragging-on of the combustion result similar tendencies considering the unburned hydrocarbons emission, too. In *Figure 3* it can be discovered that considering the incombustible hydrocarbon content of the exhausted gases there is no significant deviation present between the operation of natural gas and gas mixtures with a higher carbon-monoxide content in the range of λ=1.2-1.4 air access coefficient. The operation with low methane content of gas mixtures does not influence CO emission in the range of λ=1.1-1.4 air access coefficient.
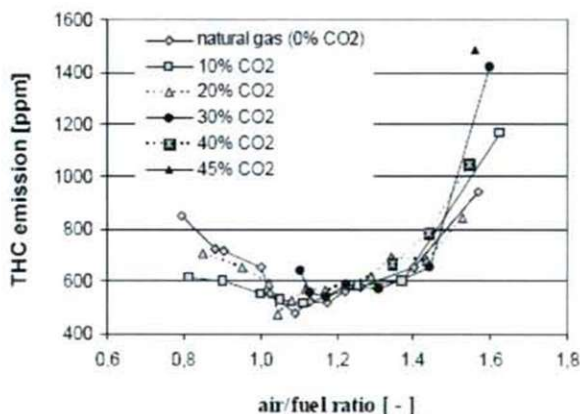
Figure 3. THC emission [Meggyes – Nagy, 2009]

3. EFFECTS OF BIODIESEL OPERATION

We had another project (NKFP4-063/2004) so we could test 10 types of vegetable oils which are suitable for use as diesel engine fuels. Application of mixtures of vegetable oils as fuels in the internal combustion engine resulted different power and torque values than diesel oil, it can be explained with different heat values and viscosity, cetane number of vegetable oils.

Nowadays we investigated emission components used with as well 5 kinds of sunflower oils mixed with diesel oil, and 4 kinds of rape oils mixed with diesel oil and RME. Our tests were performed by taking into account the requirements of EU 49 standards with PERKINS 1104C engine type at Szolnok College. In the course of our we established the amount of CO, HC, NO_x, CO_2 and O_2 components of exhaust gases and determined the rate of smoking too.

Our measuring system realized the certification cycle which contain operating conditions like speed (idle speed, maximum torque speed, maximum power speed), load (10, 25, 50, 75, 100 %) and load factors. R49 regulation requires a thirteen-step engine brake bench test in steady operation. The emissions are measured step by step, and they are registered as a specific mass emission (g/kWh) per performance. The issue is an average number that is calculated per polluting components and also per operation modes. Among the thirteen measuring points (operation modes) the sixth and the eights measuring points are high load working points. This means high average exhaust temperature.

After the emission tests it was stated that among the 5 kinds of sunflower oil mixed with diesel oil the effect of 4kinds of fuel fell back by 6.93 %-24.94 % compared to the CO value of diesel oil (*Figure 4*).
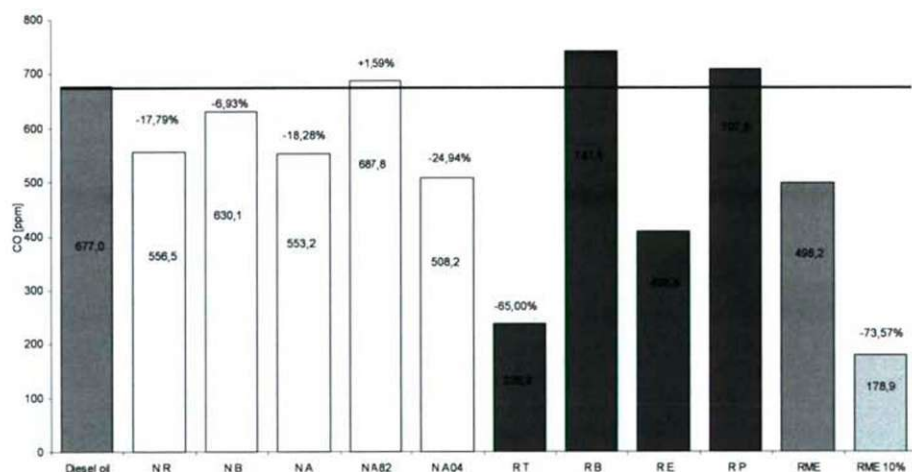
Figure 4. CO emission values [Farkas, 2009]

Among 4 kinds of rape oil mixed with diesel oil we noticed substantial falling (65 % and 39.61 %) in two cases and rising (9.52 % and 4.56 % twice). The pure RME showed 26.42 % less CO emission the mixed fuel containing 10 % RME decreased by 73.57 %.
CH emissions of all the vegetable oil-diesel oil mixed fuel remained under CH values of diesel oil (*Figure 5*).
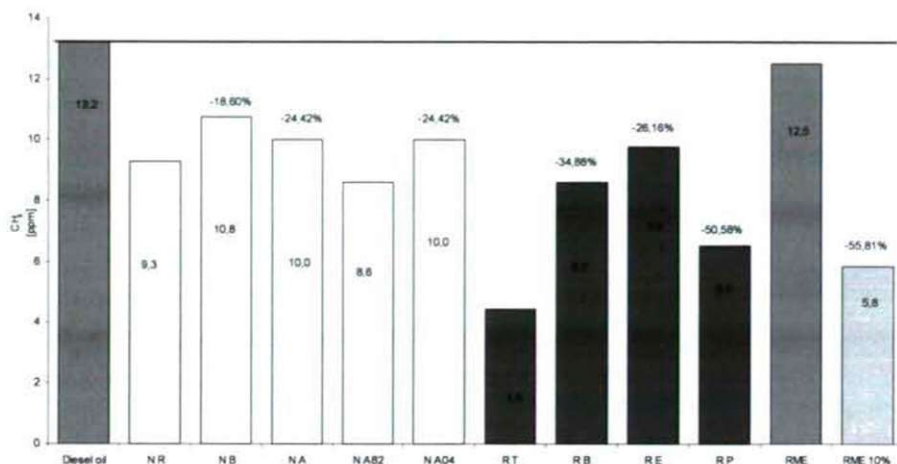
Figure 5. CH emission values [Farkas, 2009]

To compare the values of mixed fuel with sunflower oil that of there was a diesel oil, drop of 18.6 % - 34.88 % and also a fall of 26.16 % - 66.28 % mixed fuel was used with rape oil. The pure RME resulted 5.23 % less CH values, while the mixed fuel containing 10 % RME dropped by 55.81 %.

During the application of the 10 kinds of vegetable oil-diesel oil mixed fuel we measured higher NO_x values only on two cases than that of near diesel oil. (*Figure 6*).
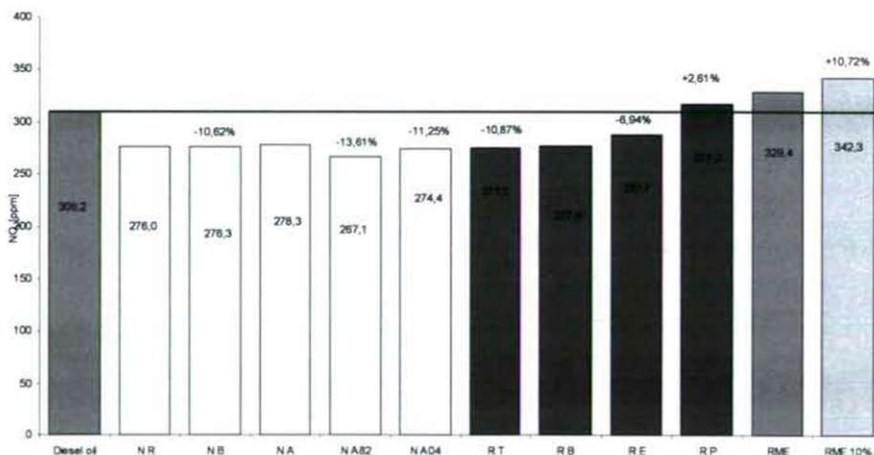
Figure 6 NO_x emission values [Farkas, 2009]

The samples with sunflower oil were slightly more favourable, than rape oil samples. Nine samples remained below the diesel fuel by 6.94 % - 13.61 %. Our further remark is that the values of pure RME exceeded the NO_x limit of diesel oil with 6.54 % and the mixed fuel containing 10 % RME also exceeded by 10.72 %.

4. CONCLUSION

The preservation of the state of our environment and the effective, economical expectations of the energy needs can be solved with the harmonized application of the traditional and renewable energy sources. That is why in nowadays the best perspectives are hidden in the energetic utilization of biogas as a universal renewable source of energy, which is among the mostly pressed tasks. Carbon-dioxide content (~25-60 %) of the biogas can be variable, depending on the organic material and the production technology. The combustion takes longer time on the effect of the carbon-dioxide, which brings forth changes in performance, efficiency and emission.

Today, all over the world, impacts of energy resources on the environment are global problem. Spread of energy carriers of biological origin can be promoted by continuous innovative activity.

Reinforcing the findings in the literature, it can be stated unambiguously that the 10 types of vegetable oil derivates tested by us are suitable for use as diesel engine fuel.

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EFFECT OF ESSENTIAL OILS OF SELECTED SPICES IN FOOD SYSTEMS

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ABSTRACT

Essential oils (EOs) of spices and herbs have substantial anti-microbial effects. Most of them have the GRAS (*Generally Regarded as Safe*) and FA (*food additive*) status by the FDA (Food and Drug Administration, USA) and can be used in foodstuffs as natural preservatives. However, the complex system of foods can protect spoilage microorganisms from the anti-microbial effect of essential oils. Our aim was to observe the germ count reducing effect of certain essential oils (cinnamon, lemon, marjoram and thyme oil) on selected bacteria and yeasts (*Bacillus cereus, Escherichia coli, Geotrichum candidum* and *Saccharomyces cerevisiae*) in growth medium, as well as in different foods and beverages (apple juice, milk, milk rice and minced pork meat). Our results showed that bacteria and yeasts are less sensitive to the EOs in foods than in growth medium. The minimal inhibitory concentrations (MICs) in liquid media varied from 0.125 µl/ml to >2 µl/ml. The MIC for lemon oil on *S. cerevisiae* in apple juice was 1 µl/ml and on *G. candidum* in skimmed milk was >4 µl/ml. One percent cinnamon or marjoram oil was required to achieve a 1 log cell count reduction of *B. cereus* in milk rice or *E. coli* in minced pork. These EO concentrations resulted in a strong odor of the foods making them hardly consumable. In the future, the combination of EOs with other preservatives or with hurdle techniques can eliminate the problems arising from these unfavorable strong aromas.

1. INTRODUCTION

Essential oils (EOs) in aromatic plants are among the most important active constituents of herbs and spices. They efficiency against a wide range of microorganisms is well documented. There is a growing interest in using EOs as natural preservatives against food spoilage- and food-borne pathogen microbes, in order to meet consumer demands for avoiding synthetic components in food (Bagamboula et al., 2003). It has been often observed that the preservative effect in food can be achieved by higher doses of EOs than *in vitro* (Burt, 2004). It is supposed that foodstuffs with high protein and fat content can protect bacteria from the antibacterial effect of EOs (Gill et al., 2002; Smith-Palmer et al., 2001). An essential oil dissolved in the fat of the food will be less available to act on bacteria present in the aqueous phase.

In our experiments the antibacterial and antifungal activities of cinnamon, lemon, marjoram and thyme essential oils was investigated against the bacteria *Bacillus cereus,* and *Escherichia coli,* and the yeasts *Saccharomyces cerevisiae* and *Geotrichum candidum.*

B. cereus is a Gram positive, facultative anaerobe, endospore forming bacterium. The endospores can survive in improperly cooked foods, especially in rice, causing food poisoning through the production of enterotoxins.

E. coli is a Gram negative bacterium living in the gut of mammals. Most strains are harmless but some serotypes can cause serious food poisoning in humans. *E. coli* is an indicator bacterium for fecal contamination of foods through poor personal or slaughter hygiene.

Spoilage yeasts cause the deterioration of plant-derived products, especially fruit and vegetable juices. *Saccharomyces cerevisiae* causes ethanol fermentation in "open" beverages. Yeast can also be found in dairy products such as yoghurt, kefir, and soft and fresh cheeses (Deák, 2007). The presence of *Geotrichum candidum* is a common problem in raw milk used for the production of soft cheeses and other dairy products.

Our aim was to evaluate the antibacterial and anti-yeast action of the essential oils in real food systems, such as apple juice, milk rice and ground meat.

2. MATERIALS AND METHODS

2.1. Essential oils (EOs)

The essential oils (EOs) investigated in this study were thyme, marjoram, lemon and cinnamon oil. The EOs were provided from Aromax Natural Products (Budapest, Hungary.

2.2. Bacteria and culture conditions

B. cereus var. *mycoides* ATCC 9634 was cultured on meat extract medium (MEE; 0.4% meat extract, 0.4% peptone, 1% glucose, 0.1% yeast extract), *Escherichia coli* SZMC 0582 was grown on Luria-Bertani medium (LB; 1% tryptone, 0.5% yeast extract, 1% NaCl,). *B. cereus* was incubated at 30 °C, and *E. coli*, at 37 °C.

2.3. Yeasts and culture conditions

The yeasts were isolated from spoiled food sources. *Geotrichum candidum* MB-102 was isolated from spoiled cottage cheese, and *S. cerevisiae* MB-21 from wild-growing black currants. Yeasts were grown on malt extract medium (ME; 0.4% malt extract, 1% glucose, 0.1% yeast extract) at 30 °C. Isolates were maintained on ME agar slants at 4 °C.

2.4. Determination of Minimal Inhibitory Concentration (MIC) values in growth media and in food systems

The MICs of the EOs were determined by macro dilution assay. 100 μl from the stock solutions of the EOs made in 50 % DMSO were added to 5 ml growth medium or apple juice resulting in final concentrations of from 0.0625 μl/ml to 2 μl/ml in twofold increments. The tubes were inoculated with approximately 10^5 CFU/ml bacterium or yeast and then incubated at 30 °C or 37 °C for 24 h. MICs were taken as the lowest concentration at which no visible growth occurred.

MIC values in milk were evaluated by plate count after 24 h incubation at 30 °C. The EO concentration where no colony formation was observed was taken as the MIC.

2.5. Antibacterial activity in minced pork and in milk rice:

Essential oils of thyme and marjoram were added to the minced pork, previously inoculated with 2 x 10^5 *E. coli*, in a concentration range from 0.125 to 1% (w/w). After 24

h storage at 4 °C, *E. coli* CFU (Colony Forming Unit) of the meat was determined on VRBG agar (Merck).

Cinnamon oil was added to fresh cooked and to room temperature cooled milk rice in the concentration range from 0.125% to 1 % (w/w). The rice was inoculated with 10^5 CFU/ml *B. cereus*. After 24 h storage at 4 °C bacterial CFU was determined on TGE agar.

3. RESULTS AND DISCUSSION

3.1. Minimal Inhibitory Concentration (MIC) values

The minimal inhibitory concentrations can be seen in Table 1. In growth medium marjoram had the lowest MIC value on *E. coli* with 0.125 µl/ml. In beverages the MIC was higher than in the medium. In minced pork and in milk rice we were not able to determine the MIC in the used concentration range.

Table 1: MIC values (µl/ml) of the investigated oils in growth medium (M) and in food systems (F). F_{mm} – minced meat; F_{aj} – apple juice; F_m – semi skimmed milk, F_{mr} – milk rice

EO	Microorganisms							
	E. coli		S. cerevisiae		G. candidum		B. cereus	
	M	F_{mm}	M	F_{aj}	M	F_m	M	F_{mr}
Cinnamon	-	-	-	-	-	-	1	n.d.
Lemon	-	-	0.5	1	1	>4	-	-
Marjoram	0.125	n.d.	-	-	-	-	-	-
Thyme	>2	n.d.	-	-	-	-	-	-

n.d. not determined

3.2. Growth inhibition effect of essential oils in real foods

In minced meat and in milk rice the CFU count of the inoculated bacteria do not reach zero under the given experimental conditions. We have monitored a cell number reduction on higher concentrations of the EOs. The maximal CFU reduction (1.8 log) was reached in the presence of 1 % cinnamon oil in milk rice. In minced pork marjoram EO showed better germ reduction capacity with 0.74 log than thyme oil with 0.5 log. Results are presented in Table 2.

Table 2: CFU count of the infection bacteria in minced pork (E. coli) and in milk rice (B. cereus) after 24 h storage at 4 °C.

Essential oil concentration (%)	Microorganism		
	E. coli		B. cereus
	Marjoram	Thyme	Cinnamon
0	4.1×10^5	4.1×10^5	7.6×10^4
0.25	6.5×10^5	7.5×10^5	4.8×10^4
0.5	3×10^5	2.2×10^5	1.3×10^4
1	7.5×10^4	1.3×10^5	1.2×10^3

There are some examples in the literature on the application of essential oils in meat or fruit based foods. In the study by Busatta et al (2008), MIC of marjoram essential oil in

growth medium against *E. coli* was 0.92 mg/ml. They applied marjoram oil in fresh sausage inoculated with *E. coli*, and after 25 days of incubation the MPN (most probably number) was reduced by approximately 1 log. The main component in marjoram EO having antibacterial activity is terpinene-4-ol, causing changes in membrane permeability. The main component of thyme essential oil, thymol, a phenolic constituent, was effective on coliforms and *Enterobacteriaceae* in minced beef patties (Del Nobile et al. 2009). In our experiments, thyme EO had only a slight CFU reduction effect which might be due to differences in its composition.

Cinnamon or citrus-based EOs were used to improve the shelf-life of fruit- or milk-based acidic foods or beverages (Smith-Palmer et al., 2001; Belletti et al., 2007). Citrus EOs has been successfully used against food spoilage yeasts (Viuda-Martos et al., 2003; Belletti et al., 2007). Aroma compounds and citron EO combined with mild heat treatment inhibited the growth of *S. cerevisiae* in non-carbonated soft drinks (Belletti et al., 2007).

The increased amount of essential oils in foods necessary to achieve good antimicrobial effect has a negative impact on the organoleptic properties of foods. The 1% concentration of marjoram and thyme EO in minced pork caused a very strong smell making the meat hardly consumable.

The combination of EOs with other preservatives or with different hurdle technologies can reduce the amount of EOs required and can eliminate the problems relating to their strong aroma (Pol et al., 2001; Gill et al., 2002; Atrea et al., 2009; de Souza et al., 2009).

4. CONCLUSION

Essential oils had better efficacy against spoilage microbes in beverages with high carbohydrate content than in foods with high protein and/or fat content. Further work is needed to determine the smallest effective concentration of EOs in foods, especially in beverages, to achieve good antimicrobial effect but avoid serious changes in taste and odour.

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MATHEMATICAL MODEL FOR COMPARISON OF THE INFLUENCE OF ESSENTIAL OILS AND HERBAL EXTRACTS ON THE MOULDS GROWTH

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ABSTRACT

The model for numerical comparison of the influence of essential oils and herbal extracts on the moulds growth, as exponential function with three parameters (S, λ, A), was proposed in this work. The model's basis is the functional relationship of the colony diameter dependent of the time and concentration of essential oils or herbal extracts. Three basical types of inhibition have been defined: inhibition to the Abscissa (IAb), inhibition of the Intensity (IIn), and inhibition to the Asymptote (IAs). The practical aplication of proposed model was done according to the results obtained after examination of the influence of different concentrations of *Allium ampeloprasum* (elephant garlic) essential oil on the growth of food spoilage causing moulds *Aspergillus tamarii*, *Penicillium griseofulvum* and *Eurotium amstelodami*. Function parameters of antifungal activity were calculated in view of 16-days time series of colony diameters, with 0, 1, 4, 7, 10 and 15% v/v essential oil of *A. ampeloprasum*. All obtained functions have high coefficient of correlation.
By comparison of parameters of obtained exponential functions, the activity of *A. ampeloprasum* essential oil to the *Aspergillus tamarii*, *Penicillium griseofulvum* and *Eurotium amstelodami* is numerically comparable. The defined functions could be used in matrix of inhibition and optimization of activity time and minimum inhibitory concentracione (MIC time) of antifungal agens.

1. INTRODUCTION

Moulds have been the most often contaminants and cause of food spoilage. They influence the health, nutritive and sensory quality of food, and cause the economical losses. Besides, some species from genus *Aspergillus, Penicillium, Fusarium, Alternaria, Eurotium* have the capability of synthesizing the toxic and cancerogenic metabolits (aflatoxins, ochratoxins, zearalenone, deoxinivaleol, fumonizine, sterigmatocystine, aleternariol, pianozonic acid, etc.), potentially harmful to human and animal health (IACR,1999; van Egmond, 2005).
The pogress of moulds have being tried to control by the addition of synthetic preservatives. However, due to their possible harmful effects, there have been rising the increasing interes in natural antimicrobial agents, extracted from spices and herbs, as alternative preservatives for lengthening the shelf life of food. This is especially the case in short shelf life products, as well as those packed in modified atmosphere. A number of works report about the influence of essential oils or extracts and their constituents to the moulds growth and micotoxin biosynthesis. There are few methods, describing the

examination of their influence on the moulds growth: agar plate method, disc-diffusion method (Rasooli and Abyaneh, 2004; Rasooli et al., 2006), agar-diffusion, macro-, and microdilution method (Lopez-Malo et al., 2007; Omidbeygi et al., 2007), poisoned food (PF) technique (Chuita et al., 2009). The most often applied is the agar plate method, based on the measurement of the colony diameter, in the presence of essential oil or herbal extract, during the time [Lopez-Malo et al., 2007; Benkeblia, 2004; Vagi et al., 2005; Fung and Zheng, 2007; Dimic et al., 2007; Viuda-Martos et al., 2008).

In this literature rewiev, a number of variables exists (different mould species, different types and concentration of essential oils and extracts, different activity time). Besides inhibition, stimulation of the moulds growth was stated in some cases. Sinergy and individual effects of essential oils and extracts to the moulds growth can be significantly different. Also, there is no standardized analytical method to compare the inhibitory activity of the most important variables, activity time and concentration of essential oils and extracts to different types of moulds.

The aim of this work was to determine the mathematical model which could enable the numerical comparison of influence of the activity time and concentration of essential oils and herbal extracts to the growth of the moulds, with the possibility of determination of MIC and MFC.

2. EXPERIMENTAL

Allium ampeloprasum essential oil was obtained by water vapour distillation of the green plant (grown at the Institute of Field and Vegetable Crops, Novi Sad, Serbia). The plant was chopped in small pieces and mashed with domestic blender (Braun Minipimer MR 400). Sample was transfered into a 2L flask and mixed with distilled water (1:1 ratio), and the Clevenger apparatus was installed. The system was heated during 3h and the essential oil was collected in the petroleum ether layer, in the oil separator tube. When the extraction time run out, petroleum ether layer was collected in a centrifuge tube and left at room temperature to evaporate the solvent. The tube, containing essential oil, was sealed with rubber stopper and stored in refrigerator.

Three moulds: *Aspergillus tamarii*, *Penicillium griseofulvum* and *Eurotium amstelodami* (isolated from spices) were used for antifungal investigations.

Microorganisms were stored in Potato dextrose agar (PDA), at temperature of 4°C. For this experiment, 7 days old cultures of moulds were used.

For each isolate, a conidial spore suspension (10^6 spores/ml) was prepared in medium which contained 0.5% v/v Tween 80 and 0.5% agar w/v in distillated water (Nielsen and Rios, 2000). Inoculation was performed with 1μl of spore suspension (10^3 spores/ml) in centred PDA medium in standard Petri dishes. Steril disc (5 mm) was placed in the centre of every dish cover, and 10μl of essential oil in concentracions of 0, 1, 4, 7, 10 and 15% v/v were added. Then, the plates were closed with parafilm and left to incubate at 25 °C for up to 16 days. Every day colony diameters were measured. All tests were performed in duplicate. Colony diameter was measured using orthogonal scales, and the mean value was calculated.

3. MODEL SELECTION FOR THE DESCRIPTION OF MOULDS GROWTH IN THE PRESENCE OF ESSENTIAL OILS AND HERBAL EXTRACTS

The moulds growth can be described using the exponential (Scheuring and Szathmáry, 2001) and Gompertz-type function (Gutiérrez-Jáimez et al., 2007). The exponential nature

of moulds development was described by models with constant and variable coefficients (Boswell, 2008). Description of the moulds growth, by everyday measurement of colony diameter, without inhibitors, can be expressed by exponential function $f(t) = 1 - e^{-\lambda(t)}$ where is: $\lambda(t)$ - growht intensity in the function of time. When the growth intensity is constant, i.e. $\lambda = const$, functional expression becomes

The maximal colony diameter is described by multiplying the expression (1) by the maximal value of diameter, A. The expression which considers maximal, asymptotical value of colony diameter, when $\lambda = const$ and parameter A, is:

$$f(t) = A \cdot (1 - e^{-\lambda t}) . \qquad\qquad\qquad\qquad\qquad (1)$$

Under hypothesis that moulds growth in the presence of inhibitors can be described by mentioned exponential distribution, three basic types of inhibition had been noticed. Those are: inhibition of moulds growth to the Abscissa – **IAb** (Figure 1a). inhibition of moulds growth intensity – **IIn** (Figure 1b), and inhibition of moulds growth to the Asymptote - **IAs** (Fig. 1c). The first type, inhibition of moulds growth to the Abscissa – **IAb** (Fig. 1a), occurs in the early phase moulds growth. Depending on the inhibition intensity, the beginning of growth is being shifted along Abscissa, at which the independent variable - time, is presented.

The second type of inhibition is presented by the change in intensity of moulds growth, which is noticeable the most in the mid phase mould growth **Iin** (Fig. 1b).

The third type of inhibition is noticeable the best in the late phase mould growth. In the case of inhibition of mould growth to the Asymptote - **IAs**, colony diameter converge to the value lower than the value in control conditions (Fig. 1c).
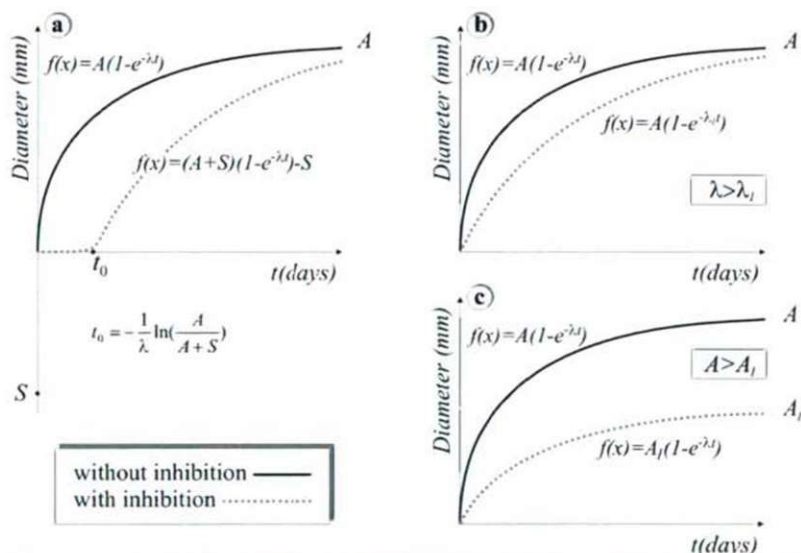
Figure 1. Types moulds growth inhibition a) Inhibition to the Abscissa – IAb, b) Inhibition of the moulds growth Intensity – Iin, c) Inhibition of the moulds growth to the Asymptota – Ias

The proposed exponential function (2) has two parameters, which can be used to describe the moulds growth inhibition Asymptote (parameter A) and inhibition of the moulds growth intensity (parameter λ). To describe the Inhibition moulds growth to the Abscissa -

IAb, it is necessary to introduce the third parameter into the exponential function (1). Theoretically, the beginning of the growth can be shifted to negative part of the ordinate (diameter axis). This is achievable by adding the S value to the value of Asymptote parameter, A. When the S value is subtracted from the function (1), the final function with three parameters, which can be used to describe the **IAb**, is derived is:

$$f(t) = (A+S) \cdot (1-e^{-\lambda t}) - S = A - e^{-\lambda t}(A+S) \tag{2}$$

Now, it is necessary to calculate the period of **IAb**, i.e. to calculate the t_0 value, in which the function $f(t_0)=0$. The t_0 value presents the period of the **IAb**:

$$A - e^{-\lambda t_0}(A+S) = 0 \Leftrightarrow e^{-\lambda t_0}(A+S) = A; \qquad t_0 = -\frac{1}{\lambda} ln(\frac{A}{A+S}) \tag{3}$$

The exponential function with three parameters and time as independent variable, which describes all three types of inhibition, is equal to:

$$f(t,c) = \begin{cases} 0, & t \le t_0 \\ A - e^{-\lambda t}(A+S), & t > t_0 \end{cases} = \begin{cases} 0, & t \le t_0, c \ge 0 \\ A(c) - e^{-\lambda(c)t}(A(c)+S(c)), & t > t_0, c \ge 0 \end{cases} \tag{4}$$

Intensities of inhibition, in dependence on the inhibitors concentration, can be followed by the change of parameters S, λ and A. Introduction of the second independent variable into the function (4) is ensured by forming the functional connection of parameters S, λ and A, and inhibitors concentration c, $S(c)$, $\lambda(c)$ and $A(c)$.

4. APPLICATION OF THE PROPOSED MODEL TO RESULTS OF THE EXPERIMENT

Time series of empirical values of the moulds colony diameters in the presence of different concentrations of *A. ampeloprasum* essential oils for *A. tamarii*, *P. griseofulvum* and *E. amstelodami* are presented in Figures 2-4. Parameters S, λ and A are obtained by heuristic searching in EXCEL. Inhibition time t_0 is calculated using the formula (4). The ratio of the diameter values of time series of control (0% v/v of *A. ampeloprasum* essential oil) and other concentrations (1, 4, 7 and 10% v/v of *A. ampeloprasum* essential oil) with theoretical values of the function and calculated parameters S, λ and A, is described by the coefficient of correlation R^2 and parameters of linear regression line (a, b).
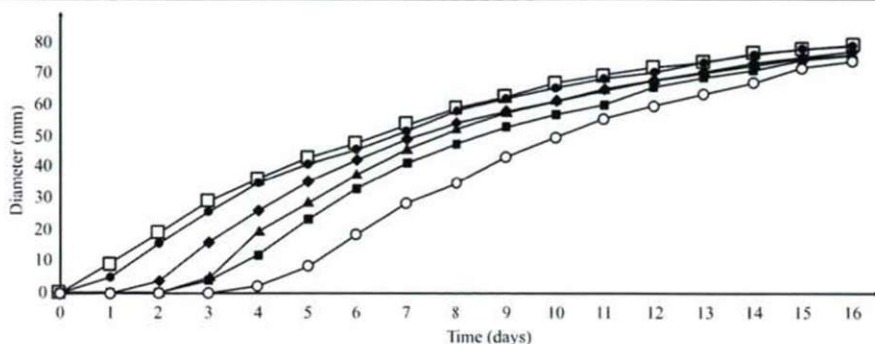
Figure 2. Time series of empirical values of the moulds colony diameters for A. tamarii in the presence of
different concentrations of A. ampeloprasum essential oil.
Fat contents: (□) 0%, (●) 1%, (◆) 4%, (▲) 7%, (■) 10% and (○) 15%
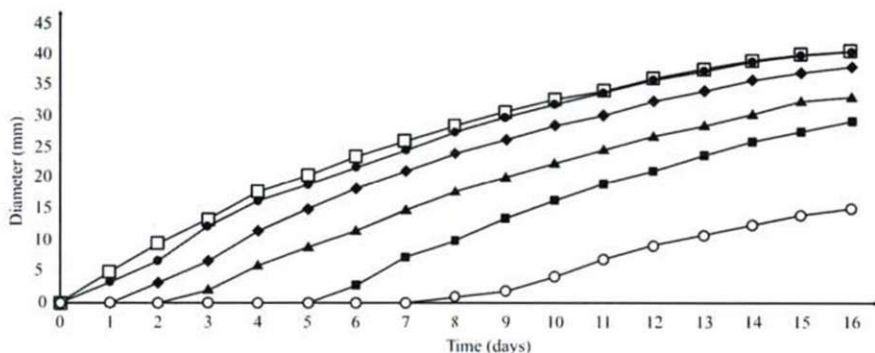
Figure 3. Time series of empirical values of the moulds colony diameters for P. griseofulvum in the
presence of different concentrations of A. ampeloprasum essential oil.
Fat contents: (□) 0%, (●) 1%, (◆) 4%, (▲) 7%, (■) 10% and (○) 15%
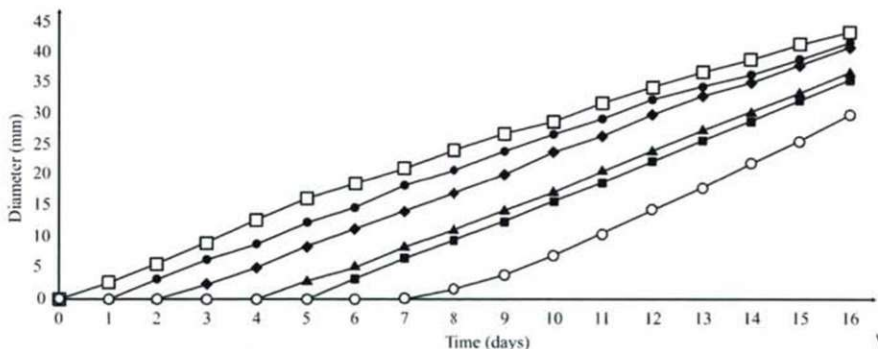
Figure 4. Time series of empirical values of the moulds colony diameters for E. amstelodami in the
presence of different concentrations of A. ampeloprasum essential oil.
Fat contents: (□) 0%, (●) 1%, (◆) 4%, (▲) 7%, (■) 10% and (○) 15%

5. MOULDS COLONY DIAMETERS IN FUNCTION OF TIME AND CONCENTRATION OF *A. AMPELOPRASUM* ESSENTIAL OIL

IAb with *A. ampeloprasum* essential oil is found for all three examined moulds. Changes of parameter S in function of concentrations of 0, 1, 4, 7 and 10% v/v *A. ampeloprasum* essential oils (Table 1.) are presented by regression lines with calculated coefficient of correlation. If c is the concentration of *A. ampeloprasum* essential oil concentration, then the functional connections of parameter S (dependent variable) for examined moulds and concentrations c (independent variable) are:

Table 1. Parameters and coefficient values for A. tamarii, P. griseofulvum and E. amstelodami in conditions of inhibition with different concentrations of A. ampeloprasum essential oils

	Concentration (%)	S	λ	A	t_0	R^2	a	b
A. tamarii	0	0.00	0.1526	86.74	0.000	0.9975	0.973	3.310
	1	12.30	0.1526	86.74	0.869	0.9982	1.019	-0.712
	4	26.07	0.1526	86.74	1.721	0.9992	1.010	-0.790
	7	39.32	0.1526	86.74	2.449	0.9991	0.964	0.069
	10	50.86	0.1526	86.74	3.023	0.9988	0.994	-0.822
	15				for validation			
P. griseofulvum	0	0.00	0.1109	43.98	0.000	0.9997	1.014	-0.181
	1	2.66	0.1075	43.98	0.546	0.9991	0.974	0.272
	4	4.79	0.0972	43.98	1.064	0.9988	0.955	1.127
	7	10.88	0.0850	43.98	2.586	0.9981	0.980	0.901
	10	21.10	0.0777	43.98	5.044	0.9716	0.886	2.543
	15				for validation			
E. amstelodami	0	0.00	0.0403	91.86	0.000	0.9992	0.998	0.757
	1	4.15	0.0403	91.86	1.094	0.9989	1.004	0.323
	4	9.59	0.0403	91.86	2.460	0.9989	0.982	0.225
	7	17.96	0.0403	91.86	4.424	0.9991	0.995	0.023
	10	19.94	0.0403	91.86	4.868	0.9985	0.969	0.422
	15				for validation			

$$S_{A.\ tamarii} = 4.8382\ c + 4.4421, R^2 = 0.9765 \tag{5}$$
$$S_{P.griseofulvum} = 1.9578\ c - 0.7288, R^2 = 0.9385 \tag{6}$$
$$S_{E.astelodami} = 2.0291\ c + 1.3999, R^2 = 0.9625 \tag{7}$$

The only change of growth intensity was observed for *P. griseofulvum*. The intensity of growth of *P. griseofulvum* is indirect proportional to applied concentration of *A. ampeloprasum* essential oil. The intensity of growth did not change in dependence of applied essential oil concentration for *A. tamarii* ($\lambda=0.1526=const$) and *E. amstelodami* ($\lambda=0.0403=const$). It means that essential oil inhibited *P. griseofulvum* also by inhibition of the growth intensity. That is the reason to find out the functional connection of parameter λ and the *A. ampeloprasum* essential oil concentration. Functional dependence of parameter λ and concentration c now becomes: $\lambda_{P.griseofulvum} = -0.0034\ c + 0.1107$.

For none of examined moulds the IAs with essential oil was not detected. Two-dimensional function for description of the *A. tamari* colony diameter growth in conditions of inhibition with different concentrations of *A. ampeloprasum* essential oil (independent variable c) and time (independent variable t) is:

$$f(t,c)_{A.tamarii} = 84.76 - e^{0.1526t}(84.76 + (4.8382\,c + 4.4421)), \quad t > t_0, c \geq 0$$

$$\text{where: } t_0^{A.tamarii} = -\frac{1}{0.526}\ln\left(\frac{84.76}{84.76 + (4.8382\,c + 4.4421)}\right) \tag{8}$$

Two-dimensional function for description of *P. griseofulvum* colony diameter growth in conditions of inhibition with different concentrations of *A. ampeloprasum* essential oil (independent variable c) and time (independent variable t) is:

$$f(t,c)_{P.griseofulvum} = 43.98 - e^{(0.1107 - 0.0034c)t}(43.98 + (1.9578\,c - 0.7288)), t > t_0, c \geq 0$$

$$\text{where: } t_0^{P.griseofulvum} = -\frac{1}{0.1107 - 0.0034c}\ln\left(\frac{43.98}{43.98 + (1.9578\,c - 0.7288)}\right) \tag{9}$$

Two-dimensional function for description of *E. amstelodami* colony diameter growth in conditions of inhibition with different concentrations of *A. ampeloprasum* essential oil (independent variable c) and time (independent variable t) is:

$$f(t,c)_{E.amstelodami} = 91.86 - e^{0.0403t}(91.86 + (2.0291\,c + 1.3999)), t > t_0, c \geq 0$$

$$\text{where: } t_0^{E.amstelodami} = -\frac{1}{0.0403}\ln\left(\frac{91.86}{91.86 + (2.0291\,c + 1.3999)}\right) \tag{10}$$

6. APPLICATION OF MODEL AND MATRIX OF INHIBITION

From the formula (5), the parameter S, which is in functional connection with *A. ampeloprasum* essential oil concentration, can be expressed. The obtained formula gives the possibility of calculation of essential oil concentration necessary for requested period of **IAb**. In the following calculations, the period of **IAb** of $t_0=10$ days is adapted. Function of time and *A. ampeloprasum* essential oil concentration for *A. tamarii* is (8):

$$4.8382c + 4.4421 = 86.74\frac{1 - e^{-0.1526t_0}}{e^{-0.1526t_0}} \Leftrightarrow c = \frac{86.74(1 - e^{-0.1526 \cdot 10})}{4.8382e^{-0.1526 \cdot 10}} - \frac{4.4421}{4.8382} = 63.62$$

IAb of the growth of *A. tamarii* for $t_0=10$ days is being achieved with $c=63.62\%$ v/v of essential oil, which is the MIC. For calculation of **IAb** of *P. griseofulvum* in period of $t_0=10$ days, it is necessary to introduce the function of parameter λ in ascertained form: $\lambda_{P.griseofulvum} = 1.9578 \cdot c - 0.7288 = 0$. It is obvious from equation that total inhibition of *P. griseofulvum* growth begins at concentration of $c=32.55\%$ v/v of essential oil. The concentration of essential oil of 32.55% v/v is the MFC for *P. griseofulvum*. **IAb** of the growth of *P. griseofulvum* for $t_0=10$ (3, 9) days is being obtained by numerical interpolation for the essential oil concentration value of $c=16.59\%$ v/v . **IAb** of the growth of *E. amstelodami* of $t_0=10$ (10) days is being achieved with $c=21.77\%$ v/v of essential oil (MIC). On the basis of derived analyses matrix of inhibition is formed (Table 2):

Table 2. Matrix of inhibition of A. ampeloprasum essential oil for A. tamarii, P. griseofulvum and E. Amstelodami, $t_0=10$ days

Moulds	Inhibition parameters				
	S (**IAb**)	λ (**IIn**)	A (**IAs**)	MIC(%)	MFC(%)
A.tamarii	4.8382c+4.4421	–	–	63.62	–
P.griseofulvum	1.9578c–0.7288	0.1107–0.0034c	–	16.59	32.55
E.amstelodami	2.0291c+1.3999	–	–	21.77	–

A. ampeloprasum essential oil has the singular system of inhibition for A. tamarii i E. amstelodami, and double system of inhibition for P. griseofulvum. For 10 days growth inhibition the highest concentration is necessary for A. tamarii (63.62% v/v), and the lowest for P. griseofulvum (16.59% v/v). A. ampeloprasum essential oil is capable to completely inhibit onlu P. griseofulvum, with MFC=32.55% v/v.

7. MODEL VALIDATION

Theoretical functions for c=15% v/v of A. ampeloprasum essential oil were carried out for validation on the basis of obtained functional dependence of essenatial oil concentration and parameter S, from formulae (5, 6, 7) and λ for P. griseofulvum.. The results of calculation of parameters, coefficients of correlation of empirical and theoretical moulds colony diameter values and coefficients of linear regression line are given in Table 3.

Table 3. Values of parameters and coefficients for examined moulds in conditions inhibition with 15% v/v of A. ampeloprasum essential oil

Moulds	S	λ	A	R^2	a	b
A. tamarii	76.9951	0.1526	86.74	0.9971	1.0033	0.7241
P. griseofulvum	28.6382	0.0597	43.98	0.9975	0.8680	0.1140
E. amstelodami	34.5364	0.0403	91.86	0.9946	1.1129	0.1346

The results of empirical values of time series of A. tamarii colony diameters, P. griseofulvum and E. amstelodami with 15% v/v of A. ampeloprasum essential oil and theoretical values of time series of colony diameters calculated for c=15% v/v on the basis of function (8) for A. tamarii, function (9) for P. griseofulvum, and function (10) for E. amstelodami, are given in Figures 2, 3 and 4, respectively.

Inhibition of A. tamarii with A. ampeloprasum essential oil has been excellently described by the proposed model. For P. griseofulvum, the time of **IAb** of empirical and theoretical values altered solution is needed. Due to high coefficient of correlation value, the alteration is being performed by multiplying the theoretical function with coefficient of linear regression line a=0.8680. For E. amstelodami, application of altered solution is needed. High coefficient of correlation enables the simple alteration by multiplying the total theoretical function by coefficient a=1.1129.

8. CONCLUSION

The proposed model has been synchronized with system of defined types of inhibition, by three parameters, S, λ and A: **IAb**, **IIn** and **IAs**, respectively. In spite of this, in case of stimulative activity of essential oil or herbal extracts to moulds growth, the model acts by positive logics.

The practical application of model for description of the growth of examined moulds in the presence of *A. ampeloprasum* essential oil showed successful interpolation and partially successful, but easy adoptable, extrapolation with experimental results. The applied model transparently compares the influence of essential oil to examined moulds.

The most possible intervals of MIC and MFC could be predicted by extrapolation of model values. The ratios of activity time and essential oil or extract concentrations to moulds growth can be optimized by interpolation of model values.

For application of proposed model, it is needed to examine the concentrations of essential oil from 0% to MIC or MFC, according to type of inhibition. With this, the calculations of essential oil inhibitory activity are being adjusted to interpolation. The defined functions could be used in matrix of inhibition and optimization of activity time and concentration of antifungal agens.

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USE PLANTS SPECIES OF *TYPHA ANGUSTIFOLIA* L. IN THE RESTORATION OF WETLAND ECOSYSTEMS IN AGRICULTURE LANDSCAPE

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ABSTRACT

Our environment is significantly impaired due to pollution and overexploitation of natural resources. All natural ecosystems have been greatly damaged. Restoring the natural functions of ecosystems is a priority for now. Wetland macrophytes, such as higher plants, play an important role in the recovery process, particularly in terms of biological treatment of water run-off from agricultural land. The phytoremediation is the main method of recovery in this context. Phytoremediation is ability of plants to receive and accumulate chemicals from environmental pollution and to improve its properties. The goal of paper is to verify the response of one species of wetland macrophytes *Typha angustifolia* L. on eutrophic conditions and to assess their use in the restoration as phytoremediants. To meet the target, container experiments were conducted in greenhouse conditions with a differentiated mineral nutrition. Plants species *Typha angustifolia* L. is able to accumulate the major macro elements (nitrogen, phosphorus, potassium) and use them to create the above-ground and below-ground biomass. *Typha angustifolia* L. is also hyperacumulator of Zinc (Zn). It has high resilience and ability to vegetative propagation. *Typha angustifolia* L. forms a large amount of biomass in the eutrophic and oligotrophic conditions and therefore has a secondary potential as an alternative energy source.

1. INTRODUCTION

Ecosystem damage is caused may be due to several disturbances, which are usually reinforced or caused by man. Human society, particularly in developed countries, recognizes the need for an active recovery (rehabilitation, revitalization, etc.) of the man destroyed or degraded ecosystems, communities or population.

Restoration is in a sense of counterpart protection (conservation). If in the country (ecosystem) is no longer the preservation is the more appropriate method of restoration (Kovář, 2006).

As the Samways reports (2000), restoration from biocentric terms should enable restoration of ecological integrity and natural succession and evolutionary possibilities. Chapin et al. (2000) define the objectives of restoration focused on restoration of ecological functions in terms of energy flow and materials through a set of biotic and abiotic components of ecosystems. Cudlín et al. (2001) believes that the reconstruction should be aimed at improving the ecological stability.

Bioremediation of wetland macrophytes skills

Certain forms of heavy metals in soil and water create natural background associated mostly with the weathering of rocks. Critical proportion of the heavy metals in soil and water come from human activity (Dercová et al. 2005). The restoration methods integrate advanced bioremediation processes that belong to biotechnology. Bioremediation is the use of metabolic activity of "living" organisms to remove contaminants from the environment. Phytoremediation is using of plants to remediation of the environmental pollution.

Phytoremediation has been developed for a wide range of applications not only inorganic pollutants, but for organic pollutants too. The issue of remediation, bioremediation and phytoremediation to deal with a number of authors as an example and recommended works Agathos, Reineke, 2000; Vise et al., 2000; Swimdoll, Stahl, 2000; Jester et al., 2003; Prasad et al., 2006; Willey, 2007.

Some plants, known as hyperacumulators, accumulate metals in high quantities. The concentration of heavy metals in biomass of these plants exceeded by one to two times of values found in normal plants. It is more than 1 mg of metal in 1 g of dry matter (Dercová et al., 2005).

Wetland macrophyts such as *Typha angustifolia* L., which we used in our experiments, is one of the dominant species of eutrophic wetlands. The anatomical, morphological and physiological characteristics predetermine it to use as phytoremediant in the processes of restoration in agricultural country.

Studies and the subsequent practical use in biological (root) wastewater treatment plants best document the bioremediation ability of wetland macrophytes.

Typha angustifolia L. is suitable for treatment of waste water with high content of organic matter.

The goal of this paper is to verify the response of plant wetland species *Typha angustifolia* L. to eutrophic conditions and identify its role in the restoration process as phytoremediant.

2. MATERIAL AND METHODS

Typha angustifolia L. (Fig. 1) is able to grow in different environmental conditions and it is propagated mainly by vegetative ways. This species is considered particularly to well suit wetland habitats.

Figure 1 Typha angustifolia L. in wetland biotope in the agriculture landscape (Photo: Kotrla, 2007)

This species do well a wide temperature ranged from 10 to 30 ° C, seeds germinate after 3 days at 15 to 37 C°, the speed of germination is influenced by many factors. It grows in the range of pH 4-10 (Cronkite, Fennessy, 2001).

Typha angustifolia L. is a wetland species, often located on the banks of ponds and water channels. It can be seen also in shallow waters where the water level ranges from 5-10 cm, in mud environment and wet meadows.

It is expanded in the altitude up to 350 m especially, but it can be located up to 500 m above sea level. This species is situated in lowland areas in particular. Its presence is also limited by slopes. It occurs in inclination from 35 to 40°. It is expanded almost throughout Europe, North Africa and Asia.

Interaction effects of factors (pH, concentration of heavy metals) on the accumulation and distribution of elements (nitrogen – N, phosphorus – P, potassium - K, zinc – Zn) in biomass of this species were followed in terms of container experiment in greenhouse conditions. We created variants (variant A, B, C, D and E) with the basic (variant A) and escalation concentration of fundamental elements (N, P, K) (variants B to D) and heavy metal zinc (Zn) (variant E). We studied the contents of N, P, K and Zn in aboveground and underground organs. We cultivated plants in a nutrient solution, to verify the ability to accumulate minerals by *Typha angustifolia* L. (Table 1).

Table 1 The composition of the basic nutrient solution, according to Hoagland (1939)

Salt	Basic solution in g.l^{-1}
$Ca(NO_3)_2$	0,821
KNO_3	0,506
KH_2PO_4	0,136
$MgSO_4$	0,320

We planted the plants in containers with double bottom with a capacity of 15 litters to medium sand – fine gravel in a 1:1 ratio (Fig. 2).

Figure 2 The scheme of experimental plant cultivation container

The control variant was without essential nutrients added to the amount represented by the nutrient content of the composition of 5 l of the basic humidification (N - 780 mg, P - 35 mg, C - 975 mg, Zn - 6 mg) (Variant A). In variants B and E three times the concentration of N, P, K and Zn were used. Variants of experiment are shown in Table 2.

Table 2 Variants of experiment – nutrient treatment

Variant name	Net amount of nutrients in the container in mg			
	N	P	K	Zn
Variant A	780	35	975	6
Variant B	3900	35	975	6
Variant C	780	105	975	6
Variant D	780	35	4875	6
Variant E	780	35	975	30

Legend: N – nitrogen, P – phosphorus, K – potassium, Zn - zinc

3. RESULTS AND DISCUSSION

The concentration of nutrients in the environment (including water) is not the actual picture elements contained in the organs of plants. We analyzed the content of elements in the aboveground and underground organs. In our experiments, we focused on the accumulation ability of the species *Typha angustifolia* L.. We have confirmed that the increased number of elements affecte the activity of plants. In biomass increased the accumulation of elements (Fig. 3, 4, 5).

The percentage of the amount of nitrogen taken by plants from the total amount in the substrate showing to force the amount absorbed N to produce biomass. In the control variant, underground organs accumulated 19.5% and aboveground organs 33.5% from the total N in the substrate. In variant B (3N) accumulated of underground organs (28.24%) and weight of biomass was increased by 24.60%. Aboveground organs accumulated 40.38% of total N in the environment, increasing their weight of biomass by 23.37%.
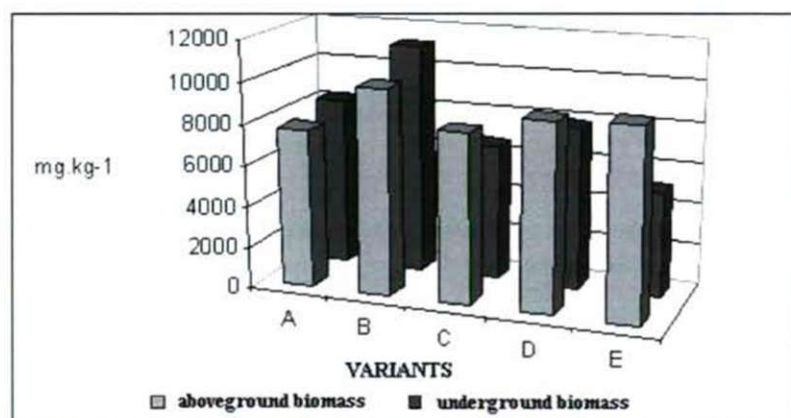
Figure 3 The amount of nitrogen (mg N.kg⁻¹ dry weight) in aboveground and underground organs of Typha angustifolia L.

The percentage of the amount of phosphorus received by plants from the total amount in the substrate, confirmed that the increased P content in the substrate plants take the increased amount of this mineral. In the control variant, underground organs accumulated 21.4% and aboveground 18.5% from the total P in the substrate. The variant C (3P) increased accumulation of underground organs (22.5%) and aboveground organs accumulated 30.05% from total P in the environment.

Figure 4 The amount of phosphorus (mg P.kg^{-1} dry weight) in aboveground and underground organs of Typha angustifolia L.

The percentage of received potassium by plants from the total amount of K in the substrate, confirmed that the increased content in the substrate, increased its revenue. In the control variant, underground organs accumulated 14.7% and aboveground organs 22% from the total P in the substrate. The D variant (3K) increased accumulation of underground organs (18.29%) and aboveground organs accumulated 39.30% from the total K in the environment.
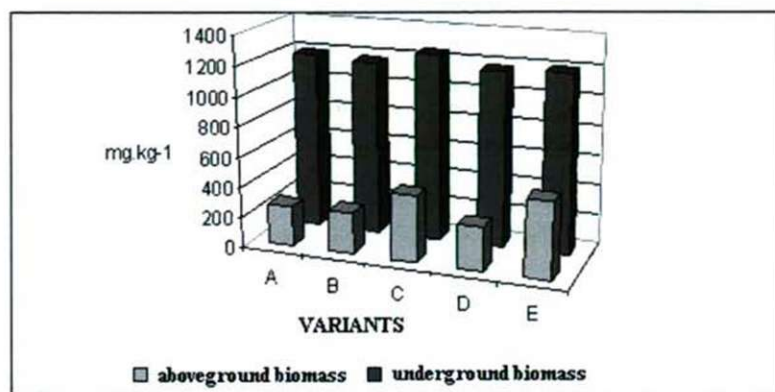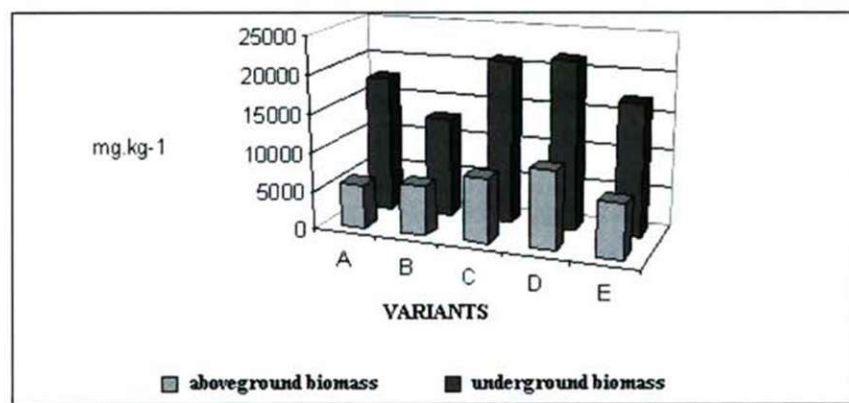

Figure 5 The amount of potassium (mg K.kg^{-1} dry weight) in aboveground and underground organs of Typha angustifolia L.

The results of our experiments focused on the accumulation ability of the species *Typha angustifolia* L., acknowledge the fact that it works with Véber (1993) and Čížková (1994). Nitrogen, phosphorus and potassium are the macro elements that wetland plant species can accumulate in their organs in increased quantities and at a higher concentration. In the environment are also able to increase its income in the underground and aboveground organs of plants.

The results of our experiments, where we found the increase in accumulation capacity of plants in an increased supply of that element are also consistent with the findings of Šálek (1999). The vegetation is directly involved in the cleaning process by accumulation and

use of the nutrients released from the environment, particularly nitrogen, phosphorus and potassium and this gradually builds in its increased quantities of biomass.

The data presented in Table 3 show that plants of *Typha angustifolia* L. are able to receive and accumulate ions of salts in high concentrations and their use for production of biomass.

Table 3 The balance of nutrients (main macro elements) delivered in a nutrient solution to plants harvested after 21 days of cultivation

The amount of available nutrients in mg			The amount of the element accumulated plant in mg		
N	P	K	N	P	K
780	35	975	334,43	30,49	462,20
3900	35	975	345,22	24,28	319,80
780	105	975	276,07	30,59	532,60
780	35	4875	277,50	24,73	522,73
780	35	975	251,00	27,61	407,50

Legend: N – nitrogen, P – phosphorus, K - potassium

In an environment of increased concentrations of elements, the plants increased their accumulation and integrate them into their biomass. Nitrogen accumulated in plant biomass in the range of 32.18 to 42.88% of the amount available in solution. The plants were incorporated in the total biomass phosphorus in high quantities (69-87%). We have not seen any increased accumulation ability of plants to elevated concentrations of potassium (10.72%). The plants accumulated potassium in the primary concentration in the range (32.8 to 47.4%). We confirmed the synergistic effect of phosphorus in relation to potassium in the triple concentration of phosphorus (54.6%).

4. CONCLUSION

Based on the results of model experiments, which were obtained in the study of adaptive responses of species *Typha angustifolia* L. we can recommend the species of restoration processes in degraded ecosystems in semi terrestrial ecosystems in the alluvial farmland. We consider the use of the plants of its species in the restoration process for perspective. They function in the semi terrestrial ecosystems positively influencing eutrophic water treatment process to accumulate minerals in the agriculture landscape. Plants species *Typha angustifolia* L. are able to accumulate the major macro elements (nitrogen, phosphorus, potassium) and allocate them in the aboveground and underground biomass. *Typha angustifolia* L. is also hyperacumulator of zinc (Zn), it is able to receive and accumulate of zinc ions in high concentrations. This species has high regeneration ability and is capable for vegetative propagation. It forms a large amount of biomass in the eutrophic and oligotrophic conditions and therefore has potential as an energy source.

We recommend to support the growth of macrophyte vegetation particularly species of *Typha angustifolia* L in the case of increased contamination of mineral elements in semi terrestrial ecosystems, where we demonstrate the ability to accumulate minerals from the substrate.

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THE SUSTAINABLE RURAL PUBLIC SPACES: THE IMPORTANCE OF HUMAN FACTOR FOR LANDSCAPE PLANNING PRAXIS

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ABSTRACT

Public spaces are interior spaces of the settlement where people move, meet and rest. As the public spaces are unique in each village, their design should be unique as well taking account people's needs and the character of space. In Slovakia are villages numerous form of settlement. There are 2898 settlements, of which 2762 rural settlements - villages, representing 95.3%. Therefore the question about quality of public spaces in rural areas is actual. In creation or transformation of public spaces in rural settlements should be taken into account human and social aspect. Here is a place for analyses based on direct observations of people's behavior. By direct observation had been analyzed age, sex, user activities and traffic load of selected central public spaces. The information obtained from the analysis gives us a picture of public life in the village, what age groups use public spaces as a percentage of men and women, what activities are taking place in public places and about the loading of public spaces. In view of the landscape planning praxis the obtained information are useful: a) for location of roads and paved areas and character of their surface, b) the number, shape and location of rest areas and their equipment,c) in the design of active sites and their target groups such as children's playgrounds, playgrounds for teenagers, or sport areas for seniors, d) selection and location of plants and the overall visual modification site of public space. Gathered information, and the outcome of this paper may serve for the local authorities, residents, businesses and other stakeholders as possible source of data for designing qualitative living space.

1. INTRODUCTION

In creation or transformation process of public spaces in rural settlements should be taken into account human and social aspect. It is necessary to emphasize how people, their needs and expectations are important for public spaces and what role plays the space in the eyes of the citizens. Carr (1992) argues that it is important to examine needs, not only because they explain the use of places, but also because use is important to success. Places that do not meet people's needs or that serve no important functions for people will be underused and unsuccessful.

Space and society are clearly related: it is difficult to conceive of 'space' without social content and, equally, to conceive of society without a spatial component. The relationship is best conceived as a continuous two-way process in which people (and societies) create and modify spaces while at the same time being influenced by them in various ways (Carmona, 2003 p. 106). In the past decade, these social goals have become secondary to economic motivation asserts Carr et. al. in book Public Space (1992, p. 293). When designs are not grounded in social understanding, they may fall back on the relative certainties of geometry, in preference to the apparent vagaries of use and meaning. Both designers and clients may easily confuse their desire to make a strong visual statement with good design. Public space design has a special responsibility to understand and serve the public good, which is only partly a matter of aesthetics (Carr et al. 1992, p. 18).

At the turn of the century Patrick Geddes taught that before attempting to change a place, one must seek out its essential character on foot in order to understand its patterns of movements, its social dynamics, history and traditions, its environmental possibilities (Hough, 1990). Beginning in the 1960s writers such as Jacobs, Lynch, William H. Whyte, Clare Cooper Marcus and danish designer Jan Gehl emphasized the need to base urban design on study of how people actually experience and use urban environments. A new discipline of environmental design emerged, devoted to researching how built environments work for people. Researchers developed methods using behavior observation, time-lapse photography, post-occupancy evaluation surveys, and cognitive mapping (in which people were asked to draw maps or images of how they perceived their urban environments) to provide factual information for improved urban design (Wheeler, Beatley, 2004).

An American urbanist, organizational analyst, journalist and people-watcher William H. Whyte, studied human behavior in urban settings. He observed and film analyzed plazas, urban streets, parks and other open spaces in New York City. All told, Whyte walked the city streets for more than 16 years. As unobtrusively as possible, he watched people and used time-lapse photography to chart the meanderings of pedestrians. What emerged through his intuitive analysis is an extremely human, often amusing view of what is staggeringly obvious about people's behavior in public spaces, but seemingly invisible to the inobservant (PPS, 1999).

In 80ties Randolph Hester was a leader of planning process in Manteo town (North Carolina, USA). In this process residents identified what they valued about life and about their landscape. Randolph Hester comments that these important social patterns and places came to be called the „Sacred Structure" by locals and inspired a plan for community revitalization and development that was controlled by them. Planning focused on behavior mapping that recorded what people did and where they did it- things that were not revealed in the standard surveys. Activities like the exchange of small talk at the post office, hanging out at the docks, checking out the water for the tides, the fishing, and the weather, happened in the same places every day. Daily rituals indicated a dependence on specific places that could be disrupted by changes in land use. A list of these was developed, and people were asked to rank them in order of their significance, and to indicate which ones could be sacrificed in the interest of tourist facilities. From these was published a map of places that people wanted protected from future development (Hough, 1990).

In Germany before second war Martha Muchow (1935 in Koll, 2009) started to apply the observation methodologies. Her methodology was based on studies of living space for urban children in Hamburg. It is one of many possible methodologies aimed at analyzing the use of public spaces.

2. Aim of the paper

The aim of the paper is to analyze sex, age, activities and traffic load during the week days on selected central public places in the village of Dobrá Voda (Slovakia).
- Introduction to the case study site
- Evaluation of the behavior mapping methodology of Šilhánková (1996) and gathered information.
- Assess their potential use in the landscape and architectural work.

3. Study area- Dobrá Voda village
Dobrá Voda village is located in Trnava district, 29 km away from town. Population density is 853 inhabitants with 26 inhabitants per km2. According to the types of spatial

organization of the housing system Dobrá Voda is a linear-chain type village and in terms of ground plan of the genetic-formation is a privileged village with the market place connected with the castle (now ruins). Village is connected with the other villages by 3rd class communication, which passes directly through the center of the village.

In the case study village Dobrá Voda were selected 3 central public spaces (main square, main street and small new square near the main square), which were identified by the borders of cadastral map of the village. They were analyzed as a one whole public space becase they are connected and influence each other.

Main square

Area of the square in front of the church of the Virgin Mary is formed by the surrounding houses, which include the parish house with a commemorative John Hollého room and restaurant. The square is the central point of the village. It is a starting point area for hiking trails and there is also the bus stop. Here all major community events take place such as the celebration of the 1st May, a local fair, or st. Nicholas Welcoming with the Christmas tree. The surface of the square is made from stone-pitch with no visible structuring of transport for walking and car transportation. In the center of the square is green area with two memorials.

New square with the playground

The newly built square with a fountain and a children playground is located on the right side at the entrance to the main square. This area had previously been used as a small park that was created on the area of the old water tank. At this time, the area provides space for relaxation for all ages. There is a pergola with benches, playground and water feature in the form of fountain. The square is formed by buildings and whole area is enclosed by a low fence.

Main street

Main Street begins at a local shop and ends at the square in front of the church. It is one of the principal and most frequented streets in the village. On both sides is bounded by houses with front gardens without fences. On the left side, towards the square is a footpath for pedestrians and Blava stream, which is separated from the main road by the grassy area with trees of the genus Tilia sp. The alley of trees ends at the main square. On the right side are houses separated from the road by grass stripe. The street ends before entrance to the square by bridge.

3. METHODS

3.1 Viera Šilhánková (1996) –Behavior mapping

The methodology of operational improvements of public spaces Viera Šilhánková (1996) is based on the principles of direct observation. Šilhánková (1996) argues that by the analysis of behavior mapping is possible to determine human activities performing on public space and what kind of conditions are necessary to prevent and develop this activities. Based on the results of this analysis is possible to design the outdoor furniture such as benches, trash cans, clocks, advertising posters, etc. and its arrange due to human activities and needs.

Šilhánková (1996) observes people in groups by sex, age and the user activities. She counts the total amount of the people. This information is written to the forms.

The Šilhánková (1996) methodology was tested on public spaces of the village Dobrá Voda in October 2009 (Lipovská, 2010) and the results showed that from final tables of Šilhanková methodology (1996) you can not detect individual genders for each age category. Overall, this information focuses only on the total percentage of men and women who visited the selected public place. This information would assist in the completion of public spaces, especially for ages 18 to 60 years, when the use of public space is different for men and women. Also the age range 18 to 60 is quite wide, so it would be better to split it into two. Similarly, analysis of activities taking place in public places can not be characterized within each sex but only generally.

3.2 New form for behavior mapping and the traffic mapping

For the behavior mapping on selected cetral public spaces in Dobrá Voda village we used the simply form for mapping the people and the traffic load for each fiften minutes every hour.

For their display and a better understanding was developed matrix for behavior and traffic mapping on rural public spaces (Lipovská, 2010):

The colums are divided by sex, age, activities and traffic. The first two columns in Table 1. indicate sex, the third to seventh indicate the age of observing people. The eighth to fourteenth columns indicate the activities. The fifteenth column is divided to other activities that were observed on public space and the traffic load mapping. The traffic load mapping can be analyzed as needed, but the number of passing cars should be mapped.

The rows are divided to: main information- first row. mapping information- other rows and the sum of the information- last grey row.

For better orientation is used for the age columns and total row the grey color.

Table 1. Form for behavior and traffic mapping (Lipovská, 2010).

Part:			Date:			Time:			Observer:					No.	
SEX		**AGE**					**ACTIVITY**							**TRAFFIC**	
M	F	0/6	7/14	15/30	31/64	65 <	STANDING	TALKING	PASSING	WALKING	SITTING ON BENCH	RIDE THE BIKE	WORKING OTSIDE	**PARKING CARS-** **PASSING CARS-**	
														OTHER ACTIVITY	
TOTAL															

2.1. Method of behavior and traffic load mapping in Dobrá Voda village

The method applied in Dobrá Voda includes behavior and traffic load mapping carried out on selected central public spaces. The data were written to the prepared forms. The central public spaces were monitored at the same time, because they are closed to each other and you can observe them from one position.

Based on the obtained information we know:

- how are these public spaces used and by whom
- what kind of activities are going on
- which groups of the village population use this spaces

- at what time are public spaces visited more or less
- how many people visit the selected public spaces per day, per hour
- how many people ride the bike on public spaces
- how many cars drive through
- how many cars park on streets and squares
- how many cars park in front of the houses

Survey period
The surveys took place on summer week days with nice weather in July and August, during the daytime and in the evening for 15 minutes every hour. The data was collected and written down to prepared forms (Table 1).

Survey days
10th July 2010 from 9.00 am to 7.00 pm
18th August 2010 from 9.00 am to 7.00 pm

3. Results
The following paragraphs present the sum of a two day observation.

3.1 The Behavior mapping (sex, age and activities) (Chart 1.)
On summer weekdays used the central public space in the village of Dobrá Voda around 1160 people per day. During the observation intervals we counted 628 people (22 observations during the two days for 15 minutes). Of these we recorded 53% of men and 47% of women. Most of the observed people from total amount were recorded at 7.00 pm (18,67%) and 73,46% from total amount of people were observed from 2.00 pm to 7.00 pm.

We observed significant representation of women compare to men in the morning, at 9.00 am (63.8%), at 10.00 (70.50%) and at 11:00 (66.0%), so almost double number compare to men.

The presence of men in central public places in the village had started to rise up from 4.00 pm, but the percentage was not so significant. At 5.00 pm we observed 54, 74% of men, at 6.00 pm the 57,97% of men and at 7.00 pm 64,46% of men.
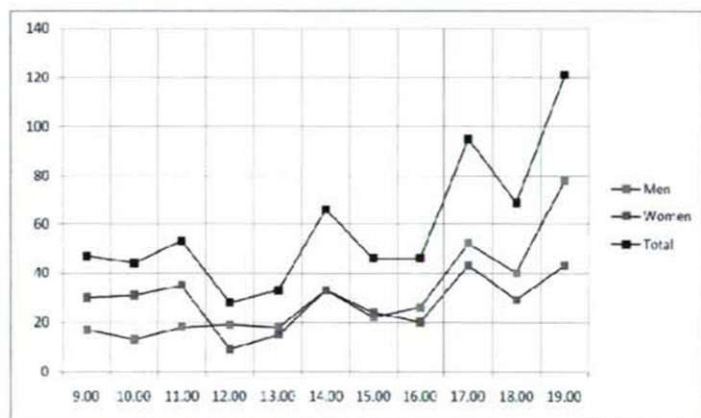

Chart 1. Sex mapping on central public spaces of Dobrá Voda village (Lipovská, 2010)

Based on age mapping chart the central public spaces of the village Dobrá Voda were visited mainly by people aged 31-64 years (38.2%) follows the age gropu 15-30 years (25.6%) and 65 and over (17.1%). The smallest representation had the group 7-14 years (11.5%) and 0-6 years (7.6%).

The most observed people on the Dobrá Voda's public spaces were between the age 31-64. The significant representation of this category was from 10.00 pm to 6.00 pm (41,70% from 5 observed age groups at that time).

We observed that the people in the age from 30-15 years had significant representation at 5.00 pm (38, 95%) and at 7.00 pm (36,50%) from 5 observed age groups at that time.

The children between 7-14 years used the public space mainly at 1.00 pm (35,30%) and the children between 0-6 years used the public space at least.
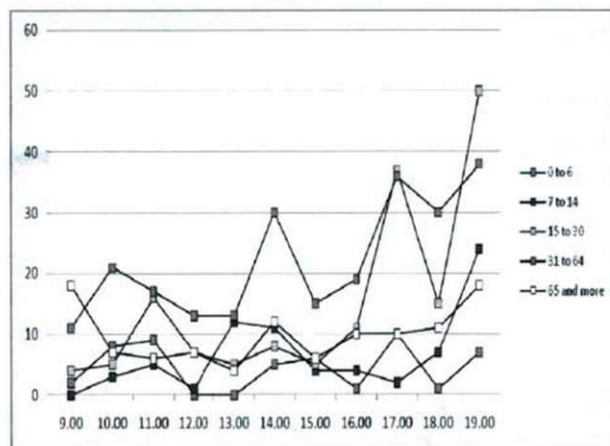

Chart 2. Age group mapping on central public spaces of Dobrá Voda village (Lipovská, 2010)

In the central part of the village Dobrá Voda we observed 28 types of activities (standing, passing through, riding the bike, going to pub, biking, sitting on bench, talking, sitting on pub terrace, passing with coach, working outside, going home, playing on street, looking around, playing on playground, playing with child, walking with coach, phoning, reading, going to church, walking with dog, sitting on the stairs, going to post office, walking, skateboarding, jogging, taking a photograph, drinking on street, getting off the bus). During the one working day about 1436 activities took place on the central public spaces. Most of them (66, 62%) took place in the afternoon (from 2.00 pm to 7.00 pm). Seven activities represented more than 3% of all activities (mentioned in Chart 3).

The largest share in the activities had passing activity (28, 27%). Other activities that represented more than 3% from all observed activities were: talking (20, 31%), sitting on pub terrace (10,37%), ride the bike (7,95%), standing (6,39%), going to pub (5,29%) and sitting on bench (3,27%). The largest number of activities were recorded at 17.00, which was carried out 14,06% of the total activities.
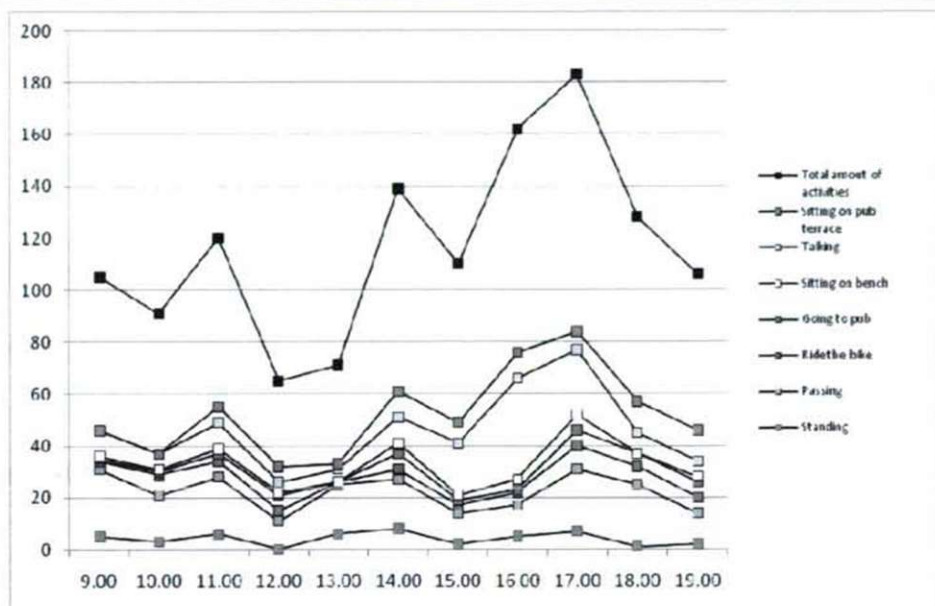
Chart 3. Activities mapping on central public spaces of Dobrá Voda village (Lipovská, 2010)

3.2 Traffic mapping.

The behavior mapping is aimed to pedestrian and cycling people, to their sex, age and activities. During the behavior mapping was possible to map the car traffic load. We mapped the standing cars in front of the houses, the cars parking on public roads and squares and the number of passing cars through the central public spaces, because they might have a big influence on activities and on the usage of the public spaces. The results show the average numbers of two days observation (15 minutes per hour, from 9.00 am to 7.00 pm).

The total amount of passing cars per one working day from 9.00 am to 7.00 pm is 380. So every two minutes 1 car passes the central public space. The highest number of passing cars is at 2.00 pm (11, 96%), at 3.00 pm (14,13%) and at 7.00 pm (13,00%)

On the area are 26 houses with the possibility to park in front of the house. These front parking spaces are usually paved with concrete. The highest amount of the cars parking in front of the houses was at 1.00 pm, at 3.00 pm and 7.00 pm, when we recorded 6 cars at the same time. The average amount of the parking cars in front of the houses was 4. The highest amount of the cars parking on the square was 7 cars at 2.00 pm. The average amount of the cars parking on the square was 4.

3.3 Assessment and recommendation

The usage of observed central public spaces was different during the day in the village of Dobrá Voda. In the morning hours were visited mainly by women and people aged 31-64 years (until 2.00 pm). Activities carried out that time were less represented than in the afternoon and they had mainly passing character. In afternoon are these central public spaces visited almost double times than in the morning. At the time, from 2.00 pm to 7.00 pm many activities were taken place that had a social character such as sitting on a bench, talking, sitting on pub terrace.Central public spaces in the village of Dobrá Voda are attractive for people aged 31-64 years. Attractiveness for adolescents and people within 30

years had increased in the evening, when it is basically a pub visit. For children from 14 years and below are all central public spaces not attractive. Despite the playground is located, the number is smaller.

Loading of central public space by transport is almost evenly throughout the day, increasing slightly in the afternoon. The number of cars passing through have any significant impact on activities in central public places.

Central publci spaces in Dobrá Voda village have a potential due to the number of activities and the number of people. A number of recommendation aimed at pointing out some general suggestions comming out from mapping analyses.

- Supply many more public benches, especially at frequentlly used routes. During the day they offer a place for elderly people and during the night they are meeting place for young people. The elderly people usualy prefer the quite areas during the day as the same as young people at night. The benchces could be facing to each other, to create good possibilities for social interactions.
- Provide space for physical activities, play and unorganised activitie in the streetscape.
- The central public spaces also provide an opportunities for outdoor entertaiment.
- The stream goes throught the central publlic spaces should be more visible.
- Improve conditions for walking- wider pavements.
- Give a high priority to pedestrians and cyclist.
- Establish new resting areas (najma pre starsich a mladych).
- The areas in front of the houses, serving as a parking spaces, do not have to be paved.

4. CONCLUSION

In view of the landscape planning praxis the obtained information are useful:
- for location of roads and paved areas and character of their surface,
- the number, shape and location of rest areas and their equipment,
- in the design of active sites and their target groups such as children's playgrounds, playgrounds for teenagers, or sport areas for seniors,
- selection and location of plants and the overall visual modification site of public space.

Gathered information, and the outcome of this paper may serve for the local authorities, residents, businesses and other stakeholders as possible source of data for designing qualitative living space.

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CALORIMETRIC STUDY OF CHANGES INDUCED BY PRESERVATIVES IN LIQUID EGG PRODUCTS

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ABSTRACT

In our tests we aimed to study the effects of additives normally used in liquid egg products on the calorimetric properties of liquid egg samples. Raw liquid egg white (pH=8.9±0.1), liquid egg yolk (pH=6.5±0.2) and whole liquid egg (pH=7.1±0.2) broken up in industrial conditions were used in our measurements. Sodium benzoate and potassium sorbate were added to the samples to achieve solutions of 0.1, 0.3 and 0.5 g/L concentrations. We used citric acid to prepare liquid egg products with various pH value (5.5, 5.0 and 4.5). The calorimetric tests were performed with MicroDSC III device. Liquid egg samples were heated up from 20°C to 95°C generally with a heating rate of 1.5°C/min. Sample weights were 500 mg±0.1 mg and water was used as reference solution. Evaluation was performed by Seftsoft2000 software, a component of the device.

Our measurements have shown significant changes in calorimetric parameters of liquid egg samples by decreasing the pH value to 5.0. In addition to the reduced enthalpy due to acidification of samples, a decrease in denaturation temperature was also observed in the egg white. While the native egg white started to precipitate at 60°C, at pH 5.0 the denaturation was already started at 54.5°C. When sodium benzoate and potassium sorbate were added to liquid egg products a significant change of the tested calorimetric values was only found in the liquid egg samples containing the preservative at the concentration of 0.5 g/L.

1. INTRODUCTION

Many additives are used in the food industry. Some of them are added to the food for increased food safety to improve the efficiency of anti-microbial treatments or to extend shelf-life [Ogihova *et al.*, 2009; Rangan *et al.*, 2009; Lee *et al.*, 2009]. Liquid egg manufacturers mainly use additives to extend shelf-life of these products. This is partly because customers using large quantities of liquid egg products prefer ready-for-use liquid egg products for the technology compared to powdered egg products, applicability and protein composition of which might be impaired [Landfeld *et al.*, 2008] but liquid egg products spoil rapidly even when stored in refrigerator.

When using additives, one should consider that calorimetric properties as well as heat sensitivity of liquid egg products (liquid whole egg, liquid egg white, and liquid egg yolk) may change [Torregiani *et al.*, 2009; Carmona *et al.*, 2007; Ichikawa *et al.*, 2007; Mizutani *et al.*, 2006]. This can be a problem mainly in case of preservation technologies where the preservatives are added to the liquid egg prior to heat treatment. Such procedures include treatment of liquid eggs in packaging for avoidance of the chance of possible post-infection during the packaging process.

From egg components, proteins are the most heat sensitive; proteins are found in high percentage in the egg white [HammershØj *et al.*, 2007; Rossi *et al.*, 1992; Gossett *et al.*, 1984]. Egg white is a protein system comprising ovomucin fibres incorporated into an aqueous solution containing numerous globular proteins. The most important representatives of these proteins – due to their amount – include ovalbumin, conalbumin (ovotransferrin), ovomucoid, ovomucin, lysozyme and globulins [Chang *et al.*, 1977].

Composition of egg yolk is more complex; it can be best described as a complex system in which diverse particles are suspended in a protein solution (livetin) [Nielsen, 1998].

DSC method has already been used several times to study thermal denaturation of egg white and its fractions [Ferreira *et al.*, 1997; Donovan *et al.*, 1976; Donovan *et al.*, 1975]. Particularly, it helps measuring the enthalpy of denaturation (ΔH_d) in case of egg white and some of its components, and thereby it is able to provide quantitative information. Furthermore, denaturation temperature of various proteins can also be measured with this method [Andrassy *et al.*, 2006; Zhang *et al.*, 2004; Mohácsi-Farkas *et al.*, 1999].

In this study we investigated the calorimetric effects of potassium sorbate and sodium benzoate used in egg processing and confectionery industry [Gliemmo *et al.*, 2004] and pH-reduction with citric acid in raw liquid egg products homogenized in the routine industrial manner.

2. MATERIALS AND METHODS

Materials

Raw liquid egg white (pH=8.9±0.1), egg yolk (pH=6.5±0.2) and whole egg broken (pH=7.1±0.2) under industrial conditions and homogenized in a piston-gap homogenizer at 100 bars were used in our tests. Sodium benzoate and potassium sorbate were added to the samples to achieve solutions of 0.1, 0.3, and 0.5 g/L concentrations. We used citric acid to prepare liquid egg products with various pH (5.5, 5.0, and 4.5).

CONSORT C831 model liquid pH-meter was used to control pH.

Differential Scanning Calorimeter (DSC)

Tests have been performed by using Setaram MicroDSC III device. Liquid egg samples were heated up from 20°C to 95°C at a heating rate of 1.5°C/minute.

The measured mass of liquid egg samples was 500mg ±0.1mg and water was used as reference. In some cases a second test cycle was also performed but no reversible phenomenon was observed.

Evaluation was performed by Seftsoft2000 program, a component of the device.

3. RESULTS AND EVALUATION

Analysis of homogenized egg products without preservative. First tests were carried out with raw liquid eggs without additives. Endothermic phenomena observed in the liquid egg white typically correspond to protein denaturation. However, from the 4 main components of egg white (conalbumin, lysozyme, ovalbumin, and globulins) fusion of peaks of lysozyme and conalbumin could be observed as a result of homogenization. Onset of denaturation was observed at 60°C while the peak (maximum) denaturation temperature was around 63.5°C

The second peak (onset of denaturation at 70 °C) is typical to denaturation of ovalbumin and globulins. Ratio of ovalbumin in liquid egg white is significantly higher (54% of total protein) compared to that of globulins (8% of total protein); therefore, peak parameters are determined by the calorimetric properties of ovalbumin. Peak denaturation temperature of these proteins was around 77°C.

Liquid egg yolk contains large amounts of lipoproteins. These cannot be separated well by calorimetric methods compared to the proteins of liquid egg white even in the non-

homogenized sample. Therefore we analyzed one peak for each sample i.e. total lipoproteins.

According to industrial experiences egg yolk is much less sensitive to heat than liquid egg white. Our tests have shown that peak denaturation temperature of these proteins was around 78 °C.

The calorimetric properties of liquid whole egg are influenced by the heat sensitive components of liquid egg white and egg yolk. The peak denaturation temperatures of ovalbumin in the homogenized liquid egg white and liquid egg yolk lipoproteins was similar (77-78°C), and the thermogram of liquid whole egg is predominantly influenced by these two fractions. In the tests, we only investigated changes affecting significant technological applicability; therefore, in case of liquid whole egg we investigated only that peak.

Analysis of homogenized egg products with preservative. Baseline and peak denaturation point as well as enthalpy of various native liquid egg white fractions have changed by pH-reduction with citric acid.

When pH of liquid egg white was reduced to 4.5 baseline denaturation point of the conalbumin-containing fraction reduced from 60°C to 45°C while denaturation enthalpy reduced by two-third (from 0.273 J/g to 0.092 J/g).

Denaturation temperatures of the ovalbumin-containing fraction considerably shifted. Reduction of pH of native liquid egg white (pH 8,0) to 4.5 reduced the baseline denaturation temperature from 72 °C to 64°C and the peak denaturation temperature from 77°C to around 70°C. Nevertheless, denaturation enthalpy decreased only slightly by pH reduction (from 1.075 J/g to 0.965 J/g at pH 4.5).

In case of pH reduction of native liquid egg yolk (pH 7,0) with citric acid, decrease in denaturation temperatures and denaturation enthalpy were measured.

For liquid egg yolk the baseline denaturation temperature has decreased to 64.5°C even at pH 5.5 compared to 69°C measured in native liquid egg yolk, but subsequently it did not change significantly. Contrarily, constant reduction in peak denaturation point has been found. While in native liquid egg white this value was around 78°C at pH 5.5, and reduced to around 74°C at pH 5.0, and 71°C at pH 4.5.

Changes in denaturation temperatures and denaturation enthalpy have been observed also in tests with liquid whole egg at various pH values. Baseline denaturation temperature has reduced from 70.5°C in the native liquid whole egg (pH 7,6) to below 65°C at pH 4.5 while peak denaturation point only slightly changed (measured range 75-78°C).

Denaturation enthalpy decreased from 1.738 J/g to 0.975 J/g by pH reduction to 4.5. The most significant change in enthalpy was found with pH reduction from 5.5 to 5.0 resulting in enthalpy change from 1.704 g/J to 1.300 g/J.

Assessment of calorimetric diagrams of native liquid eggs has shown results similar to literature data (Andrássy et al., 2006; Ferreira et al., 1997). From the egg proteins characteristics of conalbumin were changed the most significantly. Cunningham and Lineweaver (1965) have also drawn this conclusion when they established that 40% of conalbumin is precipitated with heat treatment at 57°C for 10 minutes in phosphate-bicarbonate buffer at pH 6. However, when conalbumin solution was adjusted to pH 9 and heated under the same conditions, the protein did not precipitate (Cunningham & Lineweaver, 1965).

When sodium benzoate and potassium sorbate were added to liquid egg no significant changes have been observed in calorimetric values compared to pH reduction; therefore, we only show DSC curves of liquid egg white samples that are more significant regarding the change in heat sensitivity.

No significant differences were measured in denaturation temperature for liquid egg white and egg yolk with preservative concentrations of 0.1 and 0.3 g/L. The course of the curve changed and it had two peaks meanwhile the position of denaturation peak was almost unchanged and the change in the area determining denaturation enthalpy was not significant either.

For liquid egg samples, the tests have shown smaller differences in denaturation temperature and enthalpy change of liquid egg products with added potassium sorbate and sodium benzoate compared to those with reduced pH, but we observed significant difference in liquid egg samples with 0.5 g/L sodium benzoate content. Example the baseline denaturation temperature of whole egg changed from 70.5° to 66.5 °C and peak denaturation temperature from around 78 °C to 72 °C. Potassium sorbate in concentration of 0.5 g/L. has changed denaturation temperature of liquid whole egg and liquid egg yolk by more than 2 °C compared to baseline.

Table 1: Changes in calorimetric properties of liquid egg product by pH reduction

pH of liquid egg products		Liquid egg white		Liquid egg yolk	Liquid whole egg
		Peak 1	Peak 2		
Native liquid egg	T(baseline)	60,34	71,93	69,14	70,49
	T(max)	63,52	77,06	78,35	77,91
	ΔH_d	0,2727	1,0750	1,7248	1,7384
pH 5,5	T(baseline)	60,00	70,58	64,66	68,01
	T(max)	62,47	76,46	77,75	77,94
	ΔH_d	0,1505	1,0598	1,4466	1.7040
pH 5,0	T(baseline)	54,47	67,77	64,42	67,04
	T(max)	57,31	73,73	73,90	75,13
	ΔH_d	0,1368	1,1155	1,1019	1,2229
pH 4,5	T(baseline)	45,12	63,72	64,25	64,78
	T(max)	48,99	70,28	70,79	76,76
	ΔH_d	0,0923	0,9647	0,4403	0,9753

T(baseline) – baseline denaturation temperature [°C]
T(baseline) – peak denaturation temperature [°C]
ΔH_d- change in denaturation enthalpy [J/g]

4. CONCLUSIONS

Our tests have demonstrated that preservatives used in acceptable concentrations change the protein structure and thereby calorimetric properties of liquid egg products i.e. baseline denaturation temperature. The measurements have shown significant changes in calorimetric parameters of liquid egg samples by decreasing the pH value to 5.0. In addition to the reduced enthalpy due to acidification of samples, a decrease in denaturation temperature was also observed in the egg white. While the native egg white started to precipitate at 60 °C, at pH 5.0 the denaturation was already started at 54.5 °C. When sodium benzoate and potassium sorbate were added to liquid egg products a significant change of the tested calorimetric values was only found in the liquid egg samples containing the preservative at concentrations of 0.5 g/L. Addition of preservatives to the native liquid egg prior to treatment should be considered in technologies.

In conclusion, the calorimetric test method has proved to be useful in the measurement of the effect of preservatives added to liquid whole egg as well as to liquid egg yolk and liquid egg white.

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A NEW LIQUID EGG PRODUCT

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ABSTRACT

Nowadays, pre-processed egg products are preferred as raw materials rather than shell eggs by the
food industry. These are sold as pasteurized liquid egg or egg powder products. Pasteurisation of
egg products means a heat treatment of several minutes at about 60 °C. Two important issues shall
be kept in mind: to destroy as much contaminating micro-organisms as possible and at the same
time not to damage the valuable egg proteins. Research data show that the number of micro-
organisms in pasteurized liquid eggs is between 100-1000 cfu/ml and *Salmonella* strains can also
be found among the survivors.
Microbiological examinations were carried out to develop an alternative pasteurization method,
which can be used in the manufacture of egg products. The effect of 24-hour incubation at 55 °C
was studied.
The samples were artificially contaminated with strains belonging to *Enterobacteriaceae* family,
which are the most frequently occurring contaminants in egg products. The samples were raw
liquid whole egg, liquid egg white and liquid egg yolk produced by an egg products manufacturing
plant. Liquid egg samples were inoculated with *Serratia marcescens*, *E. coli*, and *Salmonella* spp.
During incubation at 55 °C , reduction in viable cell counts were determined.
 Having determined the reduction in viable cell counts against time, the data obtained were in good
agreement with literary ones, as the destruction of bacteria is faster in liquid egg white than in
products containing egg yolk. In the case of all three test strains, experience shows that during the
incubation for 12 hours the initial cell count decreased by 4-5 log cycles. Our results showed that a
24 hours incubation at 55 °C can provide microbiologically safe, pasteurized products.
The heat treatment was compared to the widely used pasteurization procedure for these products.
Marked differences were detected, i.e., while pasteurization only slightly decreased cell counts,
after 24 hours of incubation at 55 °C, no viable cells were detected.

1. INTRODUCTOUN

During the processing of egg products (liquid egg and egg powder), which are widely used
as raw materials in the food industry, after breaking shell eggs a pasteurisation step is
applied in the technology. In the pasteurisation process of liquid egg several minutes long
heat treatment takes place at about 60 °C (USDA, 1980; JONES at al. 1983) in a heat
exchanger, during which two aspects must be take into consideration: to destroy as much
contaminating microorganisms as possible and in the same time not to damage the valuable
components of the egg, mainly proteins (FRONING at al., 2002). Hygienic control
measurements show that the number of microorganisms in pasteurised liquid egg can be up
to 10^2-10^3 cfu/ml and sometimes *Salmonella* sp. can be found among the survivors. For
this last one the regulation is 0 viable cell in 25 g of food.
The main group of microorganisms most frequently infecting egg products, are
Enterobacteriaceae family members entering into liquid egg from the shell. Their optimal
growth temperature is 37 °C but most of them grow between 10-45 °C in good culture-
medium. As they are asporogenous species they can be relatively well destroyed (ADAMS
& MOSS, 1995) by heat.
Widely used parameter for cell destruction in the food industry is the decimal reduction
time (D) or D-value. It is the time required to kill 90% of the microorganisms or spores in

a sample at a specified temperature. Literature data show that e.g. different *Salmonella* species can have different D-values (PALUMBO et al., 1996), but their thermal resistance can also be strongly influenced by the medium the cells are in. According to experiments by Jin et al. (2008) the investigated *Salmonella enteritidis* and *E. coli* strains have greater thermo tolerance in liquid whole egg than in liquid egg white. In earlier experiments the same has already been found by Michalski et al. (1999), who attributed this to the probable differences in pH, water activity and composition of egg white and egg melange (liquid whole egg); e.g. *S. enteritidis* is not able to tolerate the high pH value of liquid egg white whereas the neutral pH of liquid whole egg is appropriate for it. Moreover, several proteins and lipids were found in egg yolk, which help to stabilize the cell membrane against thermal effects (MURIANA et al., 1996; NIEDHART & VANBOGELEN, 1987).

Bunning and his colleagues (1990) examining the thermo tolerance of *Salmonella typhimurium* and Kumar (KUMAR A. & KUMAR, S., 2003) studying *Salmonella senftenberg* have found, that a preliminary 30-minute heat shock at 52°C or at 55°C enhances the thermo tolerance of these bacteria. Other authors examining *S. enteritidis* have found that after 2-3 cell cycles the effect of heat shock was not significant on bacterial grown at optimal temperature (SHAH et al,. 1991; MACKEY & DERRICK, 1986).

Taking all of this into account such pasteurisation technique is needed, which results in a lower viable cell count than the current one and guarantees that the products are free from *Salmonella* sp in every case and under all circumstances.

In order to reach this aim, various technological solutions have been tried, such as ultra pasteurisation of liquid eggs, pasteurisation of shell eggs, pasteurisation of liquid eggs with electrical heating, pasteurisation of separated egg white and egg yolk by electric current or our investigations on incubation at lower temperature than the currently known pasteurisation temperature.

2. MATERIALS AND METHODS

In our work, microbiological examinations were carried out to facilitate developing an alternative pasteurisation method which can be used in processing eggs. The effect of 24 hours incubation at 55 °C on reduction of viable cell count was studied in non-processed liquid egg.

Samples of non pasteurised liquid whole egg, liquid egg white and liquid egg yolk were coming from an egg products manufacturing plant.

First we investigated how this storage influence the original microflora of liquid egg, after this we carried out experiments with artificially infected samples. Artificial infection was made with some Enterobacteria, *Serratia marcescens* frequently occurring as a contaminating agent in food, *E. coli* an important indicator of faecal contamination and some strains of *Salmonella* which are the greatest hazard to egg products. *Serratia marcescens* and *E.coli* were isolated earlier and identified by the API 20E System, one *Salmonella* species was isolated from egg powder and the other *Salmonella enterica subsp. enterica serotype Enteritidis* B2052 originated from the NCAIM.

Bacteria grown for 24 hours on nutrient agar slope were used for inoculum in a suspension at about 10^7-10^8 cell/ml concentration with sterile water and transferred 1-1 ml to 100 ml of each liquid egg sample as well as to control peptone water per experiment. The infected samples were put into a thermostat set at 55 °C and the viable cell count was determined in every 3 hours by the pour plate method. Three parallel experiments were made from each sample.

Moreover, preliminary heat shock experiments with both strains of *Salmonella* were carried out. Egg products and the control peptone water were infected according to the above procedure. Subsequently samples were exposed to heat treatment for 10 minutes at 58 °C, then cooled to room temperature with tap water. Then the samples were put into a thermostat set at 55 °C. The viable cell count was determined in the same way as it was done with samples not exposed to heat shock (see above).

3. RESULTS AND DISCUSSION

Having compared the efficiency of pasteurisation in egg processing plants and the 24 hours incubation at 55 °C, significant differences were found. The positive effect of incubation was striking in the case of liquid whole egg, where the number of microorganisms slightly decreased after pasteurisation, while at 55 °C it was 0 CFU·ml^{-1}0 after 24 h (Fig. 1).
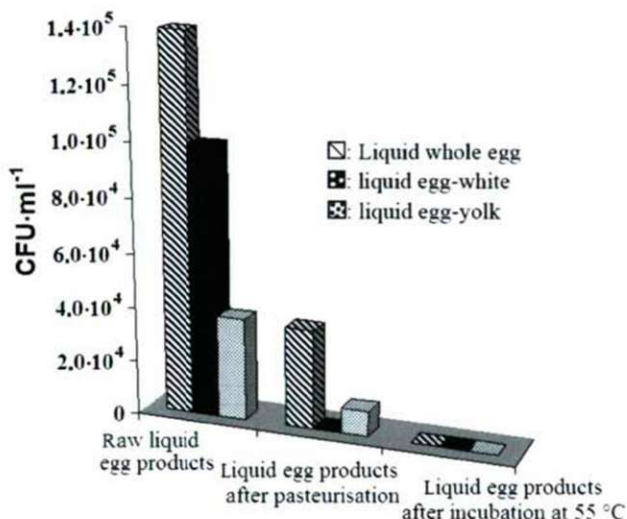
Fig. 1. Reduction in viable cell count of raw liquid egg products after pasteurisation or incubation at 55 °C.

After 24 h of heat treatment, none of the artificially infected samples contained detectable viable microorganisms. Consequently, at 55 °C the procedure is equally effective for the examined strains of *Serratia marcescens, E. coli* and the two *Salmonella* species.
In the case of *E. coli* and our *Salmonella* isolate strain, the viable cell count linearly decreased in egg white within 9 h. However, *Serratia marcescens* and *Salmonella enterica* B2052 showed similar decrease in viable bacteria count in each of the different liquid egg products.
It can be seen in the graphs that the decrease in the number of micro-organisms was relatively slow during the first three hours of incubation, then it accelerated between the third and the ninth hours and within this time period the decimal reduction time value (D-value) was approximately constant. The initial slight decrease in the number of micro-organisms can be explained by the fact that it takes time for the samples to reach the ambient temperature. Thermometer cards were placed into one group of the samples and according to our measurements the samples reached 48 °C in about fifty minutes, which was already an unfavourable temperature for multiplication of mesophilic bacteria

(MEMBRÉ et al., 2005). Within this time the rise in the number of micro-organisms does not have to be taken into account since the reproduction cycle of *Enterobacteriaceae* takes on the average 1,5 hours even under optimal conditions.

It was found in some measurements that the cell-destruction rate slowed down after the decrease of viable cell count to 10^3-10^4 CFU·ml^{-1} value. One of the possible reasons of this can be that even micro-organisms, belonging to the same strain, have different thermal resistance, and at this stage of heat treatment only the ones with high heat resistance can survive. This effect can be enhanced by the fact that if there are less heat sensitive strains among the micro-organisms comprising the stable micro flora of egg liquids than the inoculated ones, the ratio of these will become more and more dominating and thus they will influence the heat destruction curve.

According to our measurements the most rapid destruction of microorganisms was found in liquid egg white (Table 1) in most cases. Literature data show that there are several proteins in liquid egg white that reduce the number of microorganisms or inhibit their growth; such as lysozyme (PARK et al., 2006) that can lyse the bacterial cell wall, avidin (ELO et al, 1980) that is able to bind biotin (inhibiting the multiplication of Gram(-) bacteria), conalbumin (IBRAHIM et al., 2000) that is able to bind Fe^{++} (also inhibiting the multiplication of Gram(-) bacteria). Moreover, the pH value of egg white is about 9 and at this pH value egg-contaminating bacteria are not able to multiply (BOARD & FULLER, 2008). Egg yolk, however, in accordance with our measurements (Table 1) and on the contrary to egg white, has a protective effect attributed to e.g. lecithin (CHHABRA et al., 2002). In most of our measurements due to this fact the slowest destruction of micro-organisms was found in egg yolk among egg products.

Table 1. D-value (min) during incubation for 12 h at 55 °C

Microorganism	Liquid egg product	D-value
Serratia marcescens	whole	106.5±9.2
	white	110.9±11.3
	yolk	102.7±7.4
Escherichia coli	whole	284.3±9.0
	white	95.5±6.7
	yolk	271.8±14.7
Salmonella isolated	whole	114.5±8.1
	white	47.4±5.3
	yolk	189.6±10.7
Salmonella enterica	whole	175.2±2.1
	white	168.3±6.9
	yolk	182.4±7.3

In the case of our *Salmonella* isolate even after 12 hours of incubation at 55 °C, 10^2-10^3 CFU·ml^{-1} detectable viable cells remained in all the three liquid egg samples as well as in the control peptone water. Although preliminary heat shock can significantly increase the thermal resistance of *Salmonella* sp., this not always can be experienced.

4. CONCLUSION

In the case of all three Enterobacteria, experiences show that during incubation for 12 hours at 55 °C the initial cell count decreased by 4-5 log cycles and within 24 hours in not any of the liquid egg products could be found any viable cells.

Having determined the reduction in viable cell counts against time, data were in good agreement with literature ones, as the destruction of bacteria is often quicker in liquid egg white than in products containing egg-yolk. Nevertheless, all the datas show that more than 12 hours incubation at 55 °C is needed to obtain certainly germ-free product, particularly in products containing egg yolk.

In the case of *Salmonella* species isolated from egg powder the preliminary heat shock enhanced the thermo-tolerance of the bacterium. However, this phenomenon does not appear definitely in all species, e.g. for *S. enterica* B2052 we have not found anything similar.

According to our experiments, the incubation treatment proved to be more effective than the usual pasteurisation procedure for liquid egg. After 24 hours incubation at 55 °C the bacteria under investigation were destroyed. Simultaneously we did not find any significant changes in the consistency of these liquid egg products, apart from certain increase in viscosity. This warm incubation technology, carried out immediately after packaging in aseptic boxes could eliminate also post-infection coming from the surroundings of the plant.

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EVALUATION OF INNER CONTENT OF PROMISING APRICOT VARIETIES FOR PROCESSING IN INDUSTRIAL RIPENING TIME

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ABSTRACT

The apricot (*Prunus armeniaca* L.) is an important stone fruit species due to its inner content, specific flavor and fragrance. Globally fresh apricot production is about 3 million tons annually the industry uses about 85 000 tons for producing dried apricot a year from the total production. The EU counties produce about 602 000 tons apricots (fresh and dried) yearly. In Hungary about 40 000 tons of apricot is produced annually. The Hungarian processing industry was used about 3 200 tons apricots last year.

The consumers require high-class fruit products. The inner content of basic commodity influences the grade of food industrial products. The total soluble solids, titratable acids and ratio of these compounds have an important effect on quality of fruit juices as well as the high β-carotene content plays an important role in health care. Apricot is a special source of beta-carotene.

In our study we aimed to compare the new apricot varieties ('Laycot', 'Goldrich', 'Veecot') to the traditional Hungarian variety 'Gönci magyar kajszi' which contains balanced sugar/acid ration and it is the standard variety in Hungary. We examined the acid and sugar content furthermore β-carotene content in industrial ripening time. Samples were taken from the experimental and research orchard of Department of Pomology of Corvinus University of Budapest in Budapest-Soroksár, as well as from showing and research orchard of Vitamór Ltd. in Mór (Hungary). We experienced significant difference in the varieties. The minimum value of sugar content is 10.2 °Brix according to AIJN in the fruit juice industry. The examined varieties exceeded this value. Inner content of the examined varieties neared or exceeded the result of traditional 'Gönci magyar kajszi' variety.

1. INTRODUCTION

Nowadays the production and distribution of functional foods become more important. The juices and foods with high fruit content are in request of customers. Therefore the processing industry needs fruit varieties with excellent inner content value.

Apricots are a rich source of carotenoids, 50% of which consist of β-carotene (Radi et al., 1997). The carotenoid compounds of apricots are unique, are quite different from all analyzed pumpkin varieties (Kurz et al., 2008). The human diet comprises different compounds with high antioxidant capacity, are the carotenoids, ascorbate, flavonoids and polyphenols, which play role in the balance between oxidative and antioxidant processes in tissues (Diplock et al, 1998). Several experimental studies have found that people who consume more carotenoids in their diets have a reduced risk of several chronic diseases according to the reviews of Mayne (1996). Ugras et al. (2010) found that the ROS-related effects of low-dose radiation on testis tissue of rats are amended by apricot diet. The main compounds of apricot juice include carbohydrates, organic acids (Guerrieri et al, 2001), and antioxidant compounds (Ruiz et al, 2005) too.

2. MATERIALS AND METHODS

We have investigated four apricot varieties from mid-June to early July in 2010, one standard Hungarian variety ('Gönci magyar kajszi') and three new varieties ('Laycot', 'Goldrich', 'Veecot'). Samples were taken from the experimental and research orchard of Department of Pomology of Corvinus University of Budapest in Budapest-Soroksár, and the research orchard of Vitamór Ltd. in Mór. A homogeneous pulp was prepared from 30 fresh fruit of each variety at each sampling date and stored frozen at –25°C until analysis.

The total soluble solids, expressed as °Brix, was measured from homogeneous filtered fruit juice using an ATAGO Palette PR-101 refractometer (Codex Alimentarius 3-1-558/93). The titratable acid content was expressed in terms of malic acid equivalent (Hungarian Standard, 1998). The sugar/acid ratio was calculated from the total soluble solids and the titratable acid content.

The β-carotene content was determined using the method of De Ritter and Purcell (1981), as modified by the Canning Research and Development Co. Ltd. (KPKI, 1990). After thawing, the β-carotene was extracted from 1 g fruit samples using methanol and acetone, followed by separation with diethyl ether. The absorbance of the ethereal solution was measured with a Hitachi U-2800A spectrophotometer at 450 nm.

3. RESULTS AND DISCUSSION

The quality of fruit juices are influenced significantly by the adequate sugar and acid contents. In our study fruits of four apricot varieties ('Laycot', 'Goldrich', 'Veecot', 'Gönci Magyar kajszi') were examined at same ripening stage, we measured the total soluble solids, the titratable acids and ratio of these compounds. The results are shown in Table 1.

We detected the biggest soluble solid content in 'Veecot' variety (18.59 °Brix), the °Brix value of 'Laycot' cultivar was also high (16.35 °Brix). The less amount of soluble solid content (13.84 °Brix) was detected at the traditional Hungarian variety 'Gönci magyar kajszi'.

According to the nutrient tables published by Bíró and Lindner (1999), the average soluble solid content of apricots is 10.2 °Brix, Holland et al. (1992) gives less amount 7.2 °Brix value. A minimum value of sugar content is required for fruit juice processing is 10.2 °Brix (AIJN, 1997), a value surpassed by all four varieties were investigated. Stampar et al. (1999) examined the total soluble solids at commercially mature fruits of 'Laycot' and 'Goldrich'. They measured fewer amount (15.2 and 14.2 °Brix) than us in both varieties. The reason of the different might be the variant environmental conditions. Bureau and colleagues (2006) examined the soluble solid content of 'Goldrich' during the ripening, which increased from 6.2 to 12.3 °Brix value. Guerrieri et al. (2001) also analysed the fruits of 'Goldrich' variety, they detected 10.9 °Brix. These values are exceeded by investigated samples of 'Goldrich'.

We examined the total acid content in all varieties. The acid content of apricots ranged from 1.43 to 1.79 mg 100 g^{-1}. We detected the highest acid content in 'Gönci Magyar kajszi', and the fewer amounts were measured in 'Laycot'. 'Veecot' and 'Goldrich' cultivars had same quantity of acids. The total acid content was 1.40 mg 100 g^{-1} on average in the Souci–Fachmann–Kraut (2008) nutrient table. This value was exceeded by all the varieties were involved in this work.

A balanced sugar–acid ratio is important to achieve a harmonious flavour. A higher soluble solid content raises the value of this ratio, thus making fruit juices sweeter (Taylor, 2005). The highest values were in 'Laycot' and 'Veecot' varieties.

Table 1. Total acidity, total soluble solids and total soluble solids / total acidity ratio in flesh of different apricot varieties, 2010

Cultivar	TA (% malic)	TSS (°Brix)	TSS/TA
Gönci magyar kajszi	1.79 ± 0.57 c	13.84 ± 0.07 a	5.27
Veecot	1.60 ± 0.76 b	18.59 ± 0.06 c	7.91
Laycot	1.43 ± 0.67 a	16.35 ± 0.05 b	7.76
Goldrich	1.56 ± 0.65 b	15.83 ± 0.06 b	6.91

mean ±standard error, p<0.05

The β-carotene content of the fruit in industrial ripening time is illustrated for the different varieties in Figure 1. The most β-carotene content was found in sample of 'Goldrich' variety (3.32 mg 100 g^{-1}). The β-carotene content was much less in the samples of the other varieties. We analysed the second most amount in 'Laycot' (2.67 mg 100 g^{-1}). The β-carotene content of traditional Hungarian 'Gönci magyar kajszi' and Canadian 'Veecot' varieties were similar to each other; however it was not near to prominently high content of 'Goldrich'.

Souci, Fachmann and Kraut (2008) reported that the β-carotene content of apricots ranges from 0.6 to 6.4 mg 100 g^{-1}, so the values established in the present work fell within this interval. A β-carotene content of 2.1 mg 100 g^{-1} was reported in apricot by Curl (1964, cit. Kläui and Bauernfeind, 1981).

Carotene content of the 'Magyar kajszi' (syn: 'Hungarian best') variety was analysed in two regions of Croatia by Dragovic-Uzelac et al. (2007). Samples were taken in commercially mature stages and values of 1.075 and 1.376 mg 100 g^{-1} were reported. These values were exceeded by 'Gönci magyar kajszi' (2.16 mg 100g-1), which variety derived from 'Hungarian best' cultivar group.
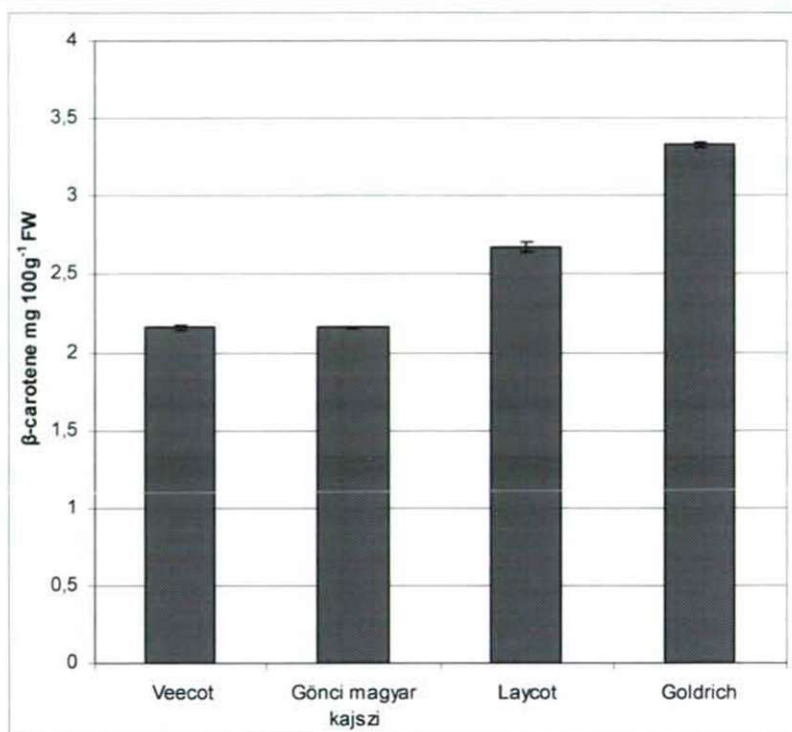
Figure 1. The β-carotene content during ripening in flesh of different apricot varieties, 2010

4. CONCLUSION

In our study we aimed to compare the new apricot varieties ('Laycot', 'Goldrich', 'Veecot') to the traditional Hungarian variety 'Gönci magyar kajszi' which contains balanced sugar/acid ration and it is the standard variety in Hungary. We examined the acid and sugar content furthermore β-carotene content in industrial ripening time.

Based on the results we can determine the inner content of the examined varieties neared or exceeded the result of traditional 'Gönci magyar kajszi' variety. The 'Goldrich' variety had prominent β-carotene content. We have advised to introduce 'Goldrich' to Hungarian production because of its important influence on humane physiology.

ACKNOWLEDGMENTS

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OFFERING OF ECO-AGRITOURISM SERVICES AND THEIR PLACE IN RURAL DEVELOPMENT

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ABSTRACT

This work describes a proposal to build a tourism facility in the village of Bertotovce (Prešov district, Slovak Republic) to serve for eco-agritourism purposes. The village has an excellent starting position, which offers many opportunities for people from Eastern Slovakia regions as well as from the other places for active or passive recovery in a healthy and pleasant environment. In addition to hospitality services, our main interest deals with the supply of specific services related to increasing awareness of nature and its conservation, which are further described in the article. On this basis, we particularly expect so-called "green customers" to the proposed facility. There are priorities of Saris region as a part of Easter Slovakia, and particularly the village of Bertotovce mentioned to develop and improve the eco-agritourism services, also the pros, cons, opportunities and threats which could meet the project. The paper referred to the project marketing strategy, SWOT analysis, operations management system, etc. In conclusion, the work touches on proposals that should be implemented in order to commence business in the village, focused on eco-agritourism and its active rural development.

Keywords: agritourism, rural tourism, tourism, eco-agritourism, tourists, services

1. INTRODUCTION

Global trends in tourism are demanded for adventure, excitement, entertainment and education of tourists stayed in the countryside. It is an interesting idea how to spend their holiday or longer weekend. Agritourism is an excellent possibility for people looking for active holidays. Even better alternative, in terms of environmental protection, is to provide eco-agritourism, e.g. agritourism operated on the certified ecofarm (biofarm, organic farm). The primary visitors will be people who want to relax or want to experience it as a new way of life. Their priority is to protect the environment and the entire operation will be based on this main pillar. This region offers beautiful nature, rich cultural heritage and especially people who are glad to provide quality services for tourists.

Therefore, we believe that there will be enough visitors who will choose this way how to spend their free time. These services are offered for people who understand that the biggest problem is that people can not or do not want to get back to the nature, those who live in their comfortable world oversaturated with technology and developments in the modern era. Those people, who did not forget where they sprang up, what is natural for them and want to restore it. Otepka and Hábán (2007) defined that agritourism is a business activity, which is provided by the operator (farmer, municipality, region, or individual entrepreneur) for tourists to their rest and recreation in rural areas. It includes specific activities of agri-entrepreneurs according to local farm, economic and natural conditions, aiming to meet the recreational requirements of tourists. Surrounding of countryside or farms is attractive particularly for urban children and every day spent in this surrounding brings them new experiences. Rural tourism can be characterized as a particular form of recreation in rural areas using a variety of possibilities that the environment provides. The rural tourism

services are provided in recreation in the countryside, using spare capacity of the rural home, business, accommodation, catering, sports and entertainment facilities and environment of the country.

Agritourism is an additive action of farm business entity. The additional functions of agriculture helps to preserve the cultural landscape, maintain and restore the population and increase the economic level by extending the market area of agricultural production, regional specialties, crafts, art products, as well as by offering folklore. One of the objectives of agritourism and rural tourism is to protect the environment and typical architecture. It should respect the conservation and hygiene regulations, as well as the architectural character of the landscape and buildings (Mach, 1993). Eco-agritourism is subjected to the conditions of the European Union for the organic farming and produced organic products are offered to visitors for tasting, buying and possibly also in foods. Slovakia has many natural, historical and cultural features for the development of rural tourism and agritourism. It has its beautiful nature, history, number of knowledgeable, creative, industrious and hospitable people. It has a full of a variety of attractions, it can offer visitors a huge amount of experience in its typical regions (Balážová et al.; 2007).

Presov Self-Governing Region is the second largest region in Slovakia, however in the socio-economic terms it is one of the least developed regions of Slovakia. One area that could help the development of this region is an area of tourism. Tourism business can be considered as one of alternative instruments of regional policy aimed at achieving optimum development of the regions. Presov Self-Governing Region is significant in terms of natural tourism potential, rich history and many important cultural monuments, folklore and folk architecture. This potential for tourism is very large but under-exploited. Presov Self-Governing Region has sufficient natural, cultural, historical and social potential for tourism development. It is little used, due to the fact that there is a lack of funds for the reconstruction and operation of many historic monuments, poorly built and the poor state of infrastructure support. The development of existing potential should help implementation of the complex information systems in tourism. The policy of sustainable tourism as a responsible approach to tourism in the long run promotes sustainable regional development at all levels - economic, social and environmental. It ensures the quality of life for present but also for future generations, and also reinforces the principle of partnership in developing and implementing sustainable regional development, building packages, creating new products (Borovský et al.; 2008).

The target of the article is:
- propose the construction of facilities "Rural yard in Berti" aimed at eco-agritourism purposes;
- propose a project for greater range of potential visitors;
- identify strengths and weaknesses as well as opportunities and risks arising from project implementation;
- defend the project, his perspective and contribution to the development of eco-agritourism in the region in the future.

2. MATERIALS AND METHODS

In the development of this work the following methods were used:
- processing of study materials, which are focused on the development of tourism, agritourism and eco-agritourism, the history of the Saris region, Bertotovce village as well as their natural predisposition for tourism;
- gathering information and promotional literature about the region and village;

- SWOT analysis of the project in terms of agritourism, eco-agritourism and overall development of the region;
- consultation of development opportunities of the region in information centers;
- survey the current state of rural tourism development, the state of roads, hiking and biking trails in the area.

Village Bertotovce is located 18 km west of Presov and 13 km south of Sabinov. It directly touches Saris Highlands. In the middle of the village is height above sea level 400 m, but grounds are extending from 372 m - 643 m. Surroundings of the village are deforested. In the near forest, vegetation of pine and spruce stands dominates. Through the middle of the village streams brook "Great Svinka", into which flows the creek Hermanovka from Hermanovce. Northern edge of the village is crossed by the National Road of first class in the direction Presov - Levoca. Bertotovce village belongs to the Presov district and to the Presov Self - Governing Region.

3. RESULTS AND DISCUSSION

Visitors of the "Rural yard in Berti" are expected from all over Slovakia, but mainly from the surrounding districts. From the foreign clients visitors from Poland, and Hungary should prevail. Our services will be served to above less demanding clientele with regard to prices. This will be especially determined for so-called "green customers" who are demanding in term of the expected environment, ecological approach, nature, rural life and the atmosphere of country life. Their primary motivation will be performance of eco-agritourism. It is considered especially for families with children, groups of young people, students, pensioners, but we are also plan to organize children's camps and biocamps.
Services of our "Rural yard in Berti" will provide various types of accommodation. Fully furnished rooms, opportunity to camp in tents and for the greatest adventurers, there is also the possibility for bivouac on restricted sites of our yard. There will be offered catering services and prepared meals from our own products, preferred will be the vegetarian cuisine. Our customers will have always prepared enough activities. For example, assistance to various agricultural works, demonstrations and workshops of folk crafts and folk traditions, teaching horseback riding, walks in the surrounding countryside, animal welfare, harvesting of medicinal plants, sitting at the bonfire, roasting, grilling, etc.
Prices will be adjusted in view of the diverse use of our farm. Customers who choose camping or bivouac provide discounts. We will also offer discounts for organizing children's camps or biocamps for larger groups of customers. People who will do some work on the farm would get discounts too. We are also receptive to accept volunteers with an interest in organic farming, rural residence. Guests, who will assist works in the appropriate time on the farm, will get accommodation and meals in reward.
Customers will be informed about the newly created "Rural yard in Berti" through the marketing communications, regional travel agencies and so on. For the advertising, main web site of the village will be used, web site of the city Presov and not least, the own web site will be created. As next promotional activities, leaflets will be distributed; promotional brochures created, as well as the participation at exhibitions and trade fairs and place of tourism information guides by the roads. Our principles will be: acceptable price and the maintenance of permanent customer needs, which is the best advertising activity. Rural tourism is a product which uses so-called promotion "from mouth to mouth."
SWOT analysis on the basis of the assessment of the situation within the organization, on the basis of mapping the strengths and weaknesses and on the basis of findings of the

market situation around the company, recognizes the opportunities and threats and sets out a strategy for the future (Madzinová, 2005).

Strengths: S	Score
• pleasant rural environment	4
• systematic approach, enthusiasm and organizational skills of people	5
• originality and style	3
• environment rich in natural beauty and mineral water springs and historical monuments	4
• organic animal husbandry	4
• close contact with livestock	2
• suitable geographical location of the village, the availability of communication	3
• sports and cultural life of the village, interested citizens, the folklore and traditions	5
• the existence of village website	2
• support and interest in community development from municipal authority and the Mayor	3
• low competition in the business of rural tourism, eco-agritourism in the area	2
Total	**37**

Weaknesses: W	Score
• initial debt of farm	4
• the need for local environmental action	3
• insufficient knowledge of foreign languages	2
• poor publicity of land and its predisposition, lack of advertising and promotional materials	4
• lack of public awareness about the possibilities of small business in the tourism	2
• underexploited tourism potential	4
Total	**19**

Opportunities: O	Score
• better use of natural conditions and cultural heritage of the region	5
• possibility for getting experiences from the other farms	4
• employ residents of the village, providing jobs to local entrepreneurs	3
• the possibility of organization of ecological days for children and adults	5

- establish an information center where will be possible to buy postcards, souvenirs and get information materials and maps of the area and its surroundings   4
- return of people to nature, to the traditions, healthy water and food, to the activities of our grandfathers and grandmothers   6
- the use of support programs for developing rural tourism and agritourism   4

Total   **31**

Threats: T	Score
- ungovernableness of all necessary conditions and requirements for the success of farm in time	2
- unwillingness of people to work	3
- unresolved proprietary business ownership	4
- the possibility of natural environment pollution, felling forests, creating wildlife dump	3
- the promotion of another region by Presov Self-Governing Region	3
- state budget and economic situation in the country	4
- problem with the investment (capital)	4
Total	**23**
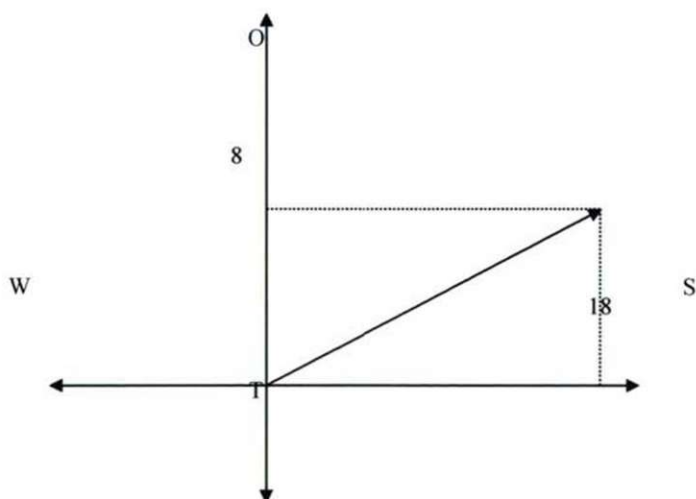
Figure 1: Results of SWOT analysis.

4. CONCLUSION

Bertotovce village has good predispositions to develop eco-agritourism. However, for the implementation of this business plan, as it is in all similar projects, the systematic approach, determination and courage are necessary. The aim of this study was to evaluate all options, negatives and positives, which implies this. The stay of tourists will provide in particular an unforgettable experience, gain new experience, knowledge of ecology, botany, zoology, speleology. Tourists have learned the traditional folk crafts, will be in direct contact with livestock, will have the opportunity to ride a horse or ride in a carriage, enjoying the taste of traditional local delicacies and food and environmental friendly foods. Visitors will meet with sincere willingness, kindness and natural respect for the customer. Our primary concern for us is that the most people will be connected with nature, they rest from the "normal" busy life in the city, to forget their problems and leave visitors full of new strength and mental harmony, with the feeling that they want to return, what we warmly welcome.

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QUALITY OF CREAM PRODUCTS WITH THE ADDITION OF EMULSIFIERS FROM DIFFERENT SOURCES

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ABSTRACT

The aim of this work was to determinate the physical characteristics of the cream spreads produced in the laboratory ball mill, with the addition of emulsifier lecithin from soybean, sunflower and oilseed rape, depending on refining time.

The physical properties of the cream products with penetration were defined by hardness at temperature of 20°C, where it was determined that the cream samples with the longest retention time in the ball mill have the highest hardness. Rheological measurements confirmed thixotropic flow curves of all samples.

The samples with retention time of 30 minutes in the ball mill have the best uniformity and stability of system, but the samples of cream with the addition of lecithin from soybean and sunflower, with retention time of 45 minutes, have the best and very similar sensory characteristics.

Key words: crem spread product, emulsifier, ball mill, rheology, quality

1. INTRODUCTION

The composition of cream products consists of powdered sugar, edible vegetable fat, sunflower oil, cocoa powder, milk powder and hazelnut mass (1). The high fat content, which is the continuous phase of cream spread products, influences the consistency and behavior of this type of products (2). Therefore, the fat selection for cream spreads requires a good knowledge of characteristics of fat and complex processes that may occur during manufacture and later in storage (3).

Production of cream mass requires the mixing the raw materials, refining in a five roll mill and conching at a temperature of 40°C. Involving the ball mill in cream spreads production all operations of preparation and mixing to obtain a homogeneous suspension take place in the ball mill (4).

The main characteristics of cream spreads are: good uniformity and softness in a wide temperature range - from the room temperature to the cooler, a rich creamy taste, smooth homogeneous structure with no separation of oil on the surface, adequate durability, and good oxidative stability (5).

The technological defect that often occures in cream spreads production causes the separation of fatty phase and migration of oil to the surface. In order to prevent the fat phase separation, which is is very undesirable from the technological aspect, the use of properly selected emulsifier is necessarily (6). The very low concentrations of emulsifiers are enough to achieve an appropriate emulsify effect. The most often used emulsifiers, derivatived from vegetable oils and based on mono-, di-and triglycerides, prevent the separation of fat, and, on the other hand, do not change the sensory characteristics of the cream products (7). Lecithin is a commonly used emulsifier in the food industry. It is a light brown liquid that contain about 65% of phosphatides and about 35% of oil. Commercial production includes the extraction of lecithin from soybean seeds (8).

2. MATERIALS AND METHODS

2.1. Row materials for cream spread production
Cream mass (semi-product of factory „Vekić", Serbia)
Vegetable fat EK Vital (Factory „Vital AD", Serbia)
Sunflower Oil (Factory „Dijamant AD", Serbia)
Lecithin from soybean (Factory Victoriaoil, Sid, Serbia)
Lecithin from sunflower (Factory Victoriaoil, Sid, Serbia)
Lecithin from oilseed rape (Factory Victoriaoil, Sid, Serbia)

2.2. Description of the experiment
The cream spread was made in the laboratory ball mill (capacity of 5 kg), by domestic producer. Row materials were measured and added into the ball mill. The diameter of balls in the mill is 9.1 mm and the mixer speed is 50 rpm. The ball mill is equipped with the recirculation system with speed of 10 kg/h. The internal diameter of ball mill is 0.125 m, and the height is 0.31 m. The volume of space provided for balls and 5 kg of chocolate mass is 0.122 m^3.

Three types of cream spreads are produced:
Cream 1 - with the addition of 0.5% lecithin from soybean
Cream 2 - with the addition of 0.5% lechitin from sunflower
Cream 3 - with the addition of 0.5% lechitin from oilseed rape

Creams samples were taken from the ball mill after 30, 45 and 60 minutes.

2.3. Methods for determining the physical properties of cream spreads
The rheological properties of cream spreads were determined by rotational viscosimeter Rometar Rheo Stress 600, Haake, according to O.I.C.C. method, on temperature $40\pm0.1^\circ C$ (9).
The hardness of the cream products were defined with penetration on the temperature of $20^\circ C$ (10).
The sensory characteristics of the cream spreads were determined by the method of scoring, where the maximum score is 20 (11).

2.4. Results of physical analysis
The hardness and work of shearing of cream spread samples at the temperature of $20^\circ C$ are shown in Figure 2, which shows that the samples of cream with the addition of soy lecithin have the greatest hardness and work of shearing, which indicates a good emulsify effect without fatty phase migration, while the cream samples with the addition of lecithin from oilseed rape have the lowest hardness and work of shearing. The longer retention time of all samples in the ball mill, as for a higher degree of reduction of particles leads to increasing the values of both examined parameters.
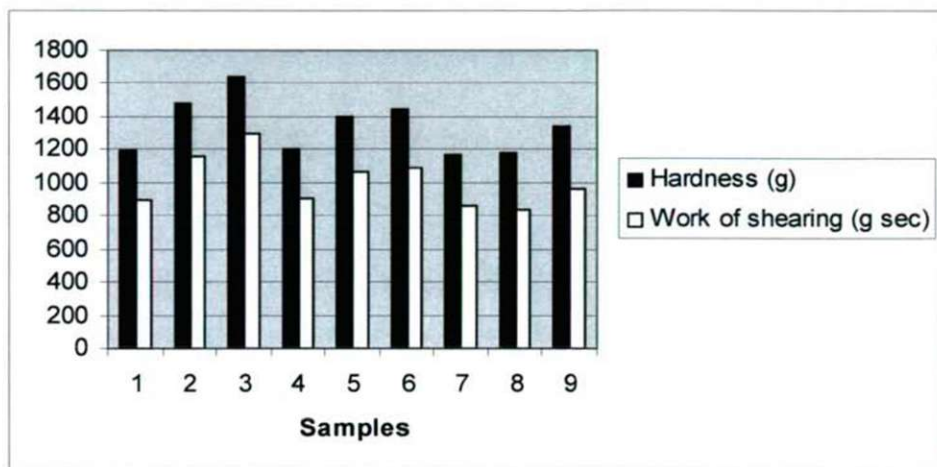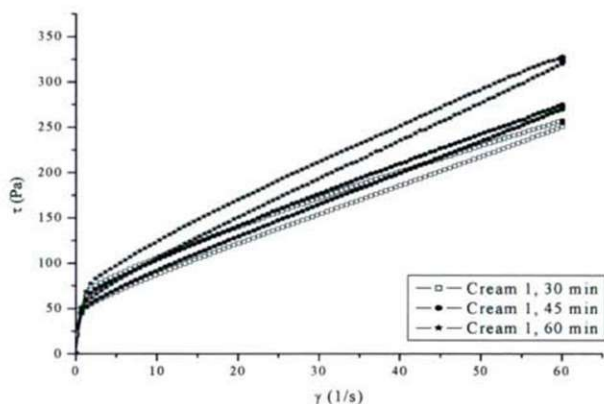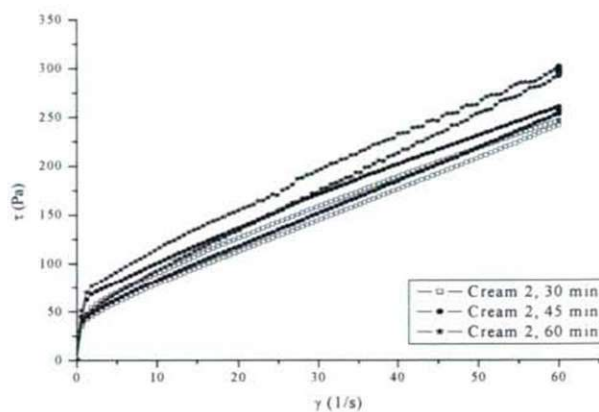
Figure 1 – Hardness and work of shearing of cream samples

The flow curves at the temperature of 40°C depending on refining time and type of emulsifier were determined for all cream samples (Figure 3 a, b, c).
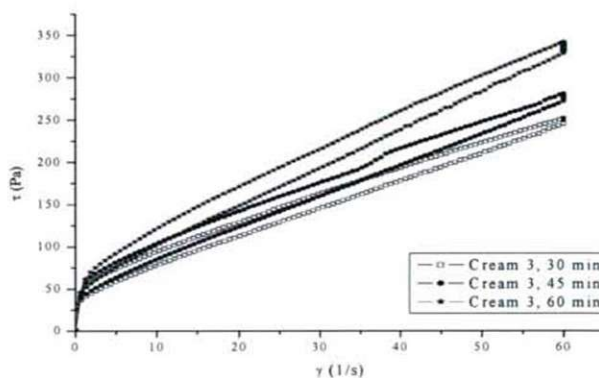

a.

b.

c.

Figure2 - Flow curves of samples depending on refining time and type of emulsifier
a) soybean, b) sunflower, c) oil rape

The source of lecithin does not have a significant impact on the viscosity of cream, but the lechitin from oilseed rape slightly reduces the value of viscosity. All samples of creams, no matter the source of lecithin, show similar thixotropic flow, while the samples with longer retention in the ball mill require higher shear stress at a given shear velocity. These samples have a higher degree of of particles reduction, as for higher viscosity comparing with the the samples with shorter retention time in the ball mill. The tixotropy curve area of cream samples are also bigger with increasing the refining time in the ball mill, as a result of greater complexity and less softness (Table 1). The samples of cream spreads with the refining time of 30 minutes have the least tixotropy curve

area, the least complexity and the best softness. On the other hand, Table 1 shows that longer time of refining reduces the value of yield stress or the minimum necessary force thet must be applied to the system to began to flow.

Table 1 - Rheological parameters determined by static measurements

Samples	Yield stress (Pa)	Tixotropy curve area (Pa/s)
Cream 1, 30 min	0.723	972
Cream 1, 45 min	0.590	707
Cream 1, 60 min	0.355	1129
Cream 2, 30 min	0.822	743
Cream 2, 45 min	0.707	1054
Cream 2, 60 min	0.313	1384
Cream 3, 30 min	0.859	928
Cream 3, 45 min	0.474	1020
Cream 3, 60 min	0.834	1258

The samples of cream spreads with the addition of lecithin from soybean and sunflower show a very similar sensory characteristics, while the lecithin derivated from rapeseed causes less emulsify effect, so the oil migration occures in in this samples, which is certainly a negative characteristic of this type of product. The samples of cream products with the shortest retention time in the ball mill, regardless of the source of lecithin, have the most glosy surface, as a result of insufficient emulsify of particles and migration of oil to the surface. In these samples the large particles are clearly observed, that produce the sandy feeling in the mouth during chewing and have a strong smell and taste of oil. Prolonged refining time leads to increase of viscosity of cream spreads, and these samples are very sticky during chewing, but their smell and taste remain rounded.

Samples of cream products with refining time of 45 minutes showed the best technological and sensory properties because they have good softness and excellent melt in the mouth during chewing, and their smell and taste are suitable.

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POPULATION DYNAMICS OF RAMETS *ALLIUM URSINUM* L. IN SOUTH-WESTERN SLOVAKIA

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ABSTRACT

Allium ursinum (*Liliaceae*) is bulbiferous spring ephemeroid and geophyte with underground organs bulbs. Population dynamics of *Allium ursinum* ramets were studied in woodland communities (with *Acer campestre, Acer pseudoplatanus, Fraxinus excelsior*) in park in Hlohovec (SW Slovakia) on four permanent plots (025 x 025 m) during growing seasons (2001-2003) in 14-days interval. Field measurements we realized with usual methods of population biology (Harper, 1977). Analyzed plots were selected by random selection. Observed characteristics were – density of populations (individual.$1m^{-2}$) and size structure of population. Self-infilling was observed to second census (in March) and than decrease density ramet between 5. and 6. census (in May). In April 2003 we observed the highest average densities (720 i.). Maximum average plant size was observed in 2002 (275 mm), this years was externally humid and minimum in 2003 (229 mm). In April 2003 we noted 53% seedling of total number ramets (1056 i) on fourth permanent research plots.

1. INTRODUCTION

There are two conceptions how to regulate the size of clonal plants populations. The first one supposes the control of shoots production (and therefore the lack of self-thinning). These populations are able to regulate the speed of shoots growing up and to synchronize their growth through the mutually connected shoots (forming the polycormon). The second conception supposes the overproduction of shoots and their regulation through the self-thinning as in the case of no-clonal species because of the successful competition with other plant species for space and nutrient resources, protection of survival in the unit, as well as the colonization of adjacent habitats. According to this vision, the clonal species don't have the ability to control the meristem activity and the production of above-ground shoots. A lot of authors have dealt with the regulation mechanisms in the developing of the overgrowth yet (Harper, 1977; Begon et al., 1996, Ricklefs, 2001) and in Slovakia (Eliáš, 1998; Končeková, 2003; Fehér, Končeková, 2005), but still we don't have detailed information on many species.

Population dynamics of spring geophytes is characterized by short duration of above-ground shoots, which rapidly grow, bloom and produce seeds. Only underground organs hibernate (rhizomes, bulbs, etc.). (Shorina, Smirnova, 1995; Skripčinskij, Skripčinskij, 1976). *Allium ursinum* L. (*Liliaceae*) is a typical spring ephemeroid geophyt growing in eutrophic parts of the deciduous forests. There are two subspecies: *Allium ursinum* subsp. *ursinum* and *A. ursinum* subsp. *ucrainicum* KLEOP. et OXNER (Marhold, Hindák, 1998). It is a perennial with triangular stem from 0.2 to 0.5 m high. The umbel inflorescence is on stem, which height varied from 0.3 to 0.5 meters. The inflorescence consists of 10-30 white flowers (Egger, 1992). The onion is a reduced basal part of stem with one or more thickened stock scales, cone and spindle-like shaped. The daughter-bulb arises inside the mother-bulb. Both bulbs have the same size. The intensity of vegetation reproduction is small (from 0 to 12.5%), but even though is important in

forest edge habitats (Pauková, 2004a). According to the clonal growth of bear's garlic, it belongs to the *Galanthus nivalis* type (Klimešová, Klimeš, 1997).

2. MATERIALS AND METHODS

The number of above-ground shoots (ramets, individuals - i) were studied by the method of repeated census during three growing seasons (2001-2003) (Table 1). Population densities were observed regularly at two-week intervals from February till June. Reported data have been recalculated into one square meter ($1m^2$). The first and the second permanent researched plot were established on the edge of the prime floodplain with western exposure. The third permanent researched plot was situated on the light side of a slope with southern exposure. The fourth researched plot was established on the shady side of a slope with western exposure.

Table 1.   Terms of measuring the populations of plants Allium ursinum in woodland communities in park in Hlohovec in 2001-2003

census/years	2001	2002	2003
1.	9.3.	3.3.	8.3.
2.	23.3.	17.3.	22.3.
3.	6.4.	31.3.	5.4.
4.	20.4.	14.4	19.4.
5.	4.5.	28.4.	3.5.
6.	18.5.	12.5.	17.5.
7.	1.6.	26.5.	31.5.

The obtained results were statistically evaluated by using the Statgraphics Plus program. To test the differences between the observed factors, we used the Multi-factorial analysis of variance and statistically significant differences were tested by LSD test. The size structure of the population was made by measuring the ramets with ruler on permanent researched plots. The data were again recalculated into one square meter. Size classes were determined on the base of minimum and maximum values and the results were evaluated. The precipitation and average daily air temperatures of the three-year period are illustrated in fig. 1-3 (distance from Nitra to Hlohovec 25 km).
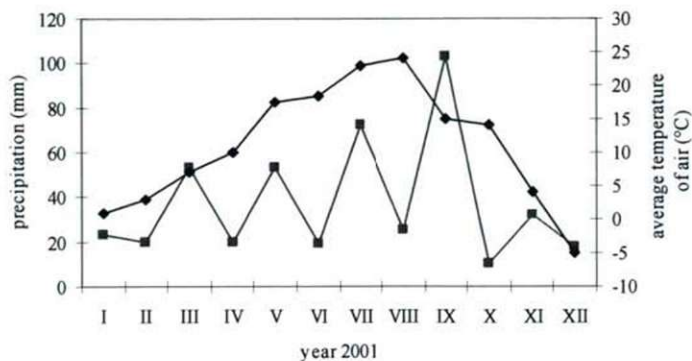
Figure 1 Average precipitation (mm) (pink color) and temperature of air (°C) (blue color) in Nitra in 2001 (Repa, Šiška 2002; processed by the author)
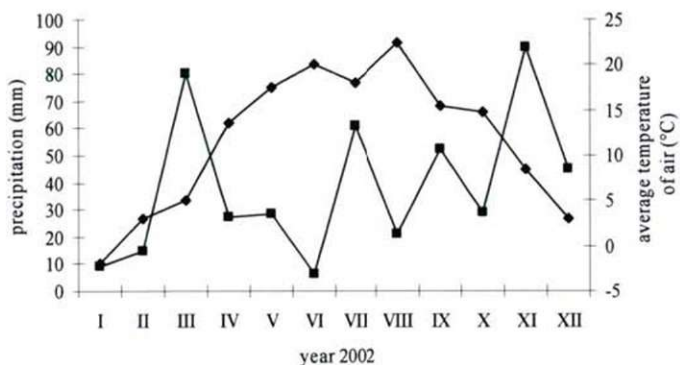
Figure 2 Average precipitation (mm) (pink color) and average temperature of air (°C) (blue color) in Nitra in 2002 (Šiška, Repa, 2003; processed by the author)
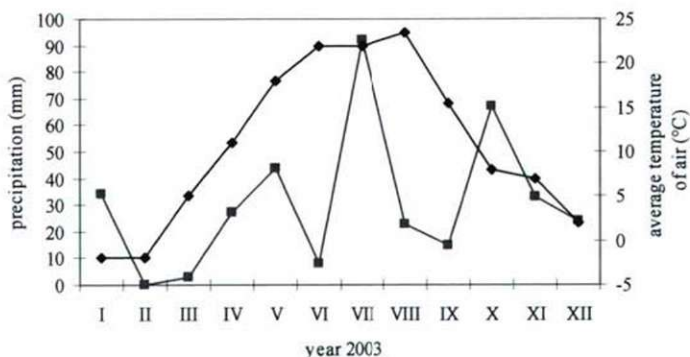

Figure 3 Average precipitation (mm) (pink color) and average temperature of air (°C) (blue color) in Nitra in 2003 (Repa, Šiška, 2004; processed by the author)

3. RESULTS AND DISCUSSION

By inter-annual assessment of the density of ramets of *A. ursinum* we haven't found differences in the number of shoots until the end of April (in the 4th census) during the growing season in 2001. In the next growing season, there was a significant decline with self-thinning to 89,7% (on the 560i at the end of vegetative season) (Fig. 4). In this studied year was the greatest variability in the number of individuals - the highest density of ramets (624i) and the lowest density of individuals (64i) on researched plot.

Population dynamics in 2002 were similar as in 2001. The number of ramets remained constant with a density of 480 individuals till the fourth census (at the end of April). In the next growing season the density of the ramets population due self-thinning mechanisms decreased less markedly than in the previous year.

Minimum initial density of individuals on the researched plot was recorded in 2003 (240i). This was connected with longer winter (February was cold with an average temperature only -1,8°C) and a later coming of warmer days than in previous years of research (Fig.3). Number of bear's garlic ramets increased sharply in the process of self-infilling in March (between the first and the second census, on 496i). We found a small reduction of individuals at the end of the growing season, which is related to the weather behaviour in that year (Fig. 3, 10).
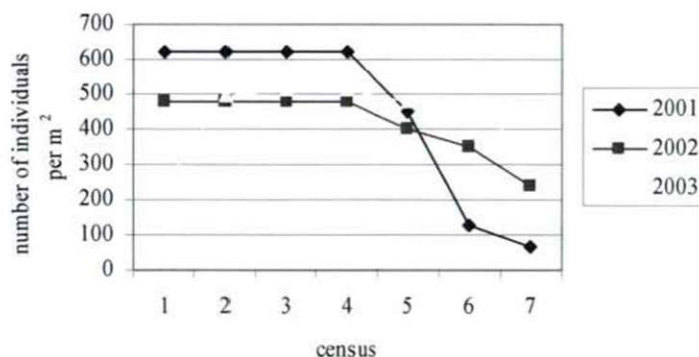
Figure 4   Population density of Allium ursinum on the 1st permanent researched plot in woodland communities in park Hlohovec in 2001-2003 [N. m²]

In 2001, the population dynamics on the second permanent researched plot had a form of curve with one peak. (Fig. 5). In the last year of assessment, we saw the highest density of 832 individuals in April (the 2nd census), again as on the first research plot, the number of ramets increased sharply (about 384) between the first and the second measurement in March. Due to the self-thinning process decreased the number of individuals by 83,3% (560i). At the end of vegetative season, ramets had yellow aging

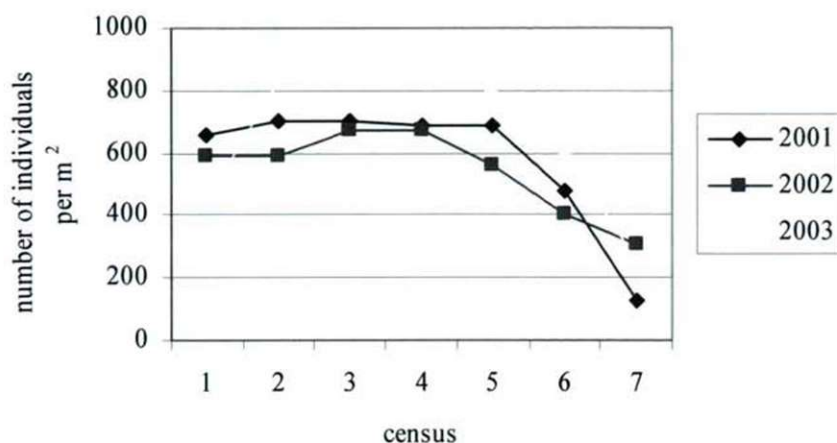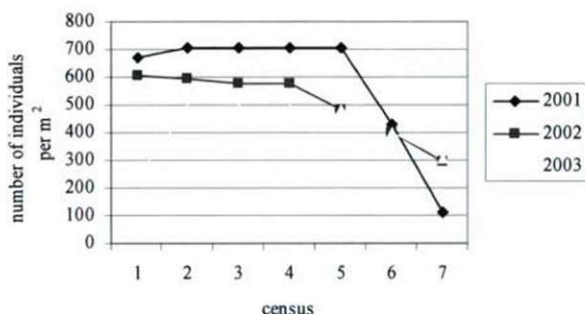leaves and down bent (diffractive) flower stalks with round black seeds.

Figure 5   *Population density of Allium ursinum on the 2nd permanent researched plot in woodland communities in park in Hlohovec in 2001-2003 [N. m^2]*

By inter-annual comparison of ramets density on the third permanent researched plot during the vegetative period 2001 and 2003, we found that the number of individuals between the second and the fifth census was approximately the same (Fig.6). Maximum number of ramets was 704 individuals in the first year of research, while the maximum number of individuals in the last year was only 480i per m^2. The whole year 2002 declined the number of individuals.
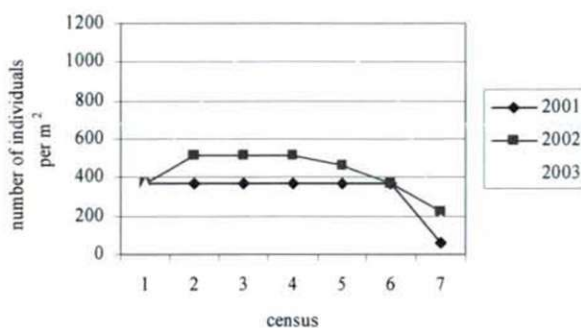

Figure 6 *Population density of Allium ursinum on the 3rd permanent researched plot in woodland communities in park in Hlohovec in 2001-2003 [N. m^2]*

For all researched plots was found the lowest mortality of ramets *A. ursinum* to 48,25% at the end of the growing season in early June 2002 (the 7th census) (Fig.8), which is related with the highest rainfall during the growing season (March-May) (135,8 mm), the highest average temperature of air in February and March (3,5°C; 6,3°C) and the highest soil moisture (Fig.2). High soil moisture and soil fertility are indispensable for *A. ursinum* because the carbon gained during photosynthesis has to cover both the energy

demand for aboveground biomass production and respiration loss during the dormancy period in summer, autumn and winter (Jandl, Kopeszki, Glatz, 1997).

The most significant mortality of bear's garlic ramets to 27,3%, was found in early June 2001, because the end of vegetative season was very dry (Fig.1). February and March were very wet, the average temperature of air was normal (Fig.1), which initiated earlier start of growth of plants as well as the highest population density at the beginning of vegetative season 2001. On the contrary, February and March 2003 were extremely dry (February cold too) (Fig.3) causing a delayed start of phenophase of leaf growth *A. ursinum* in all plots.

Figure 7 Population density of Allium ursinum on the 4th permanent researched plot in woodland communities in park in Hlohovec in 2001-2003 [N. m²]

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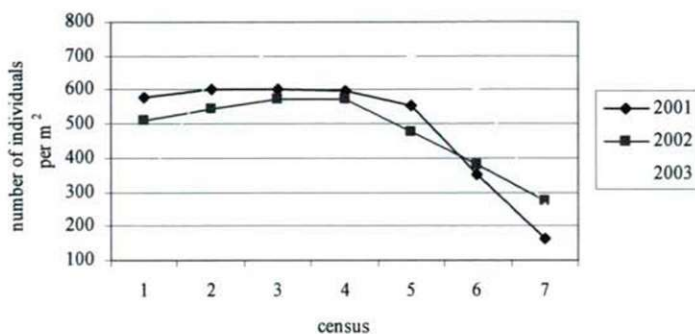
Figure 8 Population density of ramets Allium ursinum in all permanent researched plots in woodland communities in park in Hlohovec in 2001-2003 [N. m²]

Population density was statistically highly evidentially dependent on the degree of developing phase, while there was a mortality of ramets especially at the end of the growing season. In assessing of the interaction density x developing phase of plants was the most significant difference between the third and the seventh and between the fourth and the seventh measurement (LSD $_{0,05}$ ± 125 test; LSD $_{0,01}$ ± 164 test) (Fig.9).
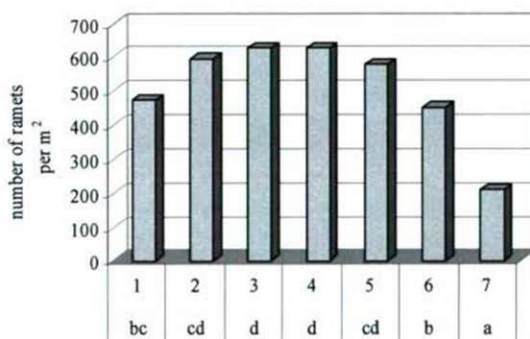
Figure 9 Statistical evaluation of significant differences in the number of ramets Allium ursinum depending on phenology. Values with different letters (a, b, c, d) in columns indicate statistically significant difference according to LSD test (P <0, 05)

Population density of *A. ursinum* was statistically significantly affected by the first and the second as well as by the first and the final year of monitoring (LSD $_{0,05}$ test ± 82,1;

LSD $_{0,01}$ test ± 113,2) (Fig.10). This means, that the weather behaviour significantly affected the number of individuals on researched plots. According to our observations mortality of ramets is indicated by environmental stress - dry soil (Fig.1, 2, 3). Self-thinning, as a mortality caused by the high density of vegetation, have observed many authors already on clonal species such as *Helianthus tuberosus* (Končeková, 2003), *Fallopia* x *bohemica* (Pauková, 2004b), *Sambucus ebulus* (Šranková, 2008).
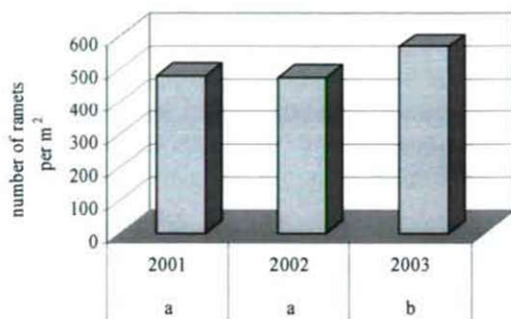
Figure 10   Statistical evaluation of significant differences in the number of ramets Allium ursinum depending on the season. Values with different letters (a, b) in columns indicate statistically significant difference according to LSD test (P <0, 05)

The population density of bear's garlic in the deciduous forest in the park in Hlohovec varied from 368 to 1056 i.m^2 in the main reproductive period at the end of April 2001-2003. According to Šmanova, Kričfalušij (1995), the density of *A. ursinum* varied from 371 to 840i.m^2 in the deciduous forests in the Carpathians in Ukraine. In mixed forests in north-western Germany at the end of the main reproductive period (mid May) were found 939 ramets, of this 260 seedlings per m^2 (Eggert, 1992). The number of individuals varied from 320 to 3350 i.m^2 in the beech forest in northern Germany (Ernst, 1979). Rychnovská and Bednář (1998) stated that the density of ramets was 700-900 per m^2 in floodplain forest in the Czech Republic. These data are comparable with our results and they correspond mainly with the values measured in Ukraine. Vice versa, Kuklová, Kukla (2006) recorded at average only 92 individuals of *A. ursinum* per m^2 in the Nature reservation Chynoriansky luh.

The number of plants on the permanent researched plots was statistically high significant between the first and the second and between the third and the fourth plots (LSD $_{0,05}$ ± 107 test; LSD $_{0,01}$ ± 142 test) (Fig.11). That means that the population density was influenced through the place of establishment of the researched plots. High significant interaction was between the permanent plots established in the plains of the prime floodplain with western exposure and the permanent plot based on the light side of a slope with southern exposure.
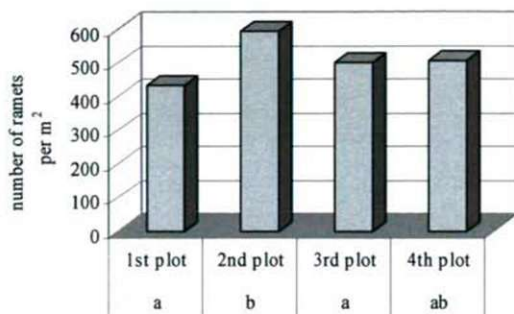
Figure 11 Statistical evaluation of significant differences in the number of ramets Allium ursinum depending on the permanent plots. Values with different letters (a, b) in columns indicate statistically significant difference according to LSD test (P <0, 05)
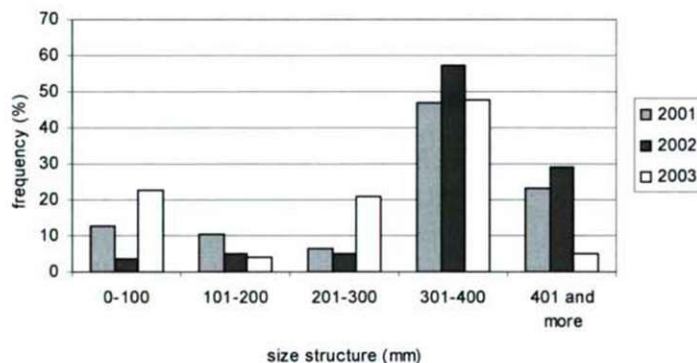

Figure 12 Size structure of populations Allium ursinum in woodland communities in Hlohovec at the end of growing season 2001 (752i), 2002 (1 312i) and 2003 (1 984i) (data represent totality for all permanent researched plots)

In general, we found out that during assessment years the population of *A. ursinum* at the end of the growing season mainly from individuals over 301 mm high (at average 78,1% of all the ramets). The highest average height of ramets 358 mm was recorded in 2002 and the lowest average height 309 mm were observed in 2001.

4. SUMMARY

At the beginning of the growing season self-infilling of ramets of *Allium ursinum* in woodland communities in the park from Hlohovec (SW Slovakia) was observed reaching the maximum density in March (the second census) 2001-2003. The density of individuals in the next growing season remained the same until April (up to the fifth census). The population density decreased mainly at the end of the growing season at the end of May (between the fifth and the sixth census). At the end of the vegetative season firstly the

overshadowed ramets (seedlings and juvenile plants) have been decayed, afterwards we observed decaying of generative plants with one or two inflorescences. According to our observation, *Allium ursinum* avoided self-thinning and in fact, it fails in applying the rule of self-thinning in natural conditions. Mortality of ramets was indicated by environmental stress - dry soil.

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DESIGN OF AN EXPERIMENTAL PCM SOLAR TANK

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ABSTRACT

The one of the most important part of a solar collector system is the solar tank. The relevant type and capacity of the solar tank is a requirement of the good operation of the system.

A solar tank particularly filled with phase change material has smaller dimensions and bigger heat capacity than the conventional tanks.

The main problem of the operating of the PCM tanks is the low coefficient of thermal conductivity of the phase change material. During the discharging of the tank the PCM solidifies to the inner surface of the tube. The thermal flux will be decreased by the thermal insulating effect of the thicker and thicker solid PCM layer.

We have calculated the time of the phase changing and the operating temperature of the heat accumulating. If the temperature is lower than the conventional tanks it could result a higher efficiency of the solar collector system. We have made pre-calculations to study this possibility.

1. INTRODUCTION

The temporal difference of energy source and energy needs made necessary the development of storage systems. Except in summer, specially in winter, the temperature of the heat transfer fluid coming from the collector is relatively low (35-60 °C). In this period of time, one way of storage is to use solid-liquid phase change materials. In comparatively small volume the phase change materials have great storage capacity in small temperature interval. [1] Adding PCM (phase change material) modules at the top of the water tank would give the system a higher storage density and compensate heat loss in the top layer because of the latent heat of PCM [2].

This construction has big heat exchanging surface, and the manufacturing is simple.

2. PHASE CHANGE MATERIALS

These materials can store energy by the melting at a constant temperature. No material has all the optimal characteristics for a PCM, and the selection of a PCM for a given application requires careful consideration of the properties of various substances. Over 20,000 compounds and/or mixtures have been considered in PCM, including single-component systems, congruent mixtures, eutectics and peritectics [3]. The isothermal operating characteristics (i.e. charging/discharging heat at a nearly constant temperature)

during the solidification and melting processes, which is desirable for efficient operation of thermal systems [4].

The paraffins are suitable by the physical and chemical properties. The paraffins are obtainable at low price. These materials have only one disadvantageous property: flammability. In this case we have not mind this because the presence of the water around the tubes of the paraffins. Our first chosen phase change material is the paraffin 5838:

Table 1. Physical properties of Paraffin 5838

melting-point	50°C
latent heat	145 kJ/kg
viscosity	1,9 mm²/s
density	1,412 g/cm³
specific heat capacity – solid	2,1 kJ/kgK
specific heat capacity – liquid	2,4kJ/kgK
coefficient of thermal conduction – solid	0,2W/mK
coefficient of thermal conduction – liquid	0,15W/mK

The paraffins are waxes at room-temperature. These are hydrocarbons. Increasing the number of C-atoms increases the melting point too. The normal paraffins of type C_nH_{2n+2} are a family of saturated hydrocarbons with very similar properties. Paraffins between C_5 and C_{15} are liquids, and the rest are waxy solids. Paraffin wax is the most commonly used commercial organic heat storage PCM [5].

Paraffin waxes are cheap and have moderate thermal energy storage density but low thermal conductivity and, hence, require large surface area [5].

3. OWN CONCEPTIONAL MODELS

In addition to the combining the advantages of the available constructions is important to mind the easy manufacturing. We have to apply available materials and keep down the costs.

The tank with inner tubes – combines the advantages: it has large surface for the quicker heat transfer, and it could be manufactured easily.

The material of the inner tubes has to resist the corrosivity of the water. The tubes should be mounted to two discs. The diameters of the discs are similar to the inner diameter of the tank. The discs have holes to place the tubes. The lower ends of the tubes are closed with welding, the upper ends have threaded cover nut.

This model has the lowest cost and the biggest surface for the heat transfer. According to these advantages we choose to design the third model.

The tubes are made of corrosion-resistant steel. The thin walls of the tubes result a very good heat transfer. The tank has 25 tubes with 60 mm outer diameter. Figure 3 shows the arrangement of the tubes and the solar heat exchanger spiral:
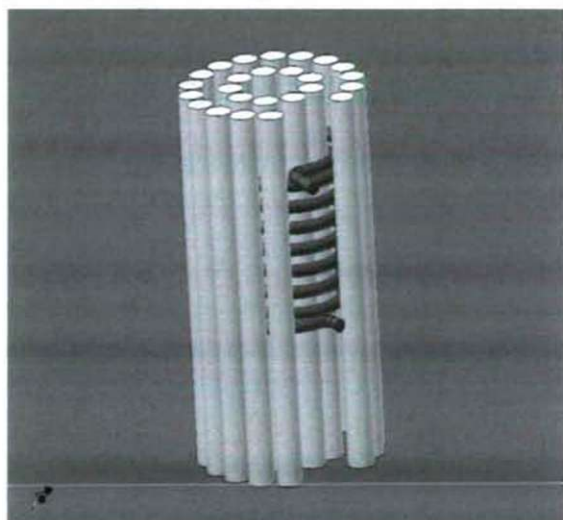
Figure 1. Arrangement of the tubes filled with paraffin and the solar heat exchanger

4. CALCULATION OF THE SOLIDIFICATION

The main problem of the operating of the PCM tanks is the low coefficient of thermal conductivity of the phase change material. During the discharging of the tank the PCM solidifies to the inner surface of the tube. The thermal flux will be decreased by the thermal insulating effect of the thicker and thicker solid PCM layer. I have calculated the required time of the solidification of the paraffin.

The equation of the thermal conductivity in tubes with two layers (layer 1 is the solid phase of the paraffin, layer 2 is the wall of the tube):

$$\Phi = \frac{2\pi h\left(t_{w3} - t_{w1}\right)}{\dfrac{1}{\lambda_{PCM}} \ln\dfrac{d_2}{d_1} + \dfrac{1}{\lambda_w} \ln\dfrac{d_3}{d_2}}$$

Legend:

λ_{PCM} - coefficient of thermal conductivity of the paraffin
λ_w - coefficient of thermal conductivity of the tube
d_1 - inner diameter of the solid paraffin layer on the inner surface of the tube
d_2 - inner diameter of the tube
d_3 - outer diameter of the tube
t_{w1} - temperature of the phase change
t_{w3} - temperature of the outer surface of the tube

During the solidification the value of d_1 decreases from d_2 to 0. The t_{w3}-t_{w1} temperature difference depends on the temperature of the water in the tank. With the equation we can calculate the required time of the solidification. The next diagram shows the decrease of the $r_1 = d_1/2$ inner radius of the solid phase in function of time. The parameters are according to 60 mm tube diameter, 1 mm wall thickness, the PCM is paraffin, the

material of the tube is stainless steel. The difference between the phase change temperature and the temperature of the outer wall of the tube is 2 °C:
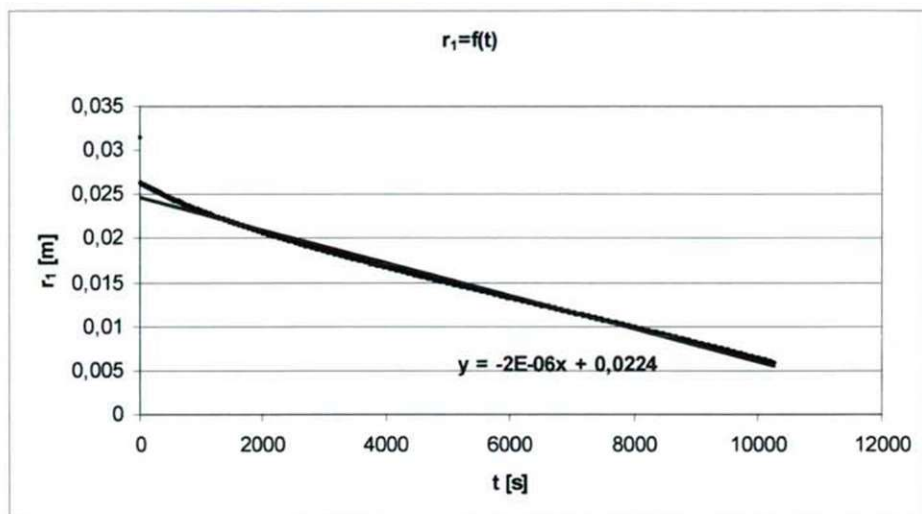

Figure 2. The decrease of the r_1 radius on the boundary of the liquid and solid phase in function of time, during the solidification

The calculated time of the solidification is 172 minutes. Choosing 40 mm tube diameter instead of 60 mm the solidification time decreases to 66 minutes. The next diagram shows the time of the solidification in function of the diameter of the tube:
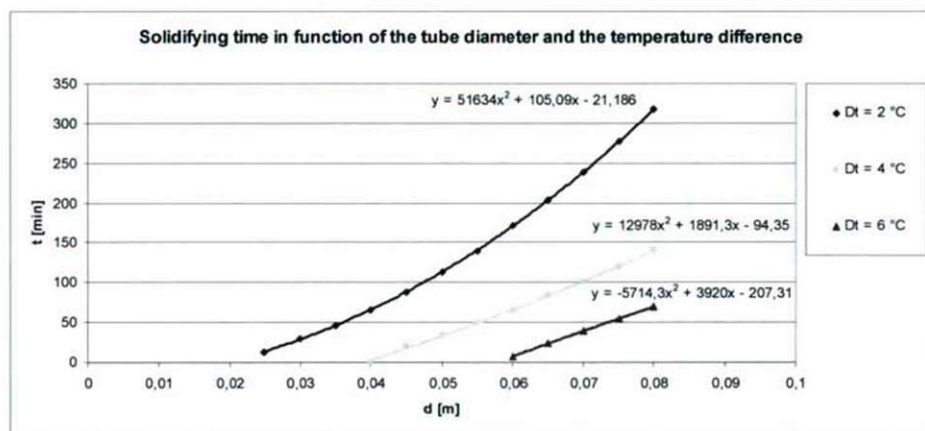
Figure 3. Time of the solidification in function of the tube diameter and the temperature difference between the PCM and the outer wall of the tube

The same amount of the PCM requires more tubes if the diameter is smaller. The specific heat exchange surface is greater, the solidification is quicker, but the volume of the material of the tubes is greater too, so the heat capacity of the solar tank is lower.

The above functions are definable according to the physical properties of the phase change material and the difference between the phase change temperature and the

temperature of the outer surface of the tube. We can calculate the maximal tube diameter for a required phase changing time. With these functions we can calculate the ideal parameters for a definite system and operating.

5. OPERATING AT LOWER TEMPERATURE

The lower difference between the temperature of the collector and the outer air results higher solar collector efficiency.

The paraffin has smaller specific heat capacity than the water, so it results higher temperature in the PCM-tank, than the conventional solar tank in a summer day:
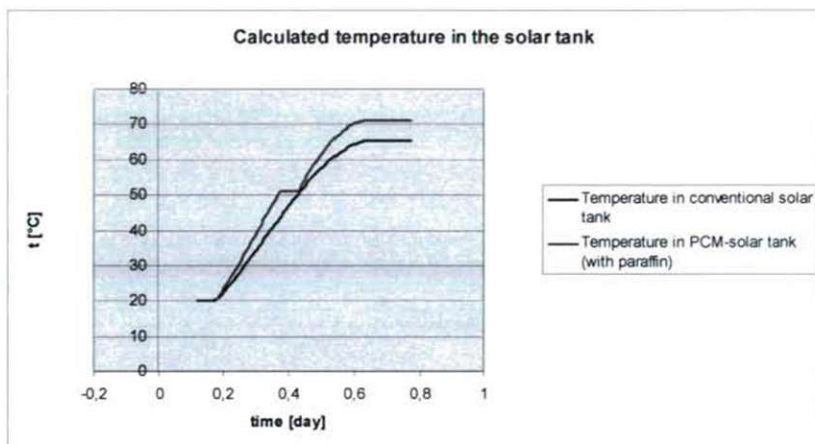
Figure 4. Comparing the temperature in a conventional solar tank and a PCM-tank with paraffin

The diagram above shows the result of a calculation of a PCM-tank with 70 kg water around the tubes and 170 kg paraffin in the tubes. We used for the calculation the efficiency characteristic of our own-designed experimental flat collectors.

The temperature of the PCM-tank is higher than the conventional because of the lower heat capacity of the PCM, so the collectors has to operate at higher temperature, and the efficiency is lower because of the heat loss from the collector to the air. If our goal is the higher efficiency we have to choose another PCM with lower melting point.

In our every calculations the same weather conditions result higher efficiency with the conventional tanks, so the main advantage of the PCM-tanks is the lower space demand.

6. SUMMARY

Tank proposed by us with inner tubes combines the advantages of the existing types of tanks. These inner tubes are filled with the PCM. The material of the tubes has to resist the corrosive effect of the water. The tubes are in a holder which has equal diameter with the tank. This holder keeps the tubes to equal distances. The lower ends of the tubes are closed with a welded ending, the upper ends have threaded cap. This is a simply configuration with large heat exchange surface area.

The cost of the manufacturing of the tank is lower than the conventional tanks in trade with the same heat capacity and the space demand is much lower too. The other advantage of the PCM tank is the constant temperature during the heat accumulation. This constant temperature could be lower, it depends on the type of the PCM. The lower temperature of the heat accumulation permits the higher efficiency of the collectors at low external temperature.

The lower heat capacity of the PCM could result higher temperature in the solar tank, so the higher collector temperature results lower collector efficiency. With our PCM-tank we can test different phase change materials to calculate the efficiency.

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INVOLVEMENT OF ACETYLSALICILYC ACID IN SUNFLOWER (*HELIANTHUS SP.*) PLANT RESPONSE TO DIFFERENT ABIOTIC AND BIOTIC STRESS

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ABSTRACT

In our researches we studied the influence of exogenous acetylsalicylic acid (ASA) in the plant response to abiotic and biotic stress. Salt stress, an abiotic stress, determine modification of some biochemical indicators, like, antioxidant enzymes, proline (amino acid accumulate in higher plants under salinity stress) content, assimilatory pigment content. Pre-treatment of sunflower seeds with ASA may cause a low level of oxidative stress, improving the antioxidative capacity of the plants. Acetylsalicylic acid can increase the plant tolerance to salt stress induced in our experiment by 150 mM NaCl treatments. Moreover we studied the role of ASA in sunflower resistance, its antifungal effect against fungal pathogens (*Botrytis cinerea* and *Sclerotinia sclerotiorum*), which has significant influence on the level and quality of the production of this plant.

1. INTRODUCTION

Acetylsalicylic acid (ASA), and salicylic acid (SA) play act as a potential non-enzymatic antioxidant as well as a plant growth regulator. Plant growth and development was intensly affected by different adverse environmental conditions and by pathogens. In plants the damaging effects of these abiotic and biotic stress factors take the shape of alterations in the plant physiology which leads to a reduction of growth and a decrease of their bioproductivity. Salicylic and acetylsalicylic acid could ameliorate the damaging effects of heavy metals in rice (Mishra and Choudhuri, 1999), drought stress in wheat (Waseem et al, 2006) and salt stress in wheat (Arfan et al, 2007) and in sunflower plants (Noreen et al, 2009).

Gutiérrez-Coronado et al 1998, found that SA sprayed on leaves increases significantly the root growth in soybean plants, and Gutiérrez-Rodríguez et al 1991, found that SA stimulated root growth in carrot, radish, and beet plants. Its important to know if SA stimulated root growth in ligneous species such as *Pinus patula* Schl. Et Cham, one specie extensively planted in parks, gardens and forests of México (Perry, 1991).

However the leaves of corn and soybean treated with acetylsalicylic acid or gentisic acid exhibited no change in their chlorophyll contents (Khan et al, 2003). Salicylic acid activated the synthesis of carotenoids, xanthophylls and the rate of de-epoxidation but decreased the level of chlorophyll pigments, both in wheat and moong plants also the ratio of chlorophyll a/b, in wheat plantlets (Moharekar et al., 2003).
Acetylsalicylic acid used in optimal concentrations can temporarily reduce the oxidative stress level in plants improving their antioxidative capacity and stimulating the synthesis of some protective components like proline.
Salicylic and acetylsalicylic acid are important signaling (signalling) molecules involved in plant defense in both locally and systemically induced disease resistance responses.

This substances are largely used compounds in human and veterinary farmacopee (MedEx 2009, Memomed 2009). They are involved in the installation of Systemic Acquired Resistance (SAR), and play an active role in plant defense on viral, fungal and bacterian pathogens (Csep and Sesan, 1996, Antofie et al.2003).

Loake and Grant (2007) relieved that SA is synthesised by plants in response to challenge by a diverse range of phytopathogens and is essential to the establishment of both local and systemic-acquired resistance (SAR). Salicylic acid application induces accumulation of pathogenesis-related (PR) proteins.

Recent advances in our understanding of plant defence signalling have revealed that plants employ a network of signal transduction pathways, some of which are independent of salicylic acid. Cross-talk between the salicylic acid-dependent and the salicylic acid-independent pathways provides great regulatory potential for activating multiple resistance mechanisms in varying combinations (Pieterse and van Loon, 1999).

2. MATHERIALS AND METHODS

2.1.Sample preparation

Surface sterilized sunflower seeds (*Helianthus sp.* L) were soaked for 12 h in water or in 0.1 mM ASA.

The germination was made in plastic recipients, 7 days, on a filter paper, moistened with 20 ml treatment solution:

- Control lot (C) – 12 h soaked in water and germinated in water.
- Sample 1 (S₁) – 12 h soaked in water and germinated in 150 mM NaCl solution;
- Sample 2 (S₂) – 12 h soaked in 0.1 mM ASA and germinated in 150 mM NaCl solution.

Each recipient contained 20 seeds. The germination was made on filter paper moistened with tape water, at 20±3 °C in a Sanyo MLR 351H phytotron, day/night, and relative humidity 65-85%, under natural photon flux density. Every day, the quantity of solutions from the recipients was brought to the level of 20 ml.

After 7 days of germination we planted the plantlets in sand, leaving them there for an additional 7 days, and sprayed their primary leaves each day with 1 ml of 0.1 mM ASA solutions or with water for the control lot.

The experiments were performed in the Agrifood Biochemistry laboratory of Faculty for Environmental Protection Oradea.

2.2. Preparation of enzme extract

0,5g fresh sample (roots and leaves) were collected from each variant in the 14-th day of germination, and were blended with 8 ml phosphate buffer solution, pH 7.0, diluted 1:9 with distilled water, cooled at 4°C. The samples were centrifuged at 15000 x g, for 20 minutes at 4°C, and the supernatant was separated. The extract is kept in the refrigerator, for 2 hours for stabilizing and expressing enzyme activity.

2.3. Peroxidase activity determination

Peroxidase activity (POX) was determined at 30°C, with a Shimadzu–UV-mini–1240 spectrophotometer, following the formation of tetraguaiacol at 470 nm wavelength, $\varepsilon=26.6 \text{mM}^{-1}\text{cm}^{-1}$, in a 3 ml reaction mixture containing 1 ml of 0.1 M phosphate buffer, pH=6.0, 1 ml 15mM guaiacol, 1 ml of 3 mM H_2O_2, and 50µl of enzyme extract. One unit of peroxidase activity (U) represents the amount of enzyme catalyzing the oxidation of 1 µmole of guaiacol in 1 min, method cited by Kim and Yoo, 1996.

2.4. Catalase (CAT) activity determination

The decomposition of hydrogen peroxide is followed at 240 nm spectrophotometrically (Aeby, 1984). For preparation of the plant extract 0.5 g plant material was homogenizing with 3 ml 0.1 M Na-phosphate buffer (pH = 6.5).

We measure into a quarz cuvette: 2 ml above phosphate buffer (pH = 6.5), 100 µl hydrogen peroxide solution (12.5 mM concentration), 50 µl plant extract. The solution is mixed, then the absorption change is registered for 3 min at 240 nm. Slope value (reaction velocity: Δ Extinction per Δ time) is calculated.
Then:

$$\text{activity} = \frac{2.15 \text{ ml}}{0.05 \text{ ml}} \cdot \frac{1}{0.04 \text{ mM}^{-1}} \cdot \frac{\Delta E}{\Delta t \, (\text{min})} \cdot \frac{3 \text{ ml}}{0.5 \text{ g}} = 6450 \frac{\Delta E}{\Delta t}$$

Where $0.040 \text{ mM}^{-1}\text{cm}^{-1}$ is the extinction coefficient of H_2O_2 at 240 nm
Unit: µmol hydrogen peroxide $\text{g FW}^{-1} \text{ min}^{-1}$

2.5. Proline determination

Proline was determined following Bates et al (1973). For the proline determination 0.5 g of plant material was homogenized 10 ml of 3% aqueous sulfosalicylic acid and the homogenate filtered throught Whatman Nr.2 filter paper. 2 ml of filtrate was treated with 2 ml acid ninhydrin and 2 ml glacial acetic acid in a test tube for 1 hour at 100°C, and the reaction terminated in an ice bath. The reaction mixture was extracted with 4 ml toluene, mixed vigorously with a test tube stirrer for 15-20sec. The cromophore containing toluene was aspired from the aqueous phase warmed to room temperature and the absorbance read at 520 nm using toluene for a blank. The proline concentration was determined from a standard curve and calculated on a fresh weight basis as follows:

[µg proline/ml x ml toluene / 115.5 µg/ µmole]/ [g sample/5] = µmoles proline/g of fresh weight material.

2.6. Assimilatory pigments

After 14th day we determined the content of chlorophyllian pigments of the sunflower plantlets primary leaves, using *N,N-dimethylformamide*, 99.9%, (Moran and Porath, 1980) for the extraction. The extraction of assimilatory pigments in higher plant tissue using *N,N-dimethylformamide* (DMF), expedites the process and enables the determination of small samples with low pigment level (Moran, 1982). There is a vast array of solvents used for the extraction and determination of the chlorophyllian pigments, but most of them necessitate grinding and centrifuging of material with or

without heating. The use of DMF renders the process simpler and faster, since the pigments can be extracted from intact tissue. For extraction, 50 mg fresh weight of primary leaves, were collected separately from each sample, and were blended with 5ml DMF and then cooled at 4°C for 72 hours. The supernatant was separated and the content of the pigment was determined using a UV-visible mini–1240 Shimadzu spectrophotometer, at 664 nm wave length for chlorophyll $\underline{a}$, 647 nm for chlorophyll $\underline{b}$ and 480 nm for carotenoids.

The data obtained after the spectrophotometrycal determination, was mathematically processed using formulae proposed by Moran and Porath (1980).

Chlorophyll $\underline{a}$ (mg/g sp) = (11.65 a_{664} – 2.69 a_{647}) • V/sp
Chlorophyll $\underline{b}$ (mg/g sp) = (20.81 a_{647} – 4.53 a_{664}) • V/sp
Carotenoids (mg/g sp) = (1000 A_{480} – 1.28 chloroph.$\underline{a}$ – 56.7 chloroph.$\underline{b}$)/ 245 • V/sp

The results obtained for all parameters are averages of 3 determinations and were statistically processed by the "t- test" using *Prisma 5 for Windows*. The values of the probabilities were determined from tables using the values of the "t" distribution and the freedom degrees based on which the variance of the empiric series was calculated.

2.7. Antifungal effect of ASA

Biological activity of ASA was studied in preliminary tests made in vitro and in vivo conditions. These tests were performed at the Agricultural Research Station Oradea. The performed tests shows a promising antifungal effect of ASA produced by Sinteza Chemical Work Oradea. ASA was tested as crystals and powder concerning their effect in vitro on the growths dimension of two parasitic fungi of sunflower, *Botrytis cinerea* and *Sclerotinia sclerotiorum*. We used local isolates of these very important parasitic fungi of the sunflower and another plants in the Western part of Romania. In the field testing we used our autohton hybrids (Fundulea 90, Felix), in natural and artificial inoculation with these pathogens.

3. RESULTS AND DISCUSSION

Peroxidase (POX) activity significantly increased ($p<0.005$) in roots of sunflower seedling and a very significant increased ($p<0.001$) was registered in leaves of sunflower after treatment with 150 mM NaCl solution, in the 14-th day of experiment, in comparison with the control lot, germinated in tape water. The soaking and the foliar treatment with 0.1 mM acetylsalcylic acid (ASA) has a protective effect during salt stress. In leaves of sunflower seedling POX activity decreased very significantly, but remained almost unchanged in the roots of seedlings in comparison with salt treated seedling (tabel 1, fig. 1).

Studying the CAT activity in the roots and leaves of sunflower seedlings, we observed a very significant increase of this activity in stressed seedling in comparison with the control lot (unstressed). The CAT activity decreased very significant in ASA treated seedling in comparison with the same parameters in stressed seedling (table1, fig.1).

*Table 1. Estimative mean values for the antioxidant enzymes activity seedling in roots and leaves of sunflower seedlings after 14 days of experiment.*

		Antioxidant enzymes	
		Peroxidase (POX) (U)	Catalase (CAT) (U)
Control lot	root	0.013± 0.0026	2.43±0.0264
	leaf	0.01±0.0017	2.86±0.0655
150 mM Salt treatment	root	0.02±0.0101 *	9.52±0.3377 ***
	leaf	0.087±0.0055 ***	11.43±0.1587 ***
0.1mM ASA and 150 mM Salt treatment	root	0.018±0.0052 *	3.33±0.204 ***
	leaf	0.032±0.0026 ***	6.19±0.0916 ***

p>0.05= not significant; p<0.05 * significant; p<0.01=** distinctly significant; p<0.001=*** very significant in comparison with control lot.

The antioxidant enzymes activity like peroxidase (POX) and catalase (CAT), enhanced by salt treatment. The highest value for POX activity was registred in leaves of sunflower seedling. In case of CAT activity the values of the enhancements of the enzyme extracts from both, roots and leaves, were similar. Bandeoglu et al, 2004, observed that upon salt stress no significant enhancement in activity of antioxidant enzymes was registered, in roots of lentil, but a higher activity was present when compared with the leaf tissue. These results suggested that roots tissue of lentil is protected better from salt stress induced oxidative damage. Acetylsalicylic acid pre-treatment ameliorate the peroxidase and catalase activity under salt stress in enzymes extracts of sunflower seedlings.
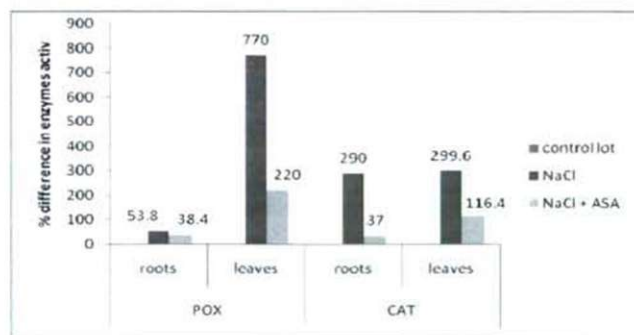
Fig.1. Percentage differences of the activity of antioxidant enzymes, POX and CAT, measured in roots and leaves of sunflower seedlings, in comparison with the same parameters measured in the leaves of sunflower plantlets from the control lot sprayed with water. The value for the control lot was considered 100% (marked with 0 on the chart).

Studying the content of chlorophyllian pigment (chlorophyll a and b) and carotenoids on the leaves of the sunflower seedling obtained from each experimental variant, we observed that the content of assimilatory pigments decreased very significantly after salt stress, but the pre-soaking and the foliar treatment with the 0.01 mM ASA solution,

reduced this difference, in comparison with the control lot (table 2 and fig 2). Similar results were obtained by Kaydan et al. 2007, they observed that under the influence of salinity the photosynthetic pigments greatly decreased. El Tayeb in 2005 found that chl a, b and carotenoids decreased significantly in NaCl treated plants in comparison to controls of barley plants.

Table 2. Estimative mean values for the assimilatory pigments content of the sunflower seedling leaves after treatment salt stress or with ASA solutions treatment.

	Assimilatory pigments		
	chl a (mg/g)	chl b (mg/g)	caroten (mg/g)
Control lot	1.247±0.0151	0.623±0.0132	0.322±0.006
150 mM Salt treatment	1.158±0.005 ***	0.376±0.0078 ***	0.245±0.0096 ***
0.1mM ASA and 150 mM Salt treatment	1.200±0.006 **	0.445±0.0096 ***	0.308±0.0051 *

p>0.05= not significant; p<0.05 * significant; p<0.01=** distinctly significant; p<0.001=*** very significant in comparison with control lot.
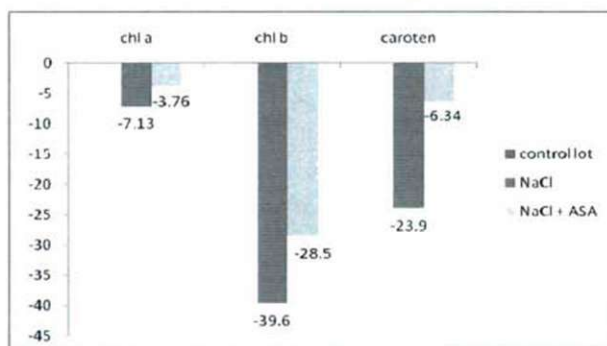
Fig.2. Percentage differences of the content of assimilatory pigments in the leaves of sunflower seedlings, in comparison with the same parameter measured in the leaves of sunflower plantlets from the control lot sprayed with water. The value for the control lot was considered 100% (marked with 0 on the chart).

Under stress condition, free proline (amino acid accumulate in higher plants under salinity stress) level increased in the leaves of sunflower seedlings. Studying the value after spectrophotometrycal determination of proline content, we observed that under salt stress the proline content increased very significantly, with 75,9%, in comparison with control lot. The treatment with 0.1mM ASA alleviated the effect of salt stress, and the free proline content in this condition was lower (with 29%) than in case of salt stressed sunflower seedlings (fig.3). Proline can be used as a metabolic marker in relation to stress. Proline produces immediately after encounter of cells with salt stress and protects the plasma membrane and proteins against stress (Santoro et al. 1992).
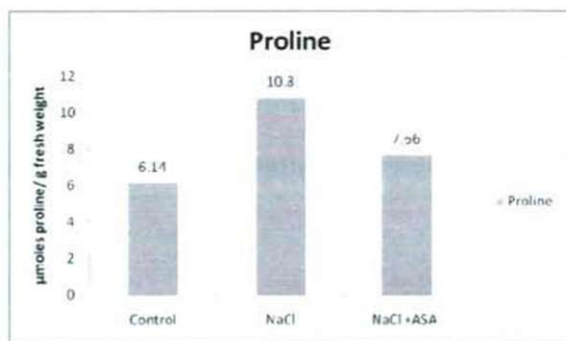
Figure.3 Proline content in sunflower seedling in stressed or unstressed condition with or without ASA treatment

Studying the influence of ASA on the isolates pathogen, we observed significant differences in the colony diameter depending on the used concentration. The 20mM concentration both in crystal and powder form of ASA assured significant limitation in the grows of *Botrytis cinerea* and *Sclerotinia sclerotiorum* colonies after 24 and 96 hours (table 4 and 5).

Studies regarding the influence of AS on seed germination shows a positive effect of ASA powder applied in sunflower seed dressing on the percentage of seed germination and frequency of infected plants, after a 7 day incubation period (table 6).

Table 4. Influence "in vitro" of ASA incorporated in PDA the grows of Botrytis cinerea isolated from sunflower -colony diameter in cm.

Concentration	ASA applied			
	Crystals		Powder	
	after 24 hours	after 96 hours	after 24 hours	after 96 hours
2,5 mM	0.20^{++}	7.00	0.90	2.00
5 mM	0.20^{++}	7.00	0.65^{o}	1.25^{ooo}
10mM	0.20^{++}	7.00	0.45^{oo}	1.10^{ooo}
20mM	0.10^{oo}	6.00^{oo}	0.40^{oo}	1.00^{ooo}
Check	0.15	7.00	1.00	2.00
SD 5%	0.03	0.09	0.31	0.24
SD 1%	0.04	0.14	0.43	0.33
SD 0,1%	0.06	0.19	0.61	0.47

Table 5. Influence "in vitro" of ASA incorporated in PDA on growing of Sclerotinia sclerotiorum isolated from sunflower -colony diameter in cm.

Concentration	ASA applied			
	Crystals		Powder	
	after 24 hours	after 96 hours	after 24 hours	after 96 hours
2,5 mM	0.700	7.000	0.250^{ooo}	2.000^{ooo}
5 mM	0.700	7.000	0.325^{ooo}	0.650^{ooo}
10mM	0.700	7.000	0.125^{ooo}	0.525^{ooo}
20mM	0.700	5.275^{ooo}	0.000^{ooo}	0.250^{ooo}
Check	0.700	7.000	2.000	3.000
SD 5%	-	0.25	0.22	0.24
SD 1%	-	0.35	0.31	0.34
SD 0,1%	-	0.49	0.44	0.48

Table 6. Influence of ASA applied in seed dressing on seed germination and frecquency of Bortytis cinerea and Sclerotinia sclerotiorum infection in sunflower

Seed treatment	Dose g/kg	% seed germination	F% infected plats	
			S. sclerotiorum	B. cinerea
Metoben 70WP	2	95.5	1.0	2.0
Rovral 50WP	2	95.0	1.0	1.5
ASA powder	1	93.5	2.0	3.5
Check (untreated)	-	89.5	3.5	8.5

- 7 day incubation in humid chamber

Studying the influence of ASA applied in seed dressing performed in the experimental plots of ARS Oradea, shows the positive influence on seed emergency percentage in field conditions, in comparison with the untreated check and two fungicides (Metoben 70 WP and Rovral 50 WP) usually used in seed dressing of sunflower. There was applied artificial inoculation at the sowing using mycelium and sclerotia of the fungus grows on autoclaved barley seed. Our results indicated also a limitative effect on the frequency of infected plants in comparison with the untreated check. The yield difference registered in these conditions (150 kg/ha, respective 10.3%) after the seed treatment with ASA powder (1 g/kg seed) shows the positive but not significant effect of ASA in the assured high infection pressure (table 7) and the necessity of the extension of our research in this direction.

Table 7. Influence of ASA applied in seed dressing on frecquency of Sclerotinia sclerotiorum infection and yield level in sunflower- artificial inoculation with mycelium and sclerotia grows on autoclawed barley seed.

Seed treatment	Dose g/kg	% of emergence	F% infected plats S. sclerotiorum	Yield kg/ha	Differences	
					kg/ha	%
Metoben 70WP	2	95.5	1.0	1750	+300++	20.7
Rovral 50WP	2	95.0	1.0	1700	+250++	17.2
ASA powder	1	93.5	2.0	1600	+150	10.3
Check (untreated)	-	89.5	3.5	1450	-	-

SD 5% 180 kg/ha
SD 1% 245 kg/ha
SD 0.1% 350kg/ha

The repeated field test in condition of natural infection confirms the favorable effect of seed dressing on the plant emergency percentage, on the frequency of natural infected plants and also on the yield quantity. The yield difference registered in comparison with the untreated check in this case was significant (table 8). These promising positive results motivates the necessity of the extension of our research in this direction.

Table 8. Influence of ASA applied in seed dressing on frecquency of Sclerotinia sclerotiorum infection and yield level in sunflower.

Seed treatment	Dose g/kg	% of emergence	F% infected plats S. sclerotiorum	Yield kg/ha	Differences	
					kg/ha	%
Metoben 70WP	2	95.7	0.5	2150	+200++	10.2
Rovral 50WP	2	96.5	0.5	2270	+220++	11.3
AAS powder	1	94.5	0.7	2100	+150++	7.7
Check (untreated)	-	90.5	1.9	1950	-	-

SD 5% 105 kg/ha
SD 1% 145 kg/ha
SD 0.1% 225 kg/ha

4. CONCLUSION

- The results obtained after pre-treatment of sunflower seeds with ASA may cause a low level of oxidative stress, improving the antioxidative capacity of the plants, increasing the plant tolerance to salt stress induced in our experiment by 150 mM NaCl treatments and the total clorophyllian pigment content under salt stress.
- The presence of ASA in PDA nutrient medium assured significant limitative effect in the colony diameter of two pathogenic fungi (*Botrytis cinerea* and *Sclerotinia sclerotiorum*), this effect depending on the used concentration.
- ASA applied in sunflower seed dressing performed in the field plots of ARS Oradea, shows the positive influence on seed emergency percentage, limiting the level of infected plants with *Sclerotinia sclerotiorum* in field conditions, in comparison with the untreated check and two large used fungicides. In condition of natural infection seed treatment had significant effect also on the yield level.

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POSITIONING OF PNEUMATIC ARTIFICIAL MUSCLE UNDER DIFFERENT TEMPERATURES

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ABSTRACT

Some researchers have mentioned that temperature creates an important part in the accuracy of positioning of pneumatic artificial muscles (PAMs). However, in literature investigations for measuring temperature inside and outside the PAMs have not been found. This paper presents our robust motion control of these muscle actuators under different temperatures using sliding-mode control.

1. INTRODUCTION

The working principle of the pneumatic artificial muscles is well described in literature ([1], [2], [3], [4], [5] and [6]).

There are a lot of advantages of these muscles like the high strength, good power-weight ratio, low price, little maintenance needed, great compliance, compactness, inherent safety and usage in rough environments. However, problems with the control of the highly nonlinear pneumatic systems have prevented their widespread use [7]. For this, a fast and robust control necessary to achieve the desired motion. Several control ways have been applied to control different humanoid or robot arms, manipulators, prosthetic and therapy devices driven by pneumatic artificial muscles. The early control methods were based on classical linear controllers and then some modern control strategies have been developed (e. g. adaptive controller, sliding-mode controller, fuzzy controller, neural network controller and others) [8].

The layout of this paper is as follows. Section 2 (Materials and methods) is devoted to display our test-bed and different LabVIEW programs. Section 3 (Result and discussion) presents several experimental results. Finally, section 4 (Conclusion and future work) gives the investigations we plan.

Fluid Muscles DMSP-20-200N-RM-RM (with inner diameter of 20 mm and initial length of 200 mm) produced by Festo company were selected for our newest study.

2. MATERIALS AND METHODS

A good background of our test bed and former experimental results of positioning can be found in [9].

The PAMs were installed horizontally and can be controlled by MPYE-5-M5-010-B type proportional valve made by Festo. Our robust position control method based on sliding-mode control. The linear displacement of the actuator was measured using a LINIMIK MSA 320 type linear incremental encoder with 0,01 mm resolution.

To measure temperature inside and outside the muscle the test-bed was completed two thermocouples type K (Figure 1). Figure 2 shows the block diagram of this positioning system with proportional valve.

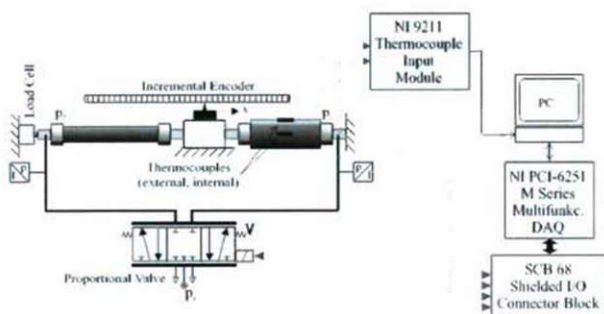*Figure 1. Muscle with two thermocouples*

Figure 2. Block diagram of positioning system with proportional valve

The data acquisition and positioning that can be achieved in LabVIEW environment (Figure 3). Aside from the desired position the number of samples and the sampling time can also be set. The data can be saved into a text file.
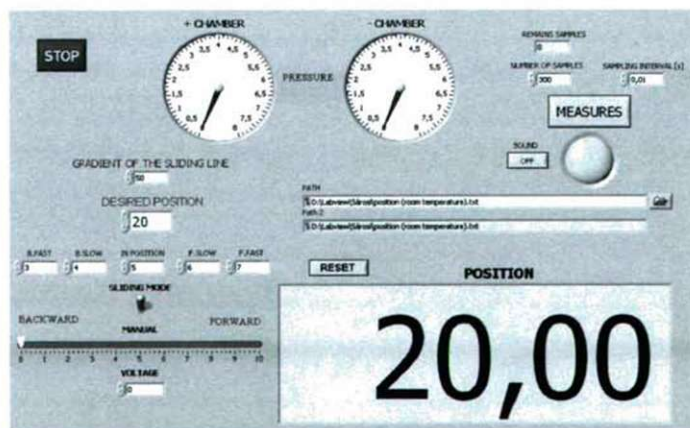
Figure 3. Front panel of LabVIEW program for positioning

The Figure 4 shows the front panel of the LabVIEW program created for temperature measurement. Here the number of samples and sampling time can also be set. During the periodic and automatic working of the muscles the contraction and rate of release can be adjusted with the frequency of the sine wave. The temperature inside and on the surface of the muscle can be read on the indicators on the screen also it is shown as a number. The measured results are saved in a text file for later processing.
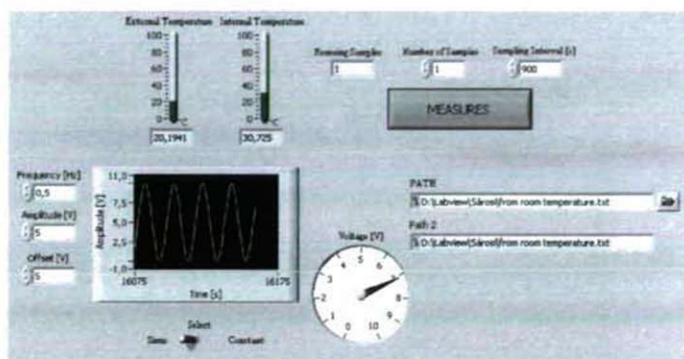
Figure 4. Front panel of LabVIEW program for measuring temperature

3. RESULTS AND DISCUSSION

Positioning was first done in room temperature on the pressure of 6 bar. The desired positioning was set to 20 mm, the number of samples was set to 300, while the sampling rate was set to 10 ms, thus the measurement took 3 s.

Figure 5 shows the positioning as a function of time. It took about 2 s for the position to reach the set value. To show the accuracy of positioning the area around the desired position has been magnified (Figure 6). This Figure shows the accuracy of positioning is within 0,01 mm.
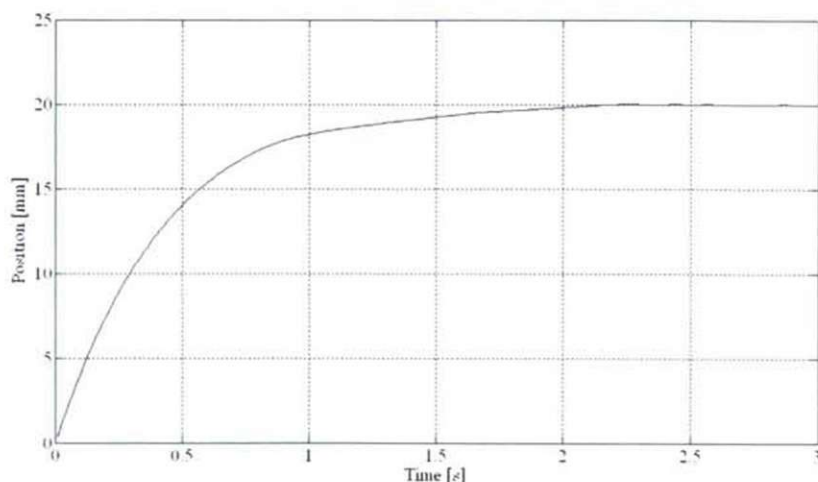
Figure 5. Position as a function of time
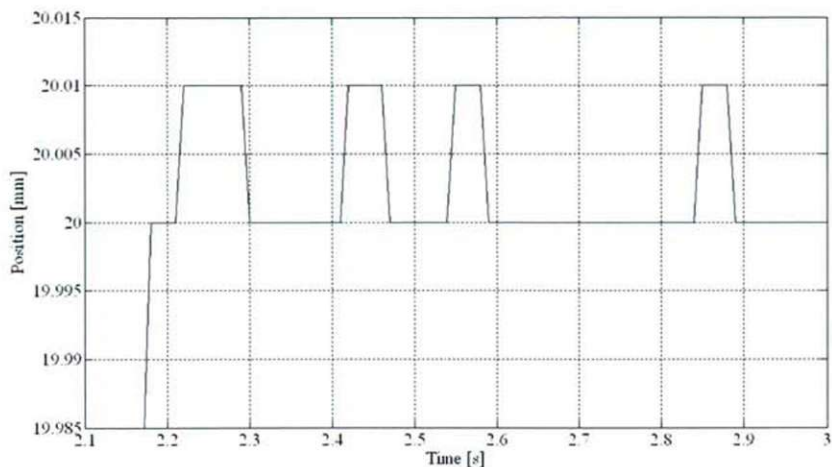
Figure 6. Position as a function of time (enlarged)

The periodic working of the muscles was achieved with a 0,5 Hz frequency sine wave. The measurement took 900 s during which the sampling time was 0,25 s, the acquired data is shown in Figure 7. While the surface temperature reached about 33 °C, the internal temperature oscillated a lot during contraction and release, for this reason a spline approximation was used for the internal temperature (Figure 8).
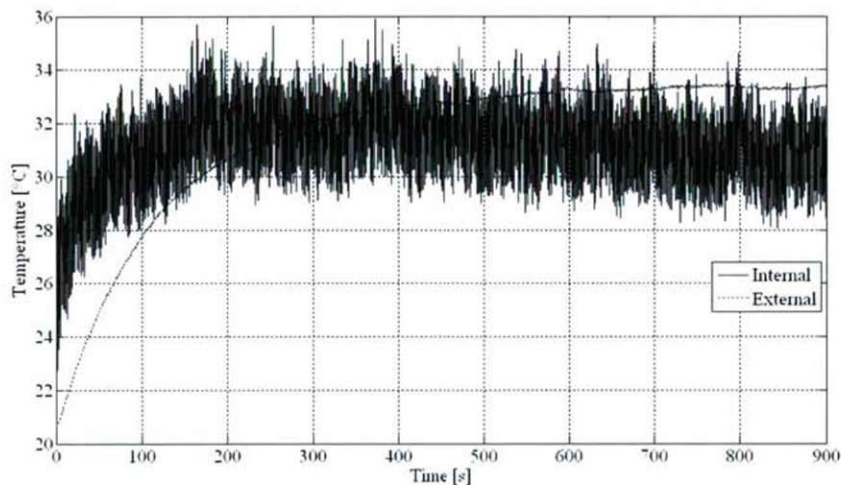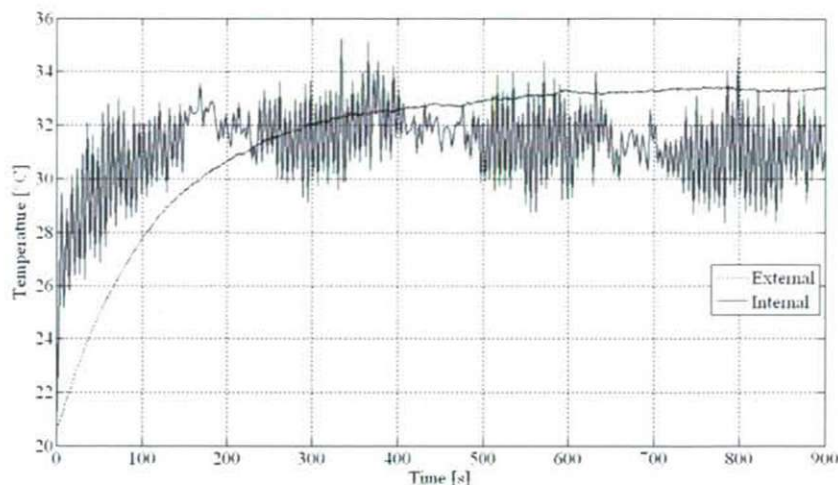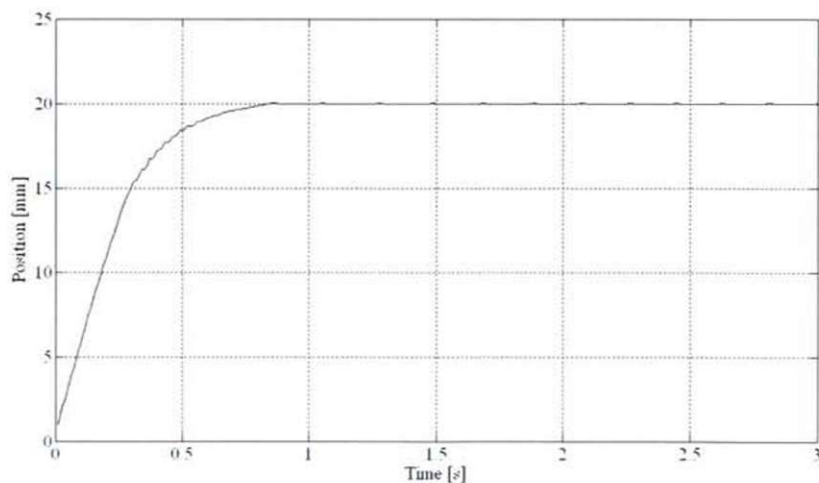

Figure 7. Temperature as a function of time

Figure 8. Temperature as a function of time with spline interpolation for internal temperature

After a constant temperature was reached positioning was measured on the pressure of 6 bar, too. The result of it is shown in Figure 9. It shows the desired position was reached within 0,8 s. To show the accuracy of positioning the area around the desired position has been magnified (Figure 10). The accuracy of positioning remained within 0,01 mm.

Figure 9. Position as a function of time after work cycle
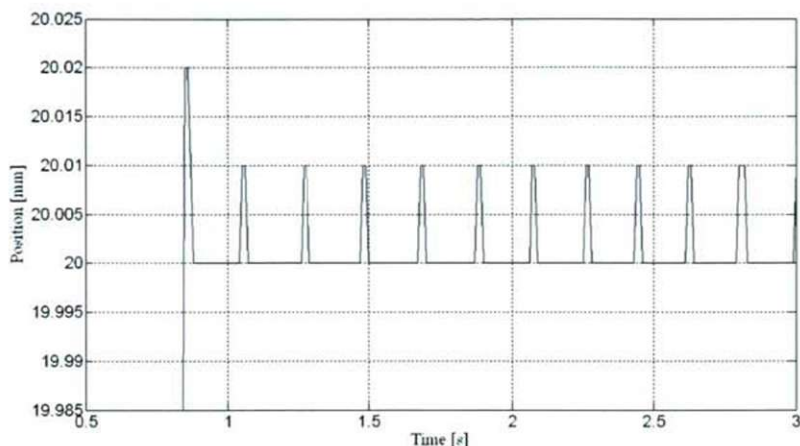
Figure 10. Position as a function of time (enlarged) after work cycle

4. CONCLUSION AND FUTURE WORK

From these measurements the conclusion is that the ideal working temperature of the muscles is not room temperature, but greater than that. To prove it new measurements will be conducted with muscles with varying geometric properties.

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EXPERIMENTAL SETUP FOR THE POSITIONING OF HUMANOID UPPER ARM

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ABSTRACT

Several control ways have been applied to control different humanoid or robot arms, manipulators, prosthetic and therapy devices driven by pneumatic artificial muscles (PAMs). The early control methods were based on classical linear controllers and then some modern control strategies have been developed (e. g. adaptive controller, sliding-mode controller, fuzzy controller, neural network controller and others) ([1], [2] and [3]).
This paper presents a humanoid upper arm and discusses its positioning using sliding-mode control.

1. INTRODUCTION

Nowadays, pneumatic actuators have been considered as a substitute of conventional motors because of its high power/weight and power/volume ratios. The newest type of pneumatic actuator the McKibben muscle possesses all advantages of traditional pneumatic actuators without the main drawback such as low power to weight ratio. The main disadvantages are connected with the accuracy of control and nonlinearities of pneumatic systems [4].

The behaviour and structures of PAMs are well described in literature ([5], [6] and [7]).

Many researchers have studied to generate easier model of PAM to overcome difficulty in control because of it's nonlinearity, also some have tried to control robot using that model, but their studies are limited on simulation and their good performances are valid only being applied to simulation model. Physical implementation is more complicated problem [4].

Pneumatic artificial muscles show similarity to biological muscles, for this it's very effective to implement humanoid. The PAMs are one-way acting, we need two ones to generate bidirectional motion: one of them moves the load, the other one will act as a brake to stop the load at its desired position and the muscles have to change function to move the load in the opposite direction. This specific connection of the muscles to the load is generally named as an antagonistic setup.

The layout of this paper is as follows. Section 2 (Materials and methods) is devoted to display our test-bed and the LabVIEW program for positioning. Section 3 (Result and discussion) presents several experimental results. Finally, section 4 (Conclusion and future work) gives the investigations we plan.
Fluid Muscles DMSP-10-250N-RM-RM (with inner diameter of 10 mm and initial length of 250 mm) produced by Festo company were selected for our newest study.

2. MATERIALS AND METHODS

In [8] can be found detailed descriptions of our test bed and former experimental results for positioning.

The newest setup for positioning a humanoid upper arm is shown in Figure 1. The PAMs were installed horizontally and can be controlled by MPYE-5-M5-010-B type proportional valve made by Festo.

Because of the difficulties caused by the nonlinear properties of pneumatic systems a LabVIEW based sliding mode control was designed. The purpose of positioning is to move the arm from a starting position to a desired position. With the use of sliding-mode control the positioning error can be minimized. The positioning of the arm was measured with a BDF-6350-3-05-2500-65 type (produced by Balluff) rotary incremental encoder.

The signals from the encoder have to be acquired by the LabVIEW program so that they can be used by computer The device is a NI 6251 card equipped with a PCI interface, to this a SCB 68 type I/O device has been attached with a special connecting cable, on the data acquisition card there are 16 16-bit analog inputs and two 16-bit analog outputs also there are 24 digital inputs and two 32-bit counters as well.
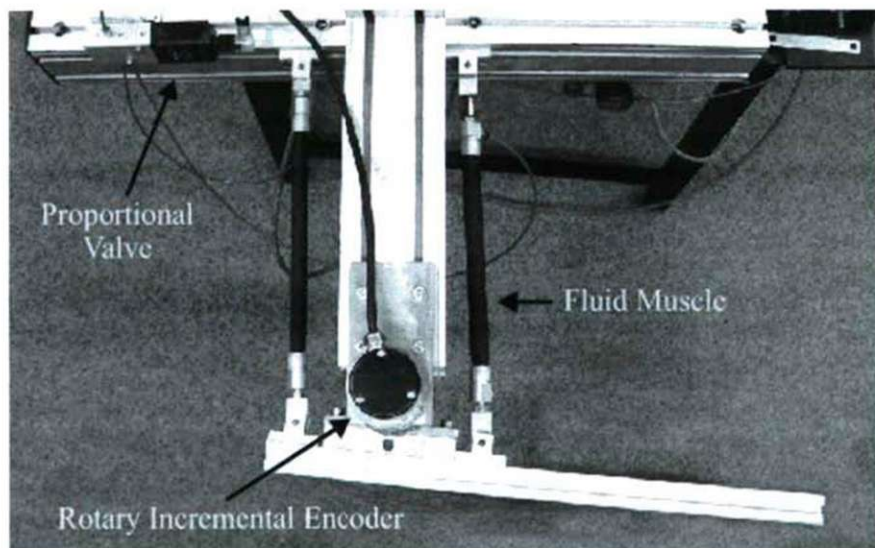
Figure 1. Experimental setup

The Figure 2 shows data acquisition and positioning that can be achieved in LabVIEW environment. Aside from the desired position the number of samples and the sampling time can also be set. The data can be saved into a text file.
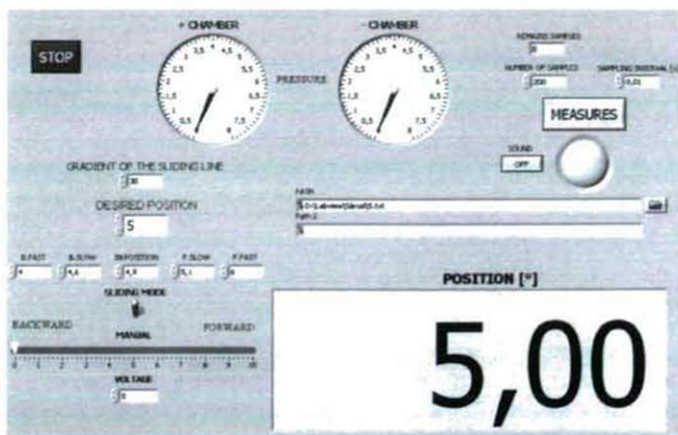
Figure 2. Front panel of LabVIEW program for positioning

3. RESULTS AND DISCUSSION

Positioning was first done in room temperature on the pressure of 6 bar. The desired positioning was set to 5°, the number of samples was set to 200, while the sampling rate was set to 10 ms, thus the measurement took 2 s. The quality of the positioning (overshot, steady state error) can be manipulated with the slope of the sliding line. When choosing the slope of the sliding line the optimum between two concurrent properties must be found (speed, accuracy). The more smaller the slope the more faster the trajectory reaches the sliding line, but it will take longer to set. For the slope of the sliding line a value of 30 was set.

Figure 3 shows the positioning as a function of time. It took about 0,8 s for the position to reach the set value. To show the accuracy of positioning the area around the desired position has been magnified (Figure 4). It has been observed that the value of the steady state error is quite favorable, 0,04°.

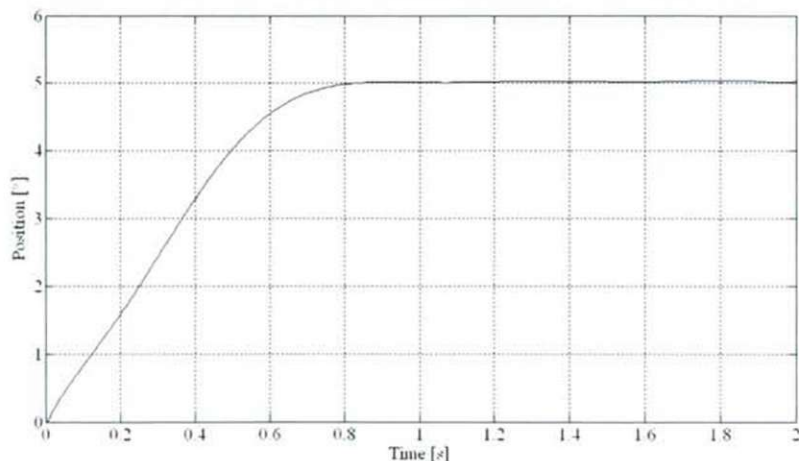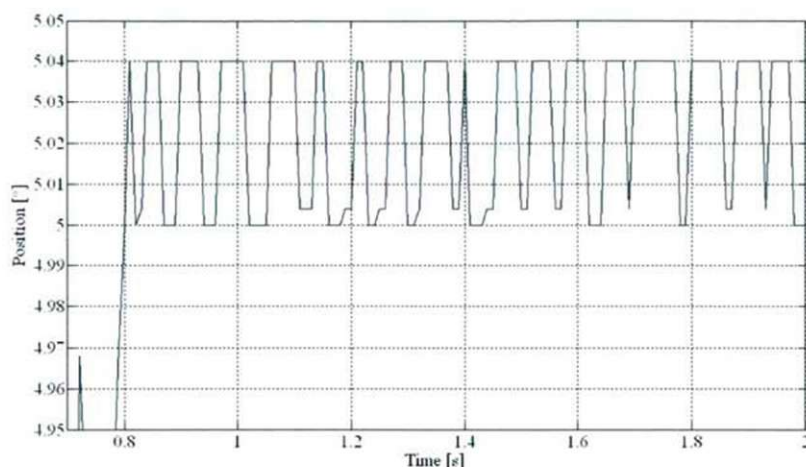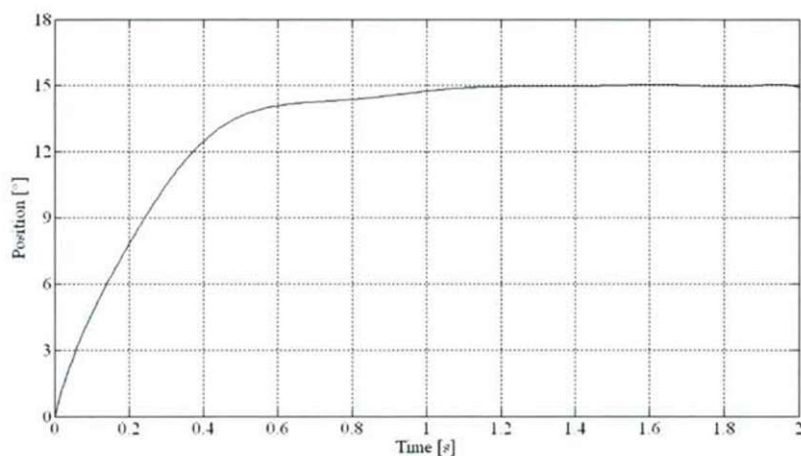*Figure 3. Position as a function of time in desired position of 5°*

Figure 4. Position as a function of time in desired position of 5° (enlarged)

The measurements were repeated in 15° position. The desired positioning was set to 15°, the number of samples was set to 200, while the sampling rate was set to 10 ms, thus the measurement took 2 s, and the slope of the sliding line a value of 30 was set. Figure 5 shows the positioning as a function of time. It took about 1,2 s for the position to reach the set value. To show the accuracy of positioning the area around the desired position has been magnified (Figure 6). This Figure shows the accuracy of positioning is within 0,04°.

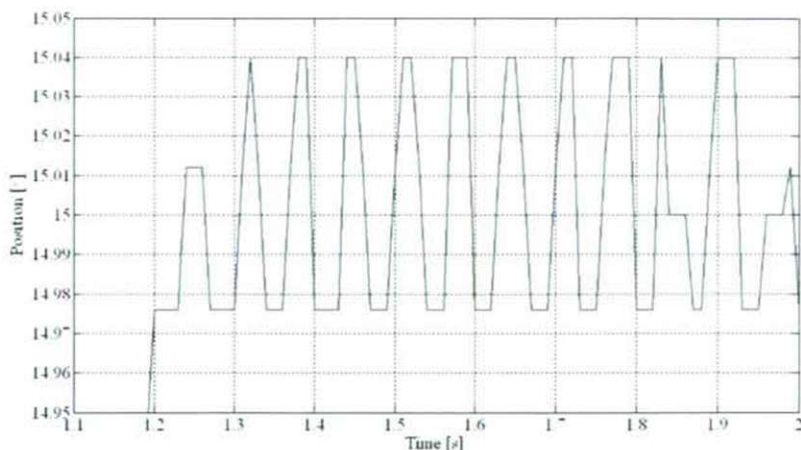*Figure 5. Position as a function of time in desired position of 15°*

Figure 6. Position as a function of time in desired position of 15° (enlarged)

4. CONCLUSION AND FUTURE WORK

From these experiments we concluded is that the sliding-mode control can be used for precise robust control of positioning of a humanoid upper arm, for it is fast, robust to external interferences and the changing of internal parameters. Our plans include building a new arm with more muscles and more degrees of freedom for more complex movement and analyzing the data.

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ASSESSMENT OF ANTIOXIDANT ACTIVITY
OF HEXANE AND ETHANOLIC TOMATO POMACE EXTRACTS

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ABSTRACT

In this paper antioxidant activity of hexane and ethanolic tomato pomace extracts (obtained from tomato varieties: Bačka and Saint Pierre) was investigated. The contents of phenolic compounds and flavonoids in ethanolic and lycopene and β-carotene in hexane extracts were determined spectrophotometrically. The antioxidant activity of tomato pomace extracts was determined using different tests, including reducing power and 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assays.

1. INTRODUCTION

The processing of fruits and vegetables results in the production of solid wastes which are promising sources of bioactive compounds. Tomato (*Lycopersum esculentum*) is the most important source of lycopene and also, contains a number of flavonoids and phenolic acids. The tomato pomace, by-product generated during juice processing is a potential source of these compounds.

2. MATERIALS AND METHODS

2.1. Extraction procedure

Samples (10 g) of freeze dried pomace obtained from tomato varieties Bačka and Saint Pierre were extracted, sequentially with hexane and 80% ethanol, using an ultrasonic bath, Heidolph DIAX 900. The obtained extracts were evaporated to dryness under reduced pressure. The yields of hexane extracts were 1.21% for Bačka and 4.61% for Saint Pierre and the yields of ethanolic extracts were 36.18% Bačka and 44.35% for Saint Pierre.

2.2. Contents of antioxidant compounds in tomato pomace extracts

The lycopene and β-carotene content in hexane extracts were determined according to the method of Nagata and Yamashita[1]. The amount of total soluble phenolics in ethanolic extract was determined spectrophotometrically according to the Folin-Ciocalteu method[2]. Total flavonoids were measured in ethanolic extract using a assay developed by Zhishen[2].

2.3. Antioxidant activity of tomato pomace extracts

The antioxidant activity of tomato pomace extracts was determined using different tests, including reducing power and 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assays[2].

3. RESULTS AND DISCUSSION

The contents of antioxidant compounds in hexane and ethanolic extracts, expressed as mg per g dry weight of tomato pomace extract, is listed in Table 1. The higher contents of

lycopene (13.10 mg/g) and β-carotene (14.87 mg/g) were detected in the Bačka pomace extract. The amounts of total phenolics (16.23 mg/g) and flavonoids (12.05 mg/g) were higher in the Saint Pierre pomace extract.

Table 1. The contents of antioxidant compounds in tomato pomace extracts

Varieties	Hexane extract		Ethanolic extract	
	Lycopene (mg/g)	β-carotene (mg/g)	Phenolics (mg/g)	Flavonoids (mg/g)
Bačka	13.10	14.87	11.70	7.62
Saint Pierre	4.29	6.22	16.23	12.05

The investigated tomato pomace extracts were able to scavenge stable free DPPH radical (Figure 1) and the higher antioxidant activity expressed as IC_{50}^{DPPH} value was obtained in the case of hexane extracts; IC_{50}^{DPPH} value was 0.06 mg/ml for Bačka pomace extract and 0.16 mg/ml for Saint Pierre pomace extract. Figure 2 shows the reducing powers of the tomato pomace extracts. The reducing power of the extracts increased with increasing concentration.
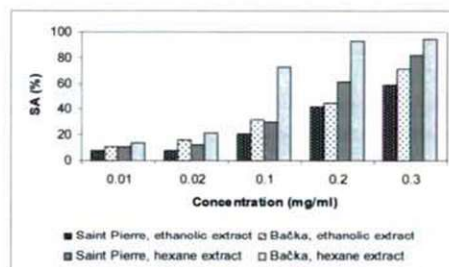
Figure 1. DPPH free radical scavenging activity of tomato pomace extracts
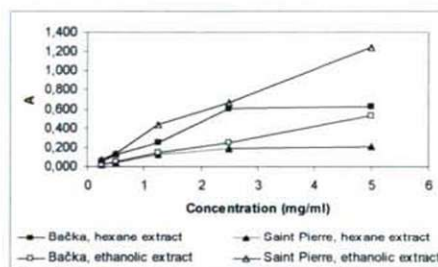
Figure 2. Reducing power of tomato pomace extract

The obtained results show that the tomato pomace should be regarded as a valuable source of carotenoids and phenolic compounds and has potential as a value-added ingredient for functional foods.

ACKNOWLEDGEMENT

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SEDIMENTATION COMBINED b

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ABSTRACT

This paper introduces the research about the possibility of applying microfiltration through a ceramic tubular membrane with 200 nm pore sizes to the wastewater obtained in the production process of wheat starch and vital wheat gluten. The consumption of process water would thus be reduced, the starch would be exploited better to a greater extent and the wastewater problem would consequently be solved. The second issue examined is the efficiency of the combination with sedimentation prior to the microfiltration as to reduce the occurrence of polarization layer on the membrane and to keep the wastewater permeate flux through the membrane constant as possible. The independent variables, the parameters that vary during the course of microfiltration, are the transmembrane pressure, flow rate and the wastewater sedimentation time prior to microfiltration while the dependent parameter that is constantly monitored during the process is the permeate flux. The maximum value of the permeate flux ($24~\mathrm{lm^{-2}h^{-1}}$) was achieved at three bars and at a flow rate of $150~\mathrm{lh^{-1}}$ after having initially allowed the wastewater to settle for four hours. Microfiltration reduces the wastewater dry matter from 11,000 mg/l to 4,000 mg/l and it also significantly decreases the values of the suspended matter, namely from 9,000mg/l to 300mg/l.

1. INTRODUCTION

In the industry of wheat processing for starch production water is used in the process of flour hydration, starch and gluten separation, starch refinement, for cooling the product of the starch hydrolysis, as well as for cleaning the used equipment and the work space. The greatest part of the wastewater that comes into existence during the process of starch production applying Martin process is obtained during the starch separation process. The obtained water settles, after which it is decanted and after a specific period of time it undergoes a purification procedure [1, 2, 3].
Water elimination and the separation of the product are the two basic processes affecting the quality and economy of the starch industry [1, 2, 3].
For a long time scientists have been investigating the application of membrane processes in wastewater treatment and in the filtering of the intermediate products in the wheat starch production [2, 3, 4, 5].
Governments of the developed countries have tried to increase the pressure on the largest waste producers in order to reduce the undesired environmental pollution. For example, the Commission of the European Communities introduced the Integral Pollution and Prevention Control Directive (Council Directive, 1996). The purpose of the directive is to achieve integrated prevention and the control of pollution arising from the particular activities listed in its Annex I. Among others, the directive defines the Best Available Techniques (BAT) as the most effective and advanced stage in the development of activities and their operation methods which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment. The European IPPC Bureau published a relevant document (BREF)

where the BAT for the Food, Drink and Milk Industry are presented. To a larger extent, the general techniques commonly used in this industry are described. However, no BAT is described relating specially to sugar beet production. Detailed information can be found in chapter 4, under the title Techniques to Consider in the Determination of BAT. The chapter contains a list of various pollution prevention, waste minimization and energy efficiency techniques applied in industry that are described everywhere, e.g. in books, journals, leaflets, the internet, etc [6, 7].

Membrane separation is a filtration technique in which a solution is forced through a porous membrane. Some of the dissolved solids are held back because their molecular size is too large to allow them to pass through. The size range depends upon the type of membranes used. Fractionation of the feed stream occurs, with some molecules being concentrated on the upstream side of the membrane, which is known as the concentrate or retentate. The smaller molecules pass through the membrane into the permeate stream. The variety of membrane separation techniques can be characterized by their membrane pore size [8, 9, 10].

Membrane filtration is used in order to achieve an increase in the quality of the finished sweetening and syrup products [11]. It has also found its application in the process of water elimination, i.e. dehydration in the course of the production. It is used to isolate proteins from diluted process flows.

A key factor determining the performance of micro- and ultrafiltration membranes is concentration polarization, which causes membrane fouling due to deposition of retained colloidal and macromolecular material on the membrane surface. A number of reviews have described the process in detail [9, 10, 12, 13]. The pure water flux of ultrafiltration membranes is often very high.When membranes are used to separate macromolecular or colloidal solutions, the flux falls within seconds.This immediate drop in flux is caused by the formation of a gel layer of retained solutes on the membrane surface due to concentration polarization. This gel layer forms a secondary barrier to flow through the membrane. This first decline in flux is determined by the composition of the feed solution and its fluid hydrodynamics. Sometimes the resulting flux is constant for a prolonged period, and when the membrane is retested with pure water, its flux returns to the original value. However, a further slow decline in flux occurs over a period of hours to weeks, depending on the feed solution. Most of this second decrease in flux is caused by slow consolidation of the secondary layer formed by concentration polarization on the membrane surface. Formation of this consolidated gel layer, called membrane fouling, is difficult to control. Control techniques include regular membrane cleaning, back flushing, or using membranes with surface characteristics that minimize adhesion. Operation of the membrane at the lowest practical operating pressure also delays consolidation of the gel layer [10].

The aim of this research is to examine the possibility of applying microfiltration through a ceramic membrane to the wastewater obtained during the course of the production of wheat starch and vital wheat gluten. The product of filtration, permeate, would return into the production process in the form of purified water playing the role of the process water, while the retentate with a high starch content could return into the drying process in a centrifugal dry-kiln representing technical quality starch. In such a way the consumption of the process water would be reduced, starch would be exploited to a better and greater extent and the wastewater problem would be eventually solved.

2. MATERIALS AND METHODS

The above mentioned researches concerning wastewater purification involve the procedure of primary sedimentation and microfiltration on a single-channel ceramic membrane with 200 nm pore sizes. The dry matter content of the wastewater varies between 0.85 and 1.2%, the suspended matter is between 4000 and 8000 mg. Solid effluents contain mostly starch, proteins, ash and cellulose.

Experiments of microfiltration are conducted on the samples of decanted wastewater following two, three and four hours' sedimentation, respectively. The dry matter content of the wastewater decanted after 2 hours is 0,95%, after 3 hours is 0,85% and after 4 hours of sedimentation the dry matter content is 0,75%.

The independent variables, the parameters that vary during the course of microfiltration, are the transmembrane pressure, flow rate and the wastewater sedimentation time prior to microfiltration while the dependent parameter that is constantly monitored during the process is the permeate flux. After the filtration has been completed, physicochemical parameters of the permeate and the feed are determined: the dry matter, chemical oxygen demand and suspended matter.

The laboratory apparatus for microfiltration is shown in Figure 1. The feed is dosed out into the tank, the membrane is fixed into the module and, after the working parameters have been set, the filtration of wastewater is initiated. Over a determined period of time the permeate volume is recorded, based on which the permeate flux is calculated.
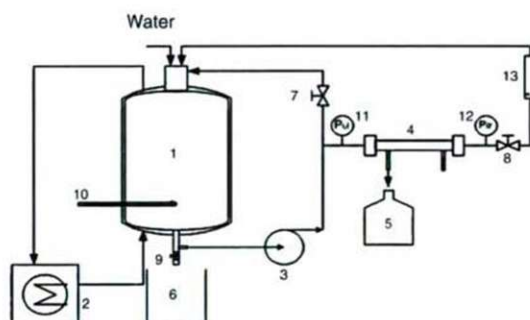

Figure 1. Apparatus for microfiltration (1 – tank, 2 – thermostat, 3 – pump, 4 – module with membrane, 5 –vessel for permeate, 6 – vessel for retentate, 7, 8 – pressure and flow regulation valves, 9 – valve for retentate release, 10 – thermometer, 11, 12 – manometers, 13 – Rotameter)

The central part of the apparatus is the module with membrane inside (Figure 1). In this research the ceramic membrane of manufacturer GEA (Germany) is used. The pore sizes of the membrane are 200 nm. The membrane is single-channel, 250 mm lenght, with inner diameter of 6,8 mm and outer diameter of 10 mm. The membrane is made of α-Al_2O_3 with TiO_2 layer. The active membrane surface equals $0.005m^2$.

The microfiltration experiments were planned based on a full 2^3 factorial designed experiment [14]. In this experiment, the factors, i.e. the independent parameters are the following: p -transmembrane pressure, t -wastewater sedimentation time and Q- flow rate. Table 1 shows the values for the independent parameters which varied during the course of filtration.

Table 1. Varied values of independent variables

Independent variables	q [L/h]	t [h]	P [bar]
Varied values	50 / 150	2 / 4	1 / 3

q – flow rate [L/h]
t – decantation time of the wastewater [h]
P – transmembrane pressure [bar]

The dependent parameter monitored during the process of microfiltration is the permeate flux, which is calculated from the active membrane surface and permeate volume got in determined period of time:

$$J = \frac{V_p}{A_m \cdot t} \qquad (1)$$

where J is permeate flux [L/m²h], V_p is permeate volume [L], A_m is membrane active surface [m²] and t is time [h].
The dry matter content is determined at the beginning and at the end of microfiltration.
The experimental data are processed with computer programmes Statistica for Windows 8.0 and Origin 6.1.

3 RESULTS AND DISCUSSION

Experiments are started with comparition of water flux and wastewater flux. On the Figure 2 the water flux and permeate of wastewater decanted after 4h, depending on the tranmembrane pressure at microfiltration on ceramic membrane with pore sizes of 200 nm at flow rate of 50 L/h and at room temperature can be seen. The water flux is the basic parameter for flux comparition with permete wastewater flux. It can be seen that the permeate flux of wastewater decanted after 4 h is 15 times reduced at transmembrane pressure of 1 bar compared to water flux (21 L/m²h). Such an effect can be ascribed to an increased adsorption and adhesion of particles and solutes on the membrane, which leads to an effective decrease in the diameter of the pores and a decline in the permeate flux. Such a change, i.e. flux decline is explained by the concentration polarization and the formation of a layer containing wastewater compounds on the membrane surface.
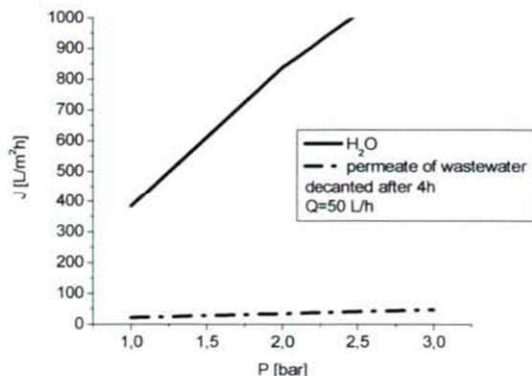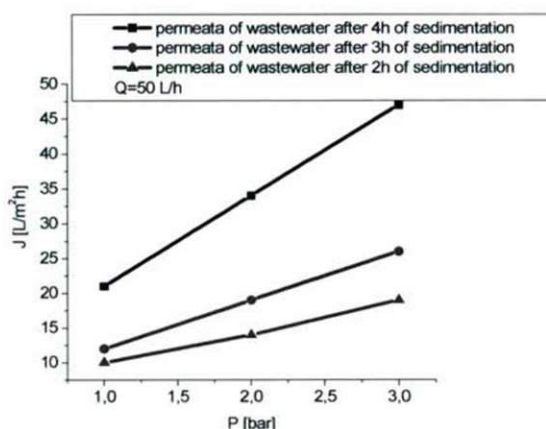

Figure 2. Water flux and wastewater permeate flux after 4 h of deposition, depending on the tranmembrane pressure at microfiltration on ceramic membrane with pore sizes of 200 nm at flow rate of 50 L/h and at room temperature

From the aspect of filtration, allowing sedimentation to take place first positively affects the microlevel since larger particles, mainly the starch ones, settle after which the dry matter content of wastewater is decreased. To examine how the sedimentation time of wastewater affects in microfiltration phase on the permeate flux, the Figure 3 has to be observed. It can be seen that with longer time of sedimentation due to the decrease of the dry matter in the wastewater from 0.95% (wastewater decanted after 2h of sedimentation) to 0.75% (wastewater decanted after 4h of sedimentation), the wastewater permeate flux increse. At transmembrane pressure of 1 bar the permeate flux of decanted wastewater after 2h sedimentation is 10 L/m²h, which is 2 times less then the permeate flux of decanted wastewater after 4h sedimentation. On the 3 bars that difference is more effective. At transmembrane pressure of 3 bars the permeate flux of decanted wastewater after 2h sedimentation is 17.5 L/m²h, which is 2.7 times less then the permeate flux of decanted wastewater after 4h sedimentation (46 L/m²h). Based on the above mentioned facts, the sedimentation phase before microfiltration has significant effect on the wastewater permeate flux.

Figure 3. Wastewater permeate flux after different time of sedimentation, depending on the tranmembrane pressure at microfiltration on ceramic membrane with pore sizes of 200 nm at flow rate of 50 L/h and at room temperature

On the Figure 4 the wastewater permeate flux after 4 h of sedimentation are shown, depending on the tranmembrane pressure at microfiltration on ceramic membrane with pore sizes of 200 nm at different flow rates at room temperature. It can be seen that on the wastewater microfiltration flow rate has also great influence, which are more intensive on higher transmembrane pressures. On the transmembrane pressure of 1 bar if flow rate is held on 50 L/h, the permeate flux is 20 L/m²h, while increasing the flow rate on 150 L/h the pereate flux can be increased for 30%.
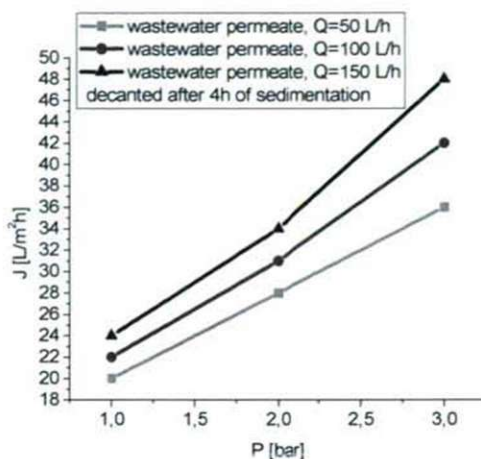
Figure 4.Wastewater permeate flux after 4 h of deposition, depending on the tranmembrane pressure at microfiltration on ceramic membrane with pore sizes of 200 nm at different flow rates at room temperature

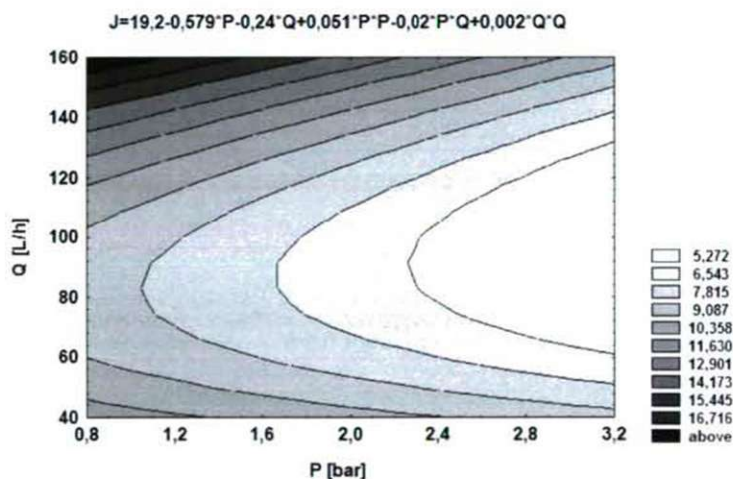$$J=19,2-0,579 \cdot P-0,24 \cdot Q+0,051 \cdot P \cdot P-0,02 \cdot P \cdot Q+0,002 \cdot Q \cdot Q$$

Figure 5. Wastewater permeate flux dependence on the tranmembrane pressure and on the flow rate at microfiltration on ceramic membrane with pore sizes of 200 nm at room temperature

On the basis of the obtained experimental values graphs depicting two dependent variables are drawn. Based on these values and using the programme *Statistica 8.0* a regression equation was obtained, which best describes the function of the flux dependency upon the transmembrane pressure and flow rate (Figure 5). Figure shows that the highest flux values caan be achieved (over 15 L/ m^{2}h) when flow rate is held over 140 L/h and the transmembrane pressure is held under 2 bars.

Using the sedimentation in combuination with microfiltration with ceramic membrane of 200 nm pore sizes the dry matter of the wastewater decreses from 11000 mg/l to 4000 mg/l, which is 64% decrease. The suspended solids are also decresed. They decrease from 9000 mg/l to 300 mg/l.

4. CONCLUSIONS

On grounds of the research into the effects of the conditions of microfiltration of the wastewater obtained during the technological process of wheat starch processing the following conclusions have been reached:

- The permeate flux of wastewater decanted after 4 h is 15 times reduced at transmembrane pressure of 1 bar compared to water flux (21 L/m^2h). Such an effect can be ascribed to an increased adsorption and adhesion of particles and solutes on the membrane, which leads to an effective decrease in the diameter of the pores and a decline in the permeate flux. Such a change, i.e. flux decline is explained by the concentration polarization and the formation of a layer containing wastewater compounds on the membrane surface.

- The initial sedimentation of wastewater significantly aproove the microfiltration of wastewater. At transmembrane pressure of 3 bars the permeate flux of decanted wastewater after 2h sedimentation is 17.5 L/m^2h, which is 2.7 times less then the permeate flux of decanted wastewater after 4h sedimentation (46 L/m^2h).

- From the beginning of microfiltration, the maximum value of the permeate flux (24 $lm^{-2}h^{-1}$) was achieved at the pressure under 2 bars and the flow rate over 140 lh^{-1} after having initially allowed the wastewater to settle for few hours.

- By using a 200nm membrane the wastewater dry matter is decreased from 11,000 mg/l na 4,000 mg/l, which is a reduction of about 60%.

- The wastewater suspended matter also declines significantly from 9,000mg/l to 300mg/l.

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EFFECT OF THE FAT CONTENT ON THE THERMAL EFFUSIVITY IN FOOD PRODUCTS: AN INVERSE PHOTOPYROELECTRIC STUDY

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ABSTRACT

Photopyroelectric (PPE) methods are capable to measure thermal properties of foods in a relatively fast and simple way. In this study a variant of PPE (the so called inverse photopyroelectric configuration, IPPE) was applied to determine the thermal effusivity of cooking cream, mayonnaise and sour cream as a function of their fat content. The effusivity decreases linearly with the increasing fat content. The change of thermal effusivity expressed as a change in effusivity for 1% change in fat content of the cooking cream, sour cream and mayonnaise samples are -13.97 $Ws^{\frac{1}{2}}m^{-2}K^{-1}$, -11.53 $Ws^{\frac{1}{2}}m^{-2}K^{-1}$ and -12.11 $Ws^{\frac{1}{2}}m^{-2}K^{-1}$ respectively.

1. INTRODUCTION

The thermal properties of foods (thermal diffusivity, effusivity, specific heat, conductivity) are very important parameters for economical planning of thermal energy in the industrial processing and technology [1]. These thermal properties are influenced by the food constituents [2]. In most cases, the two main constituents in foods are water (moisture) and fat. The ratio of these constituents determines the thermal properties of foods [3].

The knowledge of thermal properties of milk and milk products is important to the industrial processing (pasteurization, cheese draining, cheese salting). In trade flow some milk products (cooking cream, sour cream) can be purchased with different fat content. Sour cream has two different fat content categories. The first category is the so-called half fatty sour cream with fat content between 10-20%, while the second category is the fatty sour cream at least with 20% fat content or higher [4]. The cooking cream has also different fat categories [5]. Generally, in trade flow one can find cooking cream with 10g, 20g and 30g fat in 100g product.

Beside the milk products, some other foods (e.g. mayonnaise) have different fat content. Mayonnaise is prepared traditionally by carefully mixing egg yolk, vinegar, oil and spices [6] and this is a stable oil-in-water emulsion. The so-called light mayonnaise has 27g fat, while the normal mayonnaise 80g fat in 100g product.

Thermal effusivity, often called heat penetration coefficient or thermal inertia, depends on specific heat c, density ρ and thermal conductivity κ of the sample according to $e=(\kappa\rho c)^{\frac{1}{2}}$. For different materials thermal effusivity differs due to their varying ability to transfer heat. It is also the heat transfer quantity that determines the temperature at the interface of two semi-infinite objects that are brought together.

The relatively new, non destructive photopyroelectric (PPE) method is capable to determine the effusivity value by one single measurement [7]. The PPE method has two different configurations [8]. In both configurations the sample is heated by a modulated laser beam. The difference between the inverse (IPPE) and standard (SPPE) method is the

alignment of the modulated laser beam. In the IPPE configuration the modulated laser beam is absorbed directly on the pyroelecric foil [9] while in the SPPE configuration the modulated laser beam reaches the sample first. In the latter case we have to know the thickness of the sample namelly if the sample is thermally thick (the thickness of the sample is larger then the thermal diffusion length) then the generated heat due to the absorption of the sample cannot hot up the pyroelectric foil.

The objective of this study is to apply IPPE technique to determine thermal effusivity of mayonnaise, cooking cream and sour cream with a varying content of fat and to explore the extent of possible correlation between the effusivity and the content of fat in these products.

2. THEORETICAL BACKGROUND

Thin pyroelectric foil (metalized on both sides) acts as a sensor in SPPE and IPPE approaches. Heat generated due to sample's absorption of the modulated light beam produces the thermal wave field T in the photopyroelectric sensor that can be described by:

$$T = T_0 + T_{dc} + T_{ac} \qquad (1)$$

where T_0 is the ambient temperature, T_{dc} is the dc component of the temperature (depends on the modulation frequency and the geometry of the sensor), T_{ac} is the ac (oscillating) component of the temperature field. Due to changing temperature the polarised charge density differs at the two surfaces of the foil [10]. This leads to the polarised current (I_p) across the two sides of the foil given by:

$$I_p = \frac{\Delta Q_p}{\Delta t} \qquad (2)$$

where ΔQ_p is the polarised charges quantity and Δt is the time interval. The polarised charge density is given by:

$$\Delta Q_p = \frac{\Delta \sigma_p \cdot A}{\Delta t} \qquad (3)$$

where $\Delta \sigma$ is the polarised charge density and A is the surface of the pyroelectric sensor.

In the IPPE configuration the modulated laser beam is absorbed at the rear side of the black painted pyroelectric foil. If the sample is heated by the modulated light beam then the charge density will oscillate at the same frequency. The magnitude of this periodic voltage (called IPPE signal V_{sample}) generated accross the foil provides the information about the effusivity of the sample [11]. At the given modulation frequency the phase sensitive lock-in amplifier hitches up the IPPE signal to optimise the signal to noise ratio [12]. The lock-in amplifier is connected to the computer. By a single measurement the computer generates 256 readouts of the lock-in. If the PPE sensor is thermally thin, optically opaque and operates in the current mode the IPPE signal is inversely proportional to the thermal effusivity of the substrate material (sample). For a given experimental arrangement this implies that the ratio of V_{sample} (i.e. signal obtained from the sample being studied) and $V_{reference}$ (signal acquired from a reference sample of which thermo physical parameters are well known) is solely a function of their effusivities, i.e.:

$$V_{sample} \cdot e_{sample} = V_{reference} \cdot e_{reference} \qquad (4)$$

Thermal effusivity e_{sample} of the sample can be obtained in this way by measuring V_{sample} and $V_{reference}$ (under the same experimental conditions) and using the known effusivity of the reference (usually distilled water).

The effusivity value of distilled water is 1580 $Ws^{\frac{1}{2}}m^{-2}K^{-1}$ which can be found in publications.

3. MATERIALS AND METHODS

In this study, sour cream, mayonnaise and cooking cream with different fat content were investigated. Commercially available sour creams have a fat content of 12 % and 20 %. Therefore, a sour cream with higher fat content (31.4 %) was produced by the Hungarian Dairy Research Institute (Mosonmagyaróvár). The remaining three sour cream samples were produced by mechanical mixing sour creams of 31,4% and 12% fat content.

The mayonnaise samples were purchased in a Hungarian supermarket. One of the products had 80% fat content while the other one 27%. The other four samples were produced by mixing these two commercially available samples. Altogether seven samples were prepared with different fat contents.

In total, eight cooking creams were investigated, three of them were commercially available cooking creams with 10g (C1) 20g (C2) and 30g (C3) fat content in 100g product. By mixing C1 and C3 samples five additional samples were produced with 12.28g, 16.2g, 20g, 24.2g, 26.61g fat content in 100g product. Finally, we had eight cooking cream samples with different fat contents and of which two samples have the very same fat content (20%). One of the (20% fat content) cooking cream samples was mixed from C1 and C3, while the other one was purchased in the supermarket.

The effusivity values of the above mentioned samples were measured by the following home made system (*Figure 1.*).
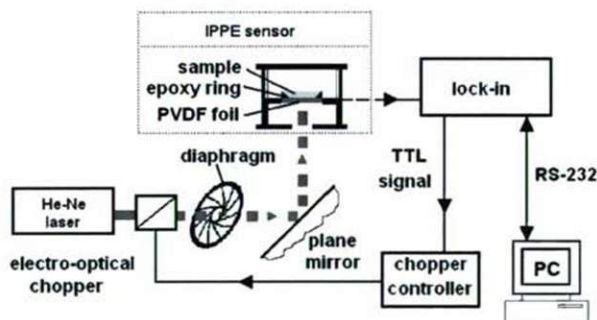

Figure 1. The IPPE measurement system

A Melles Griot 05-LHP-141 He-Ne laser was used as light source at 632 nm. The polarization was 1000:1 and the power of the non-modulated beam was 3.6 mW. The laser beam was modulated by an electro-optical modulator. If the modulator is polarised its refraction coefficient will change. This phenomena diverts the laser beam and the beam cannot pass trough the diaphragm and in this way the laser beam will be modulated. The chopper was controlled by the TTL signal of the lock-in amplifier. The modulated laser beam was absorbed by the black layer at the PVD foil and it has generated the IPPE signal. The sensor was connected to the lock-in amplifier and its output to the computer. The computer read out the amplifier and processed the data. The average of 256 successive readouts of the lock-in amplifier was the representative of a single measurement. Three independent measurements were carried out on each sample.

4. RESULTS

As a first step, the amplitude of the IPPE signal on distilled water was measured. The measurements were carried out in the frequency range of 0.2 and 4 Hz (*Figure 2.*). The obtained signal was linear (R^2=0.9963) between 0.1 and 1.5 Hz on distilled water in the function of the square root of the frequency (symbol o represents the IPPE signal of water). It can be seen that the IPPE signal is not linear anymore at higher frequencies. Not only the IPPE signal of distilled water but the IPPE signal of mayonnaise (27% fat content) are linear (R^2=0.9842) in this frequency range as well. Controlling linearity is important because of the correct analytical frequency (this has to be in the linear range). Therefore, 0.5 Hz was chosen as measuring frequency.

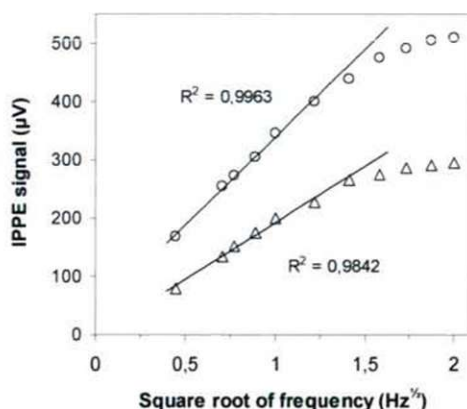*Figure 2. The amplitude of the IPPE signal obtained from distilled water (o) and the mayonnaise (Δ) (fat content 27g/100g product) plotted versus the square root of the modulation frequency.*
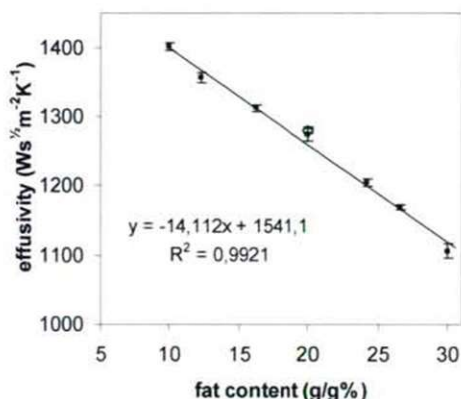

Figure 3. The relationship between thermal effusivity (obtained directly by IPPE experiment) and the content of fat in cooking creams (o symbol represents sample C2)

Next the effusivity values were measured on cooking cream samples (*Figure 3.*). The effusivity value of cooking cream samples were between 1100 $Ws^{1/2}m^{-2}K^{-1}$ and 1410 $Ws^{1/2}m^{-2}K^{-1}$. The effusivity values versus fat content show a linear correlation. If the fat content increases the effusivity decreases ($R^2=0.9921$).

Figure 4. shows the effusivity values of sour cream samples versus the fat content. The highest effusivity value of sour cream is 1623 $Ws^{1/2}m^{-2}K^{-1}$ and the lowest 1407 $Ws^{1/2}m^{-2}K^{-1}$. The correlation is linear again and a decreasing tendency was obtained versus fat content ($R^2=0.9868$).
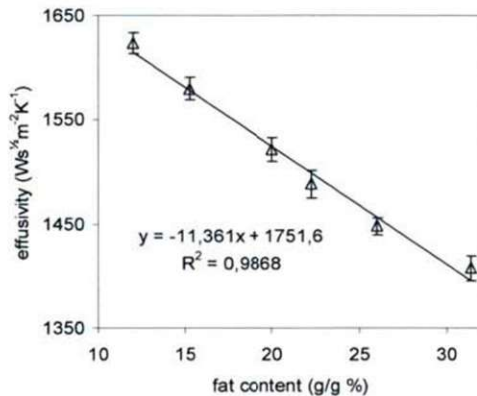
Figure 4. The relationship between thermal effusivity (obtained directly by IPPE experiment) and the fat content in sour cream
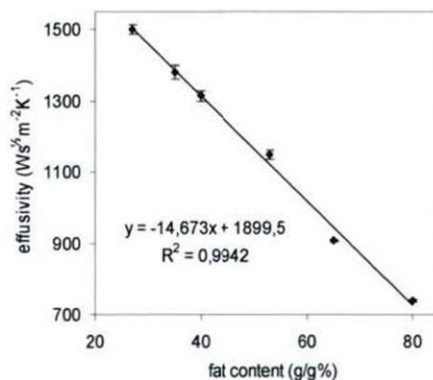
Figure 5. The relationship between thermal effusivity (obtained directly by IPPE experiment) and the fat content in mayonnaise

The obtained effusivity values of mayonnaise are plotted in Fig. 5. The relationship is linear again and 1 % increase in the fat content resulted in 12.11 ± 1 $Ws^{1/2}m^{-2}K^{-1}$ decline of the effusivity value.

The obtained effusivity values of mayonnaise are plotted in Fig. 5. The relationship is linear again and 1 % increase in the fat content resulted in 12.11 ± 1 $Ws^{1/2}m^{-2}K^{-1}$ decline of the effusivity value.

5. CONCLUSIONS

The IPPE method was capable to detect differences in thermal effusivity of sour cream, mayonnaise and cooking cream characterized by varying fat content. The observed relationship between the effusivity and the fat content is linear. Increasing fat content of the product by 1% resulted in 13.97, 11.53 $Ws^{1/2}m^{-2}K^{-1}$ and 12.11 $Ws^{1/2}m^{-2}K^{-1}$ drop in thermal effusivity for cooking creams, sour creams and mayonnaise respectively. The obtained standard deviations of the effusivity values regarding all the samples are smaller than the sensitivity (decline in the effusivity value for 1% increase in the fat content) of IPPE method and therefore, the technique and the thermal effusivity of the samples are very sensitive to the fat content of the investigated samples.

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RISK PERCEPTION OF FOOD ADDITIVES IN HUNGARY

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ABSTRACT

On the basis of international surveys, Hungarian consumers stated serious aversion against food additives.

The aim of our work was to get more detailed information about Hungarian consumers' risk perception with special regard to food additives.

For this purpose a self-administrated questionnaire was developed. Four hundred respondents completed the questionnaires in 2009. The collected data were analysed by the SPSS 18.0 statistical software.

Respondents expressed serious aversion against food additives amongst different risk factors. The responses on different statements highlighted that consumers did not have proper knowledge about food additives.

In order to explore the directly not perceptible connections, factor analysis was done, but the "goodness-of-fit test" did not show significant fitting. So with the help of the factor analysis' results 5 principal components were created.

According to the results it can be stated that - similarly to previous studies - Hungarian respondents felt food additives to be hazardous. On the basis of the principal components respondents who were not satisfied with the quantity of the information about food additives, had mixed and ambiguous knowledge about food additives. Thus Hungarian consumers need more authentic information to help their food choice to be more established and be more conscious.

1. INTRODUCTION

Due to the changing lifestyle and consumption habits and furthermore the continuously appearing food scandals and media awareness consumer's mistrust against food additives is constantly rising. According to the survey of the Eurobarometer (2006a) 13% of the respondents stated that eating healthy diet involved the avoidance of foods containing food additives (Figure 1), while in Hungary this rate was 16%.
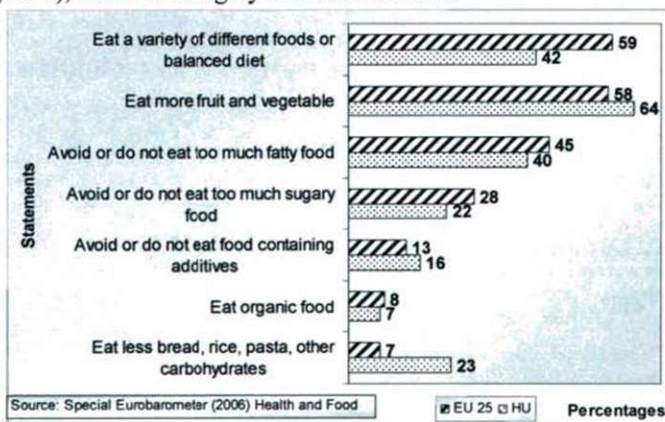

Figure 1. "What do you think eating "healthy diet" involves?"

On the basis of another survey (Eurobarometer, 2006b) 61% of the European participants worried about "additives like colours, preservatives and flavorings". This rate was higher in Hungary 76% (Figure 2) too.
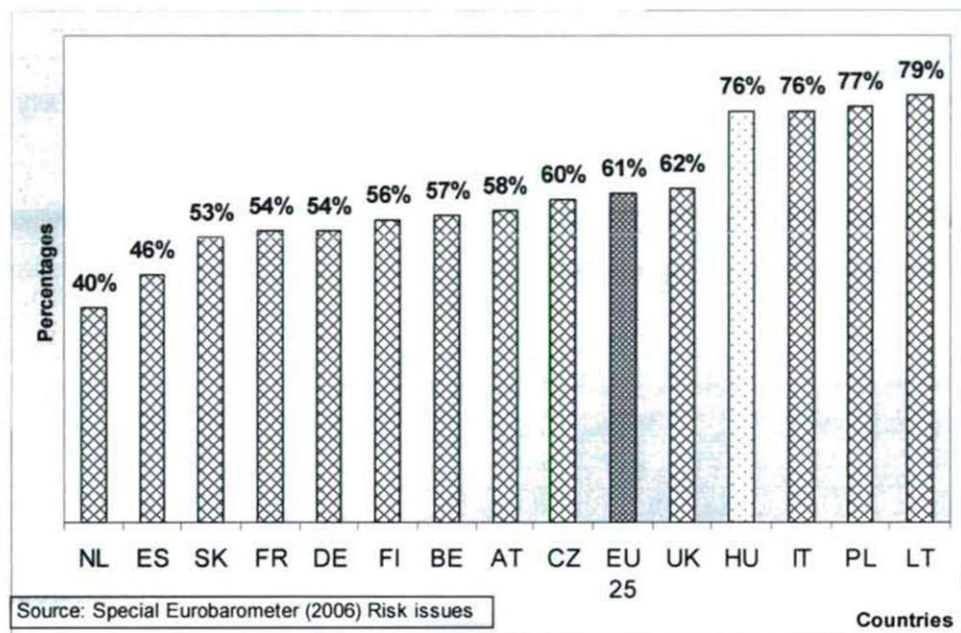
Figure 2. *Worry against food additives*

2. MATERIALS AND METHODS

In order to get information on the perception of the Hungarian adults' about food additives a self-administrated questionnaire was developed in the Central Food Research Institute. Based on the snowball method 400 respondents completed the questionnaires in spring of 2009. The collected information was analysed by the SPSS 18.0 statistical software.

3. RESULTS

3.1 Judgement of different risk factors

Respondents expressed serious aversion against the listed potential risk factors. The most hazardous factor was the "pesticides" (1.85 on a 1-5 Likert scale), while the least hazardous was the "gases of the modified atmosphere in food packaging" (3.06) (Figure 3).

There was a small difference between the judgement of "Food additives" (2.64) and "E numbers" (2.66), thus on the basis of this result Hungarian consumers ware aware of the proper connection between these two concepts.
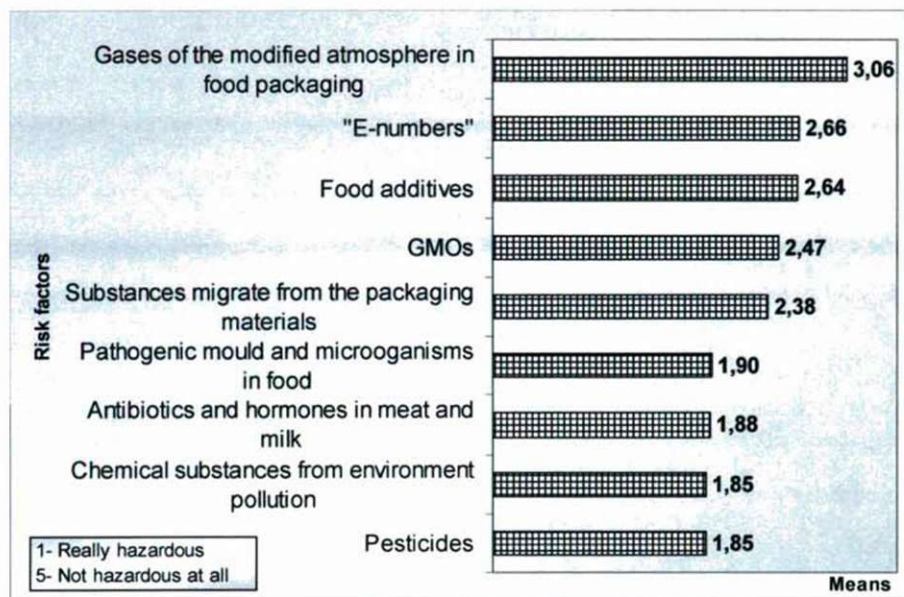
Figure 3. Judgement of different risk factors

3.2 Knowledge of food additives and "E-numbers"
Our previous result was confirmed by two statements. 84.8% asked were aware what food additives, and 72.5% that what "E-numbers" meant on food packaging. However only 53.5% understood the statement that "Every food additive can be linked to an "E-number".

3.3. Principal component analysis
In order to explore the directly not perceptible connections about respondents' knowledge and attitude related to food additives, factor analysis was done, but the "goodness-of-fit test" did not show significant fitting. So with the help of the factor analysis' results principal components were created. 7 principal components were differentiated form the 48 statements, but two of them were not created dimension (Table 1).

Table 1. Some statements of the pricipal components with their factor components and means

Principal components with some statements	Factor components	Means[1]	N (means)
1. Food additives' risks			
Safer foodstuffs contain fewer additives.	0.727	3.79	389
One reason of the more often occurring allergies is the foodstuffs' food additive content.	0.769	3.90	352
Excessive food additive consumption can cause cancer.	0.706	3.68	340
2. Indispensability of food additives			
Permitted food additives pose no danger to our health.	0.683	2.31	382
Food additives are safe in the amount used by food industry.	0.637	2.80	382
Preservatives are necessary for safety foodstuffs.	0.547	2.92	381
3. Judgement of food safety			
I think food safety is declined because of the accession to the EU.	0.700	3.00	372
I believe that labelling information reflects the truth.	-0.698	2.72	396
Food industry utilizes only permitted additives.	-0.644	2.88	378
4. Knowledge of food additives			
It is difficult to be familiar with information about food additives.	0.638	3.85	399
It is a fundamental human right to know what foodstuffs contain.	0.544	4.80	399
Different food additives mean different risks.	0.677	4.23	383
5. Food additives' communication			
Consumers have to have more information about food additives to reduce risks.	-0.504	4.32	398
I am satisfied with the information about food additives on the labelling.	0.849	2.24	394
I am satisfied with the media information about food additives.	0.828	1.93	395

[1] 1- Not agree at all 5- Strongly agree

On the basis of the principal analysis it can be stated that Hungarian respondents' attitude regarding food additives was aggregated into 5 components.

1. Food additives' risks
This principal component contains statements related to health related risks of food additives. Respondents reported strong connection between different diseases like allergy (3.90) and cancer (3.68). Furthermore this component contains statements like additive free foodstuffs are safer than foodstuffs containing number of additives (3.79).

2. Indispensability of food additives
This principal component summarized statements that food additives have an important role in foodstuffs, and their utilization is necessary. Participants were distrustful against the food industry (2.80), they did not perceive strong connection between the utilization of food additives like preservatives and safe foodstuffs (2.92). Their worries about health destroying effect of food additives (2.31) appeared again.

3. Judgement of food safety
This dimension shows that attitude related to food additives is influenced by common factors like food safety and the judgement of the work of the authorities'. In addition, trust in the producers rule observance practice and the pertinence of food labelling information. Hungarian respondents did not believe in food labelling information (2.72) and in

producers (2.88), furthermore they thought that the level of food safety was not increased by the accession to the European Union (3.00). This can be caused partly by the constantly increasing number of appearing foreign foodstuffs on the Hungarian market.

4. Knowledge of food additives
The "Knowledge of food additives" principle factor summarizes the claims related the differentiated knowledge of Hungarian respondents about food additives. On the basis of the results it was not too difficult for the Hungarian respondents to be familiar with information about food additives (3.85) and they strongly agreed with the statement that "Fundamental human right is to know what foodstuffs contain" (4.80). It was favourable that they thought that they could make difference between the hazardous levels of food additives (2.88).

5. Food additives' communication
The fifth dimension bands together claims in connection with the communication about food additives like media, labelling and the level of knowledge. According to the answers it can be stated, that most of the respondents agreed (4.32) with the statement that "Consumers have to have more information about food additives to reduce risk" in addition consumers' dissatisfaction with information about food additives on food labellings (2.24) and the media (1.93).

3.4. Results for the planning of consumer communication

Independent principal component connection resulted in relevant conclusions. On the basis of linear regression those who reported higher demand for differentiated information about food additives were significantly conducted with the information of the media and food labellings. Thus one segment of the consumers needs more detailed information, so it is important to find the best way to satisfy of these requests e.g. with easy-to-understand guidelines. Consumers' present negative perception related food additives can be moderated with the help of detailed and differentiated information.

4. CONCLUSIONS

According to the results it can be stated that - similarly to previous international studies - Hungarian respondents felt food additives to be hazardous.
On the basis of the principal components Hungarian participants expressed worried about the contingent health destroying effects of food additives and stated distrust against food industry. Thus Hungarian consumers need more authentic information about food safety and food additives to help their food choice to be more established and conscious.
In order to get more exact and detailed knowledge about the different consumer segments and to determine the required steps for a more effective consumer communication cluster analysis will be done on the basis of the principal components.

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THE RULES OF DESCERNING FOOD
FROM THE ASPECT OF BEING KOSHER IN THE JEWISH WORLD

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ABSTRACT

This paper introduces one of the greatest challenges in Jewish religion in our running world nowadays. It is not easy to keep the rules of kosher dining, and my aim is to present what the expression 'kosher' means, although, I also intend to show the foods that are forbidden to eat, the foods that are non-kosher. My goal is to introduce the following five pillars of the topic: 1) the kosher way of cutting down the animal; 2) to make the meat kosher; 3) the meaty and the milky foods; 4) kosher food in a non-kosher plate; 5) the way of making food to be kosher.

If you go into a supermarket and buy a bar of chocolate or a bottle of wine which has letter 'K' or a stamp of a rabbi printed on the back of the bar or on the back of the bottle, you can be sure that the chocolate or the wine is kosher. It means that the quality of the food and the quality of the drink is checked and is found clean from the beginning of the manufacture and of the vinification until the end of them. I think that everybody heard about the so-called kosher plum pálinka.

The basis of kosher traditions goes back to ancient times. As The Bible says: "Thou shalt not seethe a kid in his mother's milk." (Exodus 23:19) The believer Jews, who follow the eating habits of the religion, do not simply feel happy about their dining traditions or do not exactly know that these customs make them healthy, but they accept the rules as God's commandments.

In everyday speech we often use the word 'kosher' for a person, for a situation or for a thing that is all right or perfect. This usage comes from the original meaning of the expression. The Hebrew word means clean and suitable. The explanation shows that the opposition of 'kosher' is not perfect, not clean, not suitable and is not all right. The 'non-kosher' expression is used for situations, for persons and for objects that have some problems in their work.

When we read literary works of art, especially when we read Jewish literature, we get to know the realization of the fact that the theme of eating, the theme of kosher dining is in the centre of most of the novels or prose. I intend to show one of the masterpieces of Jewish American literature. My aim is to give a brief presentation of the novel of Chaim Potok, *The Book of Lights*, as the main character gets into the Korean War in the years of 1950s, and he eats according to the kosher rules even in the hard situations.

Having a kosher establishment is like the basis of a house. However, the base is not the house in itself, and you cannot live on the root without the house. On the other hand, the home standing without firm bottoms, can fall down easily. The kosher routine is the ground for living day after day following the words of The Torah, the Five Books of Moses. But to be a religious Jew, it is not enough in itself, and living without keeping the rules of being kosher, leads Jewish people to the way of assimilation. However, assimilation is not the topic for today.

1. INTRODUCTION

It is not easy to define the full meaning of the word 'kosher.' We have the connotation of the expression as being clear and being suitable for the orders, although the note of 'created by kosher mood' on the packages of foods either being kosher or not, squarely means that the specialities are 'non-kosher.' The expression of 'kosher' is neither used for

the making of special foods nor implies peculiar flavours, but it has a well-demarked denotation as a ritual term.

In my publication, my aim is to introduce the following five pillars of the topic: 1) the kosher way of cutting down the animal; 2) to make the meat kosher; 3) the meaty and the milky foods; 4) kosher food in a non-kosher plate; 5) the way of making food to be kosher. Before showing these elements, in the following table I intend to give a brief presentation of the foods and drinks that are allowed and those that are forbidden to consume. (See: Table 1.)

Table 1. A short collection of allowed and forbidden foods and drinks according to the rules of having a kosher house-hold

		Allowed	Forbidden
Foods	Meat	Bull	Pig
		Cow	Camel
		Sheep	Rabbit
		Lamb	Horse
		Goat	Ostrich
		Veal	Swan
		Springbok	Eagle
		Chicken	Owl
		Turkey	Pelican
		Duck	Vulture
		Goose	Stork
			Snake
			Insects
	Fish	Tuna	Shrimps
		Salmon	Crabs
		Herring	Mussels
			Lobsters
	Others	Fruit	
		Vegetables	
		Cereals	
		Honey	
		Diary products	
Drinks	Alcoholic	Wine	Brandy
		Whisky	Beer
		Pálinka	
	Non-alcoholic	Water	
		Mineral water	
		Orange juice	
		Coffee	
		Milk	
		Cocoa	
		Tea	

Source: The author's own collection

"According to the laws of The Torah, the only types of meat that may be eaten are cattle and game that have "cloven hooves" and "chew the cud." If an animal species fulfills only one of these conditions (for example the pig, which has split hooves but does not chew the cud, or the camel, which chews the cud, but does not have split hooves), then its meat may not be eaten." (KIR: What Does Kosher Mean?, 2010)

"The eggs of kosher birds are permitted as long as they do not contain blood. Therefore, eggs must be individually examined. ... Only fish with fins and scales may be eaten." (KIR: What Does Kosher Mean?, 2010)

As you can see, the fixity refers mainly to the meat, although questions appear around nearly every kind of provisions and of drinks. There is certainly main focus on the hygienic directions in connection with kosher dining in Jewish religion, but I do not deal with this topic in this publication.

2. RITUAL RULES

In this chapter, my goal is to present five aspects of the commandments in connection with eating traditions and in relation to kosher dining. There are several pillars of having kosher kitchen at home and outside, however, I only focus on five mile-stones of the question. I do not elaborate on The Torah, on the hygienic formulas or on medical issues. I attend to the animal-cutting, to the koshering, to the non-koshering and to the problems of the meat and the milk, instead.

2.1. The kosher way of cutting down the animal

"According to the laws of The Torah, to be eaten, a kosher species must be slaughtered by a "Schochet," a ritual slaughterer. Since Jewish Law prohibits causing any pain to animals, the slaughtering has to be effected in such a way that unconsciousness is instantaneous and death occurs almost instantaneously." (KIR: What Does Kosher Mean?, 2010)

Using drugs or medicines in order to the obfuscation of the animal is strictly forbidden, because this nervine procedure is cruel, so they make the meat non-kosher. We can say that the kosher way of cutting down the animal is a very human mode of the animal-cutting. Furthermore, this treatment has another bull-point: the "Schechita" – the cutting itself – makes it available that the blood of the animal flows out right at the moment of the ritual cutting without imbibitioning into the flesh. So, the hygienic standards and the prohibition of eating blood are also complied. (Donin H. H. 1991)

2.2. To make the meat kosher

In The Torah, in The Five Books of Moses a clear description can be found on the topic of the restraint of eating blood. Two effective ways of reaching the bloodless state of the meat exist: 1) koshering by simmering; 2) salting the meat.

As Hayim Halevy Donin argues in his book, every kind of meat is suitable for koshering by both ways except liver. It is the only type of incarnant that can be simply koshered by simmering since its blood-content is very high. (Donin H. H. 1991)

1) Koshering by simmering is a method in which the flesh must be cleaned by cold water, and it must be salted above the fire. When the meat is nearly ready, it must be cleaned by cold water again.

2) Koshering by salting is a procedure during which the flesh must be washed by cold water, and it must be glimmed into cold water for half an hour. Then the meat must be salted by middle-hard-salt, and it should be put on a down-graded area for one hour. This time is enough for the blood to bleed out from the flesh. Finally, the salt must be cleaned from the meat before cooking it.

2.3. The meaty and the milky foods

If you cannot decide what to eat together, you should keep in mind the words of The Torah: "Thou shalt not seethe a kid in his mother's milk." (Exodus 23:19) Those foods that contain parts of any kind of meat are called meaty, and the ones that have underived milk in them are called milky foods.

It is really important that the meaty and the milky nutriments are not allowed to mix. According to the traditions, if you eat something that is milky, you can eat meaty foods after half an hour is passed. On the other hand, if you eat something belonging to the meaty category, you are allowed to have milky thing only after six hours are passed.

The foods that contain neither meat nor milk are called 'parve,' and are permitted to eat together with either meaty or milky foods.

2.4. Kosher food in a non-kosher plate

Hayim Halevy Donin collected the main circumstances of having kosher food together with non-kosher plates. I highlight two major problems in this topic as they are the following: 1) every kosher food cooked or served in non-kosher pots and plates are non-kosher anymore; 2) non-kosher nourishments boiled in kosher vessels are still non-kosher. (Donin H. H. 1991)

I summarize the kosher and the non-kosher by an image in this sense. If a man living according to the kosher rules visits his friend having a non-kosher house-hold, are not allowed to eat there. On the other side of the scale, if they change places: the man bearing non-kosher rules are permitted to have a meal at his friend's house, no matter that the friend has kosher traditions at home.

2.5. The way of making food to be kosher

On the basis of The Torah, of the hygienic possibilities and of medical issues, having a kosher house-hold is an analogue for living in a healthy mood. With its advantages and disadvantages, being kosher is a way of living according to strict rules for Jewish and for non-Jewish people, as well.

The best way of making foods and drinks to be kosher is using kosher and clean primary commodities. In our enlightened world, you have the chance to find shops and supermarkets where the shelves are full of kosher products and stocks. When you buy the signed goods, you have only one duty left: you should get your kitchen clean and make it kosher following the rules of koshering pots and pans. (I do not deal with the topic of kosher kitchen in this publication.)

3. LITERATURE INSPECTION

Living according to the kosher ritual rules is not a habit; it is a lifestyle. If you keep the customs at home, you have the traditions outside, too. There are several literary works of art dealing with the topic of eating and the topic of eating habits. It is natural that some Jewish literature exists concerning with religious themes including Jewish dining and its kosher orders.

Chaim Potok is one of the greatest Jewish American writers of the 20th century. Several novels and short stories tend his name as their author. In this paper, I intend to show one of his novels, entitled *The Book of Lights* from the point of view of keeping kosher eating habits.

The main character of the novel is Gershon Loran, a young Jewish boy who is born into a religious family having strict rules for everyday living and for dining, as well. After finishing school, Gershon is inducted as a chaplain to the Far East right after the end of the Korean War in the years of 1950s. "It is this young man--raised in the absolute belief that "the Jewish religion made a fundamental difference in the world"--who, at the end of the Korean War, finds himself a chaplain in a country where Judaism has played no part, has had no reality, has never existed." (Potok C.: Synopsis: From the Dust Jacket, 1986) In these circumstances, he has to face the harsh conditions and he also has to fit Jewish traditions, such as holidays, Shabbat and eating kosher food. He suits everything: he keeps the festivals, reads The Torah and eats according to the ritual rules. When his fellows have meat for lunch, Gershon has eggs and bread. He knows that the most important commandment in Judaism is human life. Every Jew has to live his life in the safety of subsistence. So Gershon has to eat in order to stay alive even if the dishes and the plates are non-kosher in the kitchen of the army.

The Book of Lights written by Chaim Potok is just one example of the topic as part of literature. You can find some novels and short stories from the great assortment of the world's classics engaging in the theme of being kosher and having a kosher house-hold.

4. CONCLUSION

Today's deconsecrated society is full of prejudice. Jewish people are the objects of a great number of aggressions. One of the targets is the ritual side of the religion including the characteristics of eating habits, too. In this paper, my aim was to show some major points of Jewish dining traditions called 'kosher eating.'

In my publication, I introduced the following five aspects of the theme of being kosher: 1) the kosher way of cutting down the animal; 2) to make the meat kosher; 3) the meaty and the milky foods; 4) kosher food in a non-kosher plate; 5) the way of making food to be kosher. First of all, I gave a brief description of the meaning and of the using of the word 'kosher' itself. Furthermore, in a table, I made a short collection of foods and drinks that are allowed and those that are forbidden to consume in a kosher house-hold.

In the last unit of my thesis, I made an expansion of the topic dealing with Jewish American literature in the way of introducing Chaim Potok's novel, *The Book of Lights*.

There are several other pillars of kosher and non-kosher topics such as The Torah, medical problems and hygienic situations. These items are the focus of other publications but were not the basis of this writing.

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THE DEPENDENCE OF THE ENGINES ROTATION AND THE ENVIRONMENT TEMPERATURE OF THE COMBUSTIBLES MASS

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ABSTRACT

In this paperwork is presented the fuel charging scheme for both the multipoint injection system design by authors. The software outputs are the 3-dimensional variations between angular speed and outside temperature respectively angular speed. It was effectuated a engines with spark lighting program for the calculation of parameters with the gasoline injection with the under- program: the calculation program of engines with spark lighting parameters (depending on n and λ at t_o=-35...+45°C and p_o=1·10^2 kPa);- the calculation program of engines with spark lighting parameters (depending on n and t_o at λ=1 and p_o=1·10^2 kPa).

Key words: *debit meter, electronic injection, lambda, electric pump, revolution.*

1. INTRODUCTION

1.1. Plane from realization of project:

-elaboration programmes from calculate for modelling of the electronic injection gasoline from engines;
-programme from calculation;
-publication source code;
-experimental stall for control and to draw a parallel between the date to gate with the help's of programme.

1.2. The date about project:

Through project we must to present:
a-growth of the dynamical parameters of motor vehicle;
b- growth economically parameters;
c-reduction of pollution gas of escapement.

The project itself to refer to at modelling electronic injection of gasoline of spark ignition engines, going from the general aspect of modelling, the general model at the spark ignition engines with electronic injection, the model of system proposed from author through execution one programs on the computer for calculate variable parameter spark ignition engines with electronic injection, to simulate on the computer to functionally of propose system, the experimental try the propose system, the comparative study between obtained value through modelling and the same experimental to gate.

In this presence working itself contribute at modelling injection from gasoline at spark ignition engines; the model of fuel pump from gasoline, the model of regulator from pressure and injector.

For model of system proposed from author was proposed one system from injection of gasoline Bosch Motronic who power for air with ultrasonor wave. It be used plate from acquisition from trial, program from acquisition from date, electrical sounder from

temperature, electrical sounder from pressure, electrical sounder from revolution and position angular, analyzer from gas. It be to achieve a experimental equipment for try the propose model by the author, gifted with device and electrical sounders necessary of modelling and drawing cycle spark ignition engines with electronic injection from gasoline for propose model by the author. It by raise experimental diagram indication a engines

2.THE COMPARATIVE STUDY LOOK CARBURETION AND GASOLINE INJECTION
IN PERFECT TO IMPROVE OF CARBURETOR

The carburetor with more parts; carburetor's with double part, with 4 part, multiple carburetor, one for one cylinder or group for cylinders. The heating mixture air + gasoline before from his admission in cylinder from to evacuation gas (figure 1.a.). This device placed at going out from carburetor has a blade from adjustment commanding from one rheostat. The heating is stopping again blade C is forbidden and gas for escapement when for work temperature is to touched (figure 1.b.). [5]

a)   b)
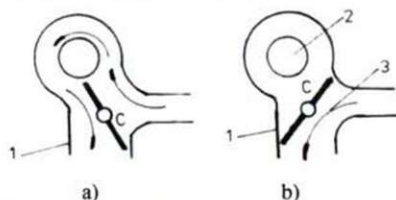
Fig.1. The heating mixture; 1-from evacuation pipes; 2 –from admission pipes; 3 –gas from evacuation; C –the blade.

For injection's equipment for gasoline make by Bosch, specialized in building for injection equipment in engines with compression kindling no differ essential that this from the last. The delicate problem of this equipment constitute to smear couple from piece in rub from high direction pressure, who have got in seeing quality ant lubricating those gasoline to need ensuring in one alone smear circuit.

Ulterior the equipment for gasoline injection in engines with spark lighting was to adapt to necessity for lubricating the couple from piece in rub, the place where itself injection of gasoline and injection duration. As follows, was developed equipment from injection to who gasoline not come in contact with part of equipment who achieve to put pressure upon high from injection, the equipment who permit to introduce gasoline in the room burning or in a received of motor, as and the equipment's who allow the continue injection or discontinuous to gasoline.[5]

The expert to estimate that at the finished 2006 year about 99 % from touring car who are be make, to make in electronic system for injection from gasoline. Making one comparative study between carburetion and electronic injection from gasoline, upon last year's, take as to start foundation 1986 year when weight of carburetion at car was from 80 %, and after the estimation in 2006 year is 1 % result replacement near in totality of carburetion with injection from gasoline.

Introduction from gasoline injection at engines with spark lighting has been pursuit with priority improvement performances from power and consumption, performances to limited from modulus from forming of mixture and to fill in cylinder's 'ore little efficient at engines with spark lighting with carburetor.

Subsequent restriction's examination of medium pollution to ward gas that burn of engines with spark lighting header of gasoline injection discovery a new virtue: to reduce of pollution emission out of evacuation gas. To appear equipment's who to permit introduction of gasoline in chamber from burn or in gallery from admission has engine, again injection from gasoline to be possible continue or discontinuous.

Advantage and disadvantage carburetor's

Carburetor's with electronic command to present advantage considerable in comparison with traditional carburetor: simplification mechanics structural has system; economy from carburant; reduction relation pollution out of in gas from evacuation; automation system from acting; stability working conditions from ralanti.

The modern carburetor's to take device corrector or perfect system, they are deliver one air mixture / gasoline homogeneous and with precision dosing at all working conditions. The acceleration's to obtain are appreciable and consumption for combustible in general is acceptable. The same time, carburetor's that are correspondent for high working of engine, oneself to adapt difficult at low working to that:

-to contain circuit's or corrective elements or complementary more much or little complex and trough following delicate or fragile;

-is associate at much other carburetor's from to assure one correct dosage of mixture for all the characteristic phases of working condition engine. Between other, carburetors are at the same time, signal perturbation phenomena. The vaporization oneself to produce for warm time. The gasoline is possible oneself to evaporate and to pas in canalize at vaporization State in forming from gauze bulge, who liquid gasoline obstacle from has free circulate, to lead at stopping engine. For restarted must to let to oneself cooling (and to chill with one gauze moist for example) sewerage system as to place near from driving. One manner from ice who are state one claque obturator and loudspeaker again jet stopped that by retail. When the engine and carburetor are not warm, the gasoline that are come can to enter jet under form from steam in the received tube where she to lay down through condense, under form from drop, who provoke a rich abnormal and not controllable to mixture, ruling at stop driving. The advantage injection from gasoline can to be sum up at: reduce the drawback carburetor for all the working conditions; to enlarge the power and conducts at reduce the full consumption by combustible; to reduce pollution.

Until present oneself apply:

- the internal carburetion or direct injection when gasoline is spray each room from combustion, figure 2.a.

- carburetion quasi internal or direct injection, when gasoline is spray in admission pipes, in admission gallery, near from admission valve, or in collector, figure 2.b. [5]

When gasoline injection are place in the admission time from air, with one so very small pressure (0,1- 0,5 MPa) to light is to set going by one spark that is give us by one sparking plug command from one system electronic light.

If in case from compression relation ε and temperature t_a [°C] of air or mixture air +combustible, at end of compress can to be exist for example:

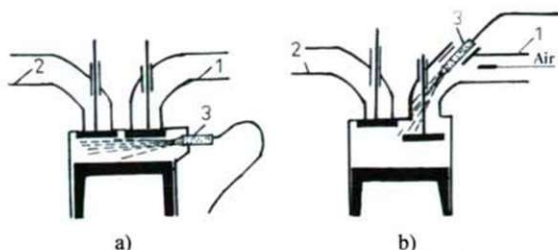a)   b)

Fig. 2. The gasoline injection scheme: a- in burning valve; b- in admission gallery; 1- admission gallery; 2- evacuation gallery; 3-injector.

3. PLANE FROM REALIZATION OF PROJECT

Elaboration programmes from calculate for modeling of the electronic injection gasoline from Volkswagen engine;programme from calculation;publication source code;experimental stall for control and to draw a parallel between the date to gate with the help's of programme.

3.1.The date about project

Through project we must to pressent:a-growth of the dynamical parameters of motor vehicle; growth economicals parameters;reduction of pollution gase of escapement.

The project itself to refer to at modeling electronic injection of gasoline of spark ignition engines, going from the general aspect of modeling, the general model at the spark ignition engines with electronic injection, the model of system proposed from author through execution one programe on the computer for calculate variabil parameter spark ignition engines with electronic injection, to simulate on the computer to functionally of propose system, the experimental try the propose system, the comparative study between obtained value through modeling and the same experimental to gate.In this presence working itself contribute at modeling injection from gasoline at spark ignition engines; the model of fuel pump from gasoline, the model of regulator from pressure and injector. For model of system proposed from author was proposed one system from injection of gasoline Bosch Motronic who power for air with ultrasonor wave. It be used plate from acquisition from trial, program from acquisition from date,electrical sounder from temperature, electrical sounder from pressure, electrical sounder from revolution and position angular, analyzer from gas.

It is be make one study for select excess coefficient from air $\lambda=1$ (electronic dosage).
It will be present the model from calculation for pressure p_{ga} and admission pressure p_a in two first variant when density is constant and the two almost near from reality of driving running with injection of the gasoline when the density of gasoline is variable.
The author suggest a personal model for calculation from pressure regulator, a electromagnetic injector, a combustible mass injected on the cycle and a time's injection

with revolution at total load. This model can be used at modeling of system's electronic injection from gasoline with one point or more point's.

To bring into being of the model is necessary modeling cycle spark ignition engines with electronic injection from gasoline on a model from cycle helping propose from the author.

It is calculating the parameters for optimum for to run cycle at spark ignition engines with electronic injection from gasoline and to simulate on the computer.

The theory from calculation:

A delicate problem from point of program on the computer, adiabatic coefficient is it starting calculation, temperature in different point are unknown and the adiabatic exponents not can be determinable. For solution of this problem has been used at impose to some value, found initial more correct, who permit a cycle crossing and determination more precise temperature.

The temperature at the finished admission T_a was to consider known as initial date and she's expression calculation it be used at the finished as equation from verify at finished the cycle. It is to determine the expression temperature's in succession from route of cycle $T_c, T_z, T_u, T_d, T_{d1}, T_r$ and T_{r1}, as well as expression of gas temperature from evacuation T_e and the expression temperature thermodynamics medium to process from burning T_{med}. It is calculating the expression coefficient gas burnt residual γ_r.

Must to remark that all the expression that was used at mathematical modeling cycle spark ignition engines with electronic injection from gasoline proposed from the author it is correlation betweens to can be introduce on the computer. This expression is correlation only in function from temperature's from characteristic point of cycle; pressuring suice this point it is substitute with pressure's exponent's and coefficient from initial date.

Through calculate again of adiabatic exponent on amount foundation temperature's to get from the new cycle. In this mode, through some cycle the error can be reduce upside a calculate estimate admit in a thermal calculus very pretentious. Must be introductory simplify hypothesis that one with starting burning at finished corresponding thermal agent composition it is instantaneous becoming that finished corresponding the excess coefficient from air λ with who are place burning combustible.

It be make calculus mechanical this theoretically proposed L_{tp}, theoretical medium pressure proposed p_{tp} and of theoretical output propose η_{tp}.

It be calculate effective pressure p_e, effective output η_e and mechanical output engine η_m, theoretic power propose P_{tp}, effective moment M_e, from combustible mass that have been on cycle engine m_{cb}, the stole theoretic Ch_t, the stole theoretic specific from combustible c_e and drawing cycle spark ignition engines with electronic injection from gasoline for propose model by the author; the models by calculus for pressure-volume and pressure-angle motor shaft diagram.

The molding of engine with spark lighting cycles with gasoline injection supposed by the authors is carried out by the 3-D dimensional and by dimensional parameters in two cases in figure 3 and 4.
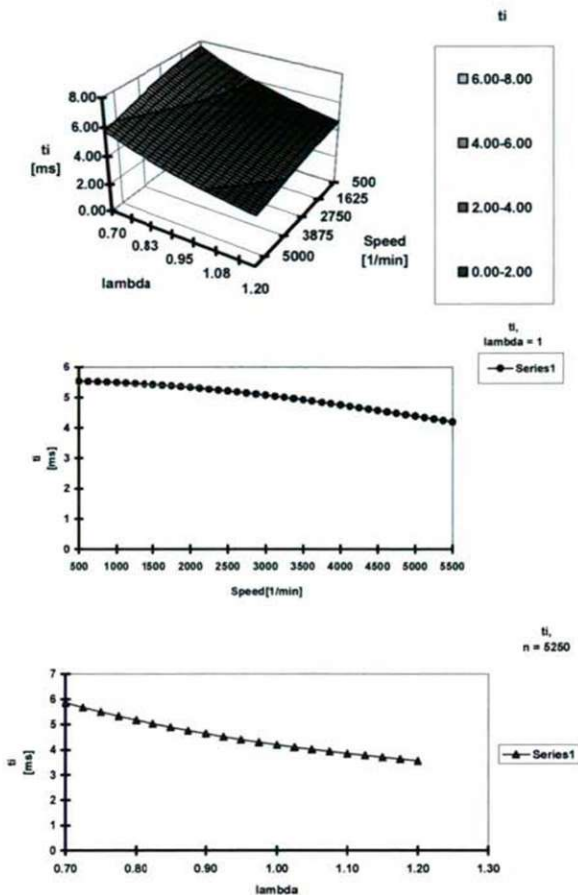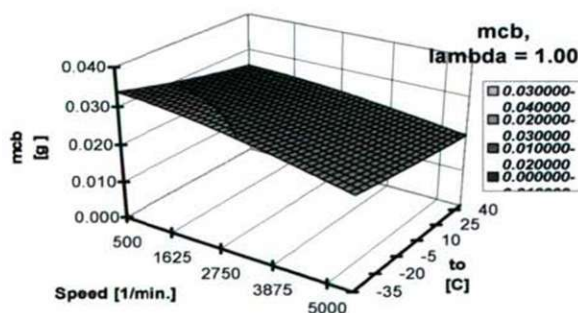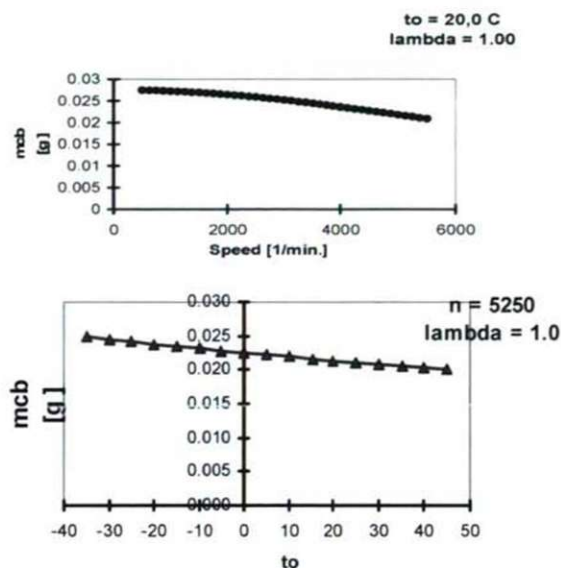
Fig.3 The dependence on the engines rotation and the airs excess co-efficient of the injections duration for the model suggested by the authors.

Fig.4 The dependence of the engines rotation and the environment temperature of the combustibles mass
for the authors suggested model.

4. THE THEORY FROM CALCULATION

A delicate problem from point of program on the computer, adiabatic coefficient is it starting calculation, temperature in different point is unknown and the adiabatic exponents not can be determinable. For solution of this problem has been used at impose to some value, found initial more correct, who permit a cycle crossing and determination more precise temperature.[Delanette, 1989]; [Blaga,2000]. The temperature at the finished admission T_a was to consider known as initial date and she's expression calculation it be used at the finished as equation from verify at finished the cycle. Through calculate again of adiabatic exponent on amount foundation temperatures to get from the new cycle.[Grünwald,1980]. In this mode, through some cycle the error can be reduce upside a calculate estimate admit in a thermal calculus very pretentious. Must be introductory simplify hypothesis that one with starting burning at finished corresponding thermal agent composition it is instantaneous beckoning that finished corresponding the excess coefficient from air λ with who are place burning combustible. It be to achieve a experimental equipment for try the propose model by the author, gifted with device and electrical sounders necessary of modeling.

6. THE PROPOSE CONTRIBUTIONS

It be realize a program from calculate parameter spark ignition engines with electronic injection from gasoline with subrogates:

- the program from calculate to parameter spark ignition engines with electronic injection from gasoline (dependence after revolution n and excess coefficient of air λ at temperature ambient medium t_o=-35...+45°C and pressure ambient medium p_o=1·10^2 kPa);
- the program from calculate to parameter spark ignition engines with electronic injection from gasoline (dependence after revolution n and temperature ambient medium t_o at excess coefficient of air λ=1 and pressure ambient medium p_o=1·10^2 kPa); [Blaga,2000]
- debit meter point of cycle, coefficient from fill, dosage, measure thermal combustion of unity cylinder engine, rapport from grow of pressure in isochors combustion, rapport growth volume in post burning, the technical-economical of driving and duration injection. [Blaga,2005].

It be representation 3-D variation of parameter technical-economic of model proposed with revolution engine and temperature ambient medium. It be to achieve a comparation between the calculate and measured of duration injection and angle injection with revolution growth from at 500 at 6500 rot/min, of engine with electronic injection gasoline type Bosch Motronic. It be realization one comparation between diagram theoretic from cycle proposed by the author and diagram of engine with electronic injection of gasoline, that was obtain one the experimental installation.

It is to effect calculation error and the correction factor face atmospheric condition from reference, on the engine electronic injection of gasoline system. For engines fitting out with propose from author it well be raise on engine stall, from foundation diagram 3-D for duration injection, angle from kindling at total load and partial load and enrichment coefficients at total load.

Investigation realized to be continue for determine mechanical loss at electronic injection of gasoline, in domain little revolution. [Negrea, & Sandu ,2000].

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THE CHARACTERISTIC FOR INJECTIONS TIMES

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ABSTRACT

With help to present parameters in this working are realize on the stand engine: the characteristic from speed at all load, the characteristic from speed at partial load, the combustible consumption's at totally task, the combustible consumption's at partially task In the writing "The characteristic's for revolution at partial's of engine load type 106-10 with injection for gasoline ", the experimental test of settle proposal was determine the performance dynamics and combustible consumption. The equipment for to try is more feet that is existing now. Was using equipment for test of Engines with Spark lightning with help injection of petrol that is present in number one imagines.

Key words: gasoline injection, effective power, totally task, partially task, angle of lighting.

1. INTRODUCTION

The general objective is the development of the infrastructure by the way of acquisition equipment and complementary calculation systems, including the dedicated soft, instruction services etc.), which allow the researchers to work under conditions which assure performance, having the same devices and equipment as that exiting in the European laboratories which have similar profiles. The real objective is development of the research infrastructure for internal burning engines, motor engines, tractors, and agricultural machinery. The specific objective is the growth of the usage rate of the existing research infrastructure, the development of informing and scientific documentation infrastructure and carrying out services towards third persons using the purchased equipments. Among the objectives specific for the research objectives we can mention: refining the internal combustion engines in order to reduce fuel consumption and gases evacuated by the engines of the automobiles and tractors; research regarding experimenting non-conventional fuels, especially bio-diesel for automobiles and tractors; research regarding conversion systems of renewable energies (geothermal thermal energy, solar energy, wind energy etc.); research regarding new types of engines with a mono-regime functioning; research regarding the usage of biogas at the internal combustion engines in agriculture; research regarding the efficiency of the tilling of the soil for agricultural and horticultural in a classical and ecological agriculture cultures; studies and research methods to control and reduce the phonic and chemical pollution at engines with internal combustion. The derived objectives lead to the development of research infrastructure. There will be made equipment and device purchasing, as well as performing works like (appropriating interior space, cleaning, re-dividing of the multifunctional laboratory for Agricultural Mechanization from the University from Oradea having the total usable surfaces $24 \times 16 = 384$ m^2 according to the figure above). By means of the purchased devices, we can sketch the indicated diagrams for the engines starting with their project and applicative research, and those operating, in this way being possible to determine all technical-economical and operating parameters of the tractors. We will try, check, and adjust the engine parts from motors, tractors, and agricultural machinery. We intend to buy equipment for testing engines made of: trying stalls equipped with instruments and devices for fuel supply and cooling water, pipes for gas evacuation,

instruments, and devices for making these measurements. In order to determine the dynamic and fuel consumption performances we will purchase a stall equipped with an electric brake with eddy currents R&D AVL - Austria with all peripheral equipments. The laboratories instruments for determining the polluting products, stalls with rolls having brake with eddy currents and a set of detachable with insertion SCHENCH 364/260, gas analyzer AVL Austria, which works on the non-dispersive absorption principle in specter of infrared radiations, is used for the analysis of engine evacuated gases. We will buy stalls, devices, and testers used for trying the engines, tractors and agricultural machineries presented in the list of equipments necessary to carry on the project. We will purchase devices, office equipment and furniture, testing and consulting services, technical assistance including assembling, functioning, maintenance, repairing and instructing.

General Objective: The general objective of the project is to develop research capacities, the opening of the research-development-innovation system towards the international scientific environment, and connecting it to the national socio-economic environment. The development of research development innovation is made by the way of acquisition of research development innovation equipment and contiguous goods (complementary calculation systems, including the dedicated soft, instruction services etc.), which allow the researchers to work under conditions which assure performance, having the same devices and equipment as that exiting in the European laboratories which have similar profiles. The real objective is development of the research infrastructure for internal burning engines, automobiles, tractors and agricultural machinery.

Specific objectives

The development of the research infrastructure in the prior research domains established through the National Strategy research development innovation; the growth of the usage rate of the existing research infrastructure; the development of informing and scientific documentation infrastructure; revaluation of the potential and of research development innovation resources in the region; sustaining the science-society dialogue; participation of the research development innovation entities to international research programs; participation and representing Romania at international scientific and technical organizations. Among the specific objectives for the research objectives we can mention: refining the internal combustion engines in order to reduce fuel consumption and gases evacuated by the engines of the automobiles and tractors; research regarding experimenting non-conventional fuels, especially bio-diesel for automobiles and tractors; research regarding conversion systems of renewable energies (geothermal thermal energy, solar energy, wind energy etc.); research regarding new types of engines with a mono-regime functioning; research regarding the usage of biogas at the internal combustion engines in agriculture; research regarding the efficiency of the tilling of the soil for agricultural and horticultural in a classical and ecological agriculture cultures; studies and research methods to control and reduce the phonic and chemical pollution at engines with internal combustion. The results will be measured through indicators which reflect the impact of the investment in the research development innovation system:

Derived objectives: the development of research infrastructure: modernizing, consolidating, extension, and conservation of the existing infrastructure and existing research development devices in the universities, laboratories, high performance equipments, great size databases. The devices from the multifunctional laboratory for agricultural mechanization are essential, as long as we want agriculture in our country to be internationally competitive, we need to have the necessary devices to form new

generations of researchers in the agricultural mechanization domain, who, by a close co-operation with researchers from agricultural research centers to develop relevant research projects on national and international level in agriculture. By means of the purchased devices, we can sketch the indicated diagrams for the engines starting with their project and applicative research, and those operating, in this way being possible to determine all technical-economical and operating parameters of the tractor. We will try, check and adjust the engine parts from motors, tractors and agricultural machinery, namely the greasing and cooling system, the engine supply pump, the ignition system, the starting system, the electric equipment of tractors and agricultural machinery, the hydraulic system, the trying and grinding of these machineries, the power balance of the tractors, to determine the traction force.

## 2. PRESENTATION OF THE MULTIFUNCTIONAL LABORATORY

The multifunctional laboratory for Agricultural Mechanization, the Faculty for the Protection of the Environment, from the University from Oradea is presented in fig.1. The Multifunctional Laboratory will serve the following specializations from the University: Agriculture, Horticulture, Forestry, Forest Exploitation, Wood Processing, Thermal Engines, Motor vehicles, etc.
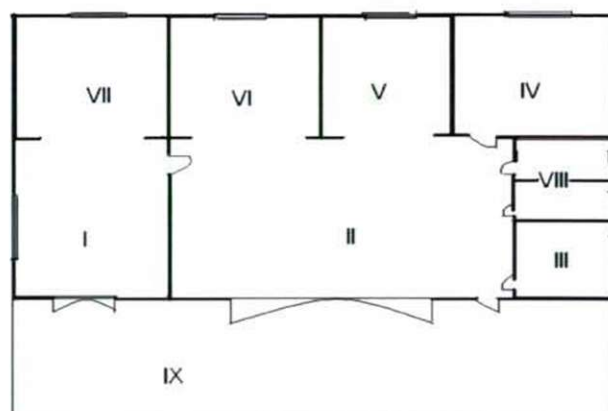
Fig.1 The scheme of multifunctional laboratory for Agricultural Mechanization, Faculty for Protection of the Environment, University from Oradea: I- engine testing(surface 6x8 m^2); II- tractors and agricultural machinery(surface 14x8 m^2); III-office (surface 4x4 m^2);IV- electrical equipments (surface 6x8 m^2); V- electronic testing direction, brakes (surface 6x8 m^2); VI- pollution testing (surface 6x8 m^2); VII- hydraulic tests (surface 6x8 m^2); VIII-health group (surface 4x4 m^2); IX- cold park.

The afferent subjects for these specializations which will use the laboratory for their work are: energetic base for agriculture, Agricultural machinery, Mechanization of forestry work, Machinery operation for agriculture and food industry, General course for machineries, Thermo-techniques and thermal machinery, Thermal engines, The thermo gas dynamics of the engines, Designing and calculation for engines, Designing and calculation for motor vehicles, The technology of transport, The electric equipment on board,

Dynamic of the motor vehicles, Methods of fighting and reducing phonic and chemical pollution at engines with internal combustion. Specialists who will use the multifunctional laboratory will participate to draw up this project.
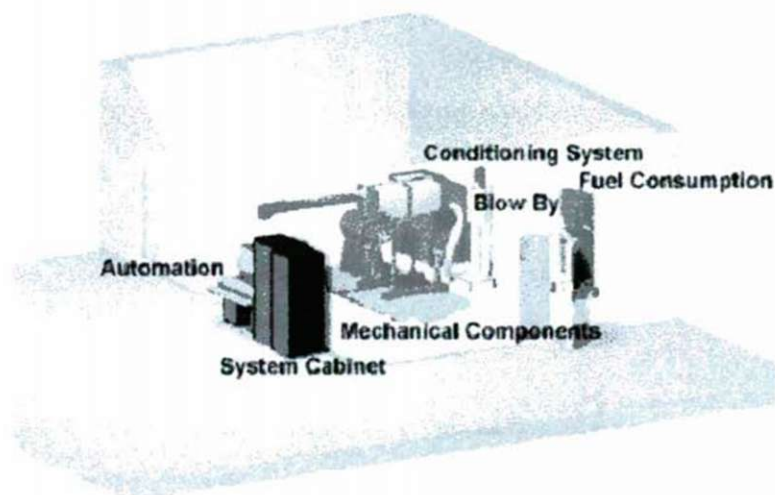
Fig. 2 System Cabinet

2.1. The equipment for i.c.e. testing

The equipment for i.c.e. testing are constituted by: test benches equipped with apparatus and the devices for fuel and water supply, the exhaust gases manifolds, apparatus and devices for the measurement's effectuation. The equipment for to try of the engine with fuel injection is made by: figure 3
-foundation with a plate and a frame, on which it is fixed the equipment for testing;
-electric or hydraulic brake
-the engine fuel supply system and the devices which allow the determination of fuel consumption;
-the engine's starting system;
-the exhaust system of the burned gases and of the damping of the noise;
-the system for measuring oil consumption, air and water rate;
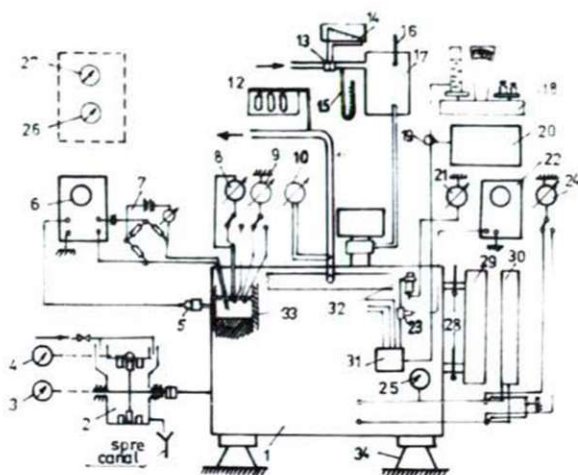-apparatus for measuring temperatures, pressures etc.

Fig. 3. The engine test bench with diesel fuel injection system:
1-engine; 2-electric brake; 3-tahometer; 4- brake's indication dial; 5-piezoelectric transducer; 6-oscilograph; 7-apparatus to measure gases temperature in the cylinder; 8-piezoelectric pyrometer to measure the valve's temperatures; 9- piezoelectric pyrometer to measure lid cylinder's; 10- piezoelectric pyrometer to measure the temperature in the exhaust manifold; 11- the exhaust manifold;12-exhaust gases analyzer; 13-dyaphragm; 14-micrometer; 15-manometer with liquid; 16-thermometer; 17-the tank for air; 18-device to measure fuel rate; 19-tap for 3 ways; 20-tank; 21- piezoelectric pyrometer for measuring the temperature at the injector; 22-oscilograph; 23- piezoelectric transducer for measuring the injection's pressure; 24- piezoelectric pyrometers for measure ting oil's temperature; 25-manometer for oil; 26-thermometer for the environment's temperature; 27- barometer; 28-thermometer for the cooling water; 29-radiator for water; 30-radiator for oil; 31-fuel supply electric pump; 32-injector; 33-the engine's cylinder; 34-the engine's support on foundation.

We will buy test benches, devices, and testers used for trying the engines, tractors and agricultural machineries presented in the list of equipments necessary to carry on the project.
We will purchase devices, office equipment, and furniture, testing and consulting services, technical assistance including assembling, functioning, maintenance, repairing and instructing.

3. THE TESTING PRESENTATION

At the engines stall have been brought in order to try a Mono-Motronic [Delanette,1989], injection system engine type 106-20 equipped with carburetor 28/30 DCI. The injection's and lighting map drawings used at the engine with fuel injection expert meted by the author constitute some networks of characteristics with are put in the memory under the numerical form into an electronic module. They do not alter net much on the whole duration of the engine's work-ink.
The electronic variation of the advance at the lighting has two important advantages the relative information to the revolution speed is directly taken from the shaft engine thank to in inductive sound with a highly precision of measure and the using of a map drawing allows to obtain adjustment of the advances angle at the lighting. The testing have carried

on retiring to the followings the engine's running in; the determination of the dynamic and of consumption's .

At the engines stall have been brought in order to try a Mono-Motronic injection system engine type 106-10 equipped with carburetor 28/30 DCI. The injection's and lighting map drawings used at the engine with fuel injection expert meted by the author constitute some networks of characteristics with are put in the memory under the numerical form into an electronic module. They do not alter net much on the whole duration of the engine's work-ink. The electronic variation of the advance at the lighting has two important advantages the relative information to the revolution speed is directly taken from the shaft engine thank to in inductive sound with a highly precision of measure and the using of a map drawing allows to obtain adjustment of the advances angle at the lighting. [Bataga, 1996] The testing have carried on retiring to the followings the engine's running in; the determination of the dynamic and of consumption's performances according to SR ISO 1585/1998 and the carburetor variant; the determination of the STAS 6635/87 and of the combustible consumption's performance according to; in the fuel injection's variant; the comparison of the obtained results in the two equipment variant presented in the figures 4,5, and 6. [Blaga,2000];[Blaga,2005].
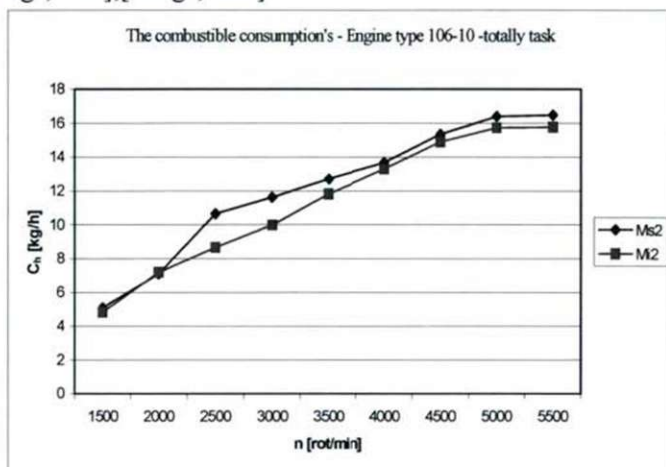

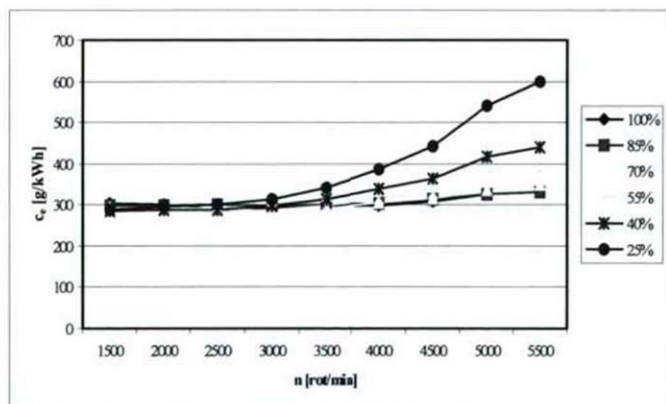*Fig. 4. The combustible consumption's - Engine type 106-10 -totally task*

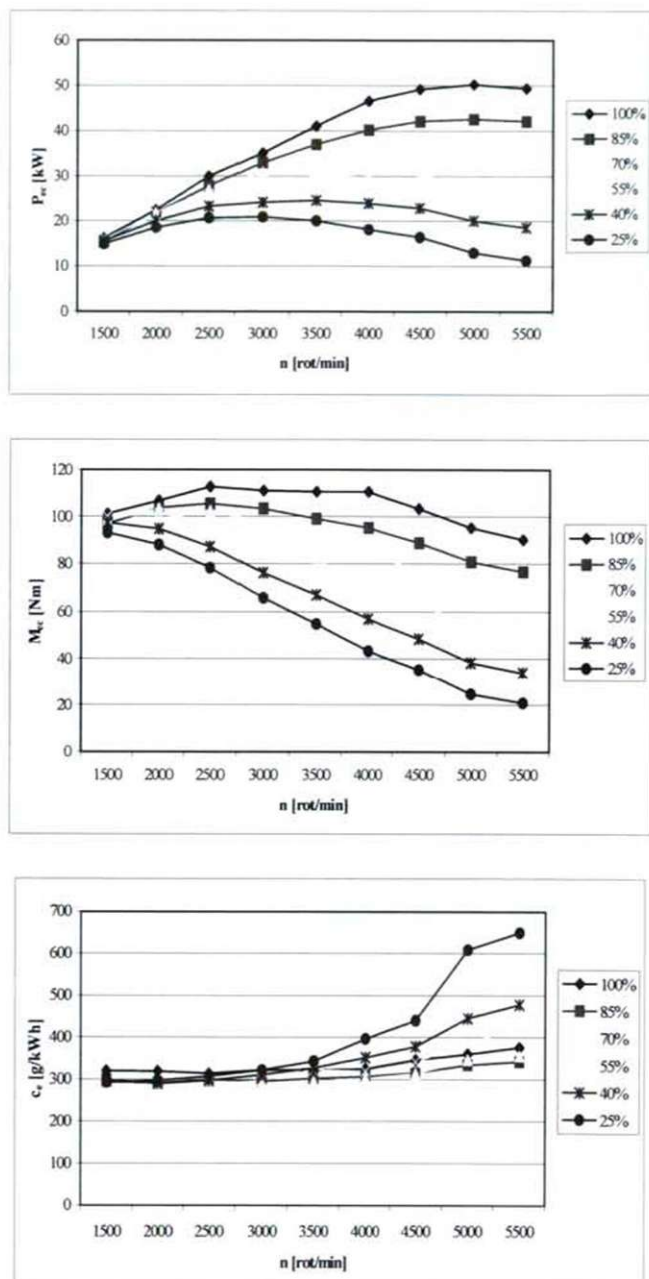*Fig. 5 The rotation characteristic's at partially task. Engine's type 106-10 with carburetor 28/30DCI*

Fig.6. *The rotation characteristic's at partially task. Engine's type 106-10 with engine injection*
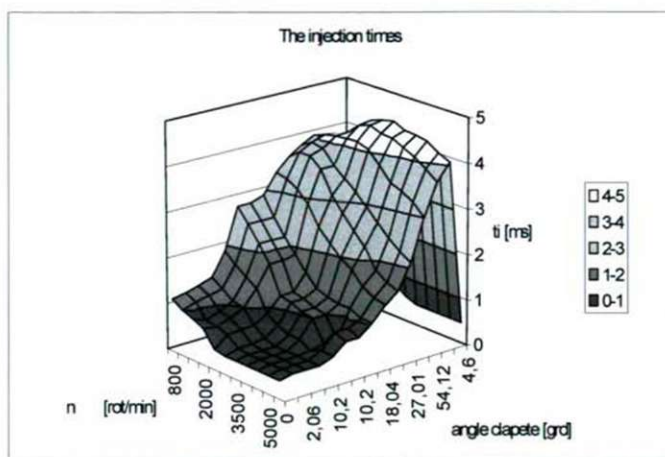
Fig. 7.The characteristic for injection's times

4. CONCLUSION

For the equipped engine's with the model supposed by the author, have been raised up on the engine stall, the main cartograms for the injection's times, at totally and partially task [Grünwald,1980] and the enrichment's coefficient at the totally task which are presented in the figure no 5 .[Blaga,2000]

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ATTITUDE OF THE SMEs IN THE SOUTH PLAIN REGION TO THE ACADEMIC INNOVATION

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ABSTRAKT

In the 20th century the role of the university transformed towards to research, applied research besides education, In addition, there is a third function, too, namely marketing/saleing, of the research results via spin off companies.

The European Commission – according to what was said at the summit of Lisbon- regards universities as the heart of the economic development (Shattock, 2009). They say that the European universities –comparing to the ones in the USA- do not utililize fully their potentials. They consider as the main shortcomings, that the European universities are not able to react to the new challenges, to support economic development and thus, they should be forced to accomplish reforms (COM, 2006(a)).

For this reason, the European universities, so have the national ones, have started to realize technology transfer offices, spin-off firms, regulations on research utilization.

The necessity of these changes has been widely debated by the society so far.

We intended to get to know the attitude, motivation and actual problems of small and medium entrepreneurships in the region of the South Plain with a questionnaire research. First of all, we asked the managers to fill in the compiled questionnaires separately, online. They were the members of Chamber of Commerce and Industry of Csongrád County. They were informed about our survey by the Chamber in the form of Newsletter. Supply of data was voluntary, but in the interest of further availability we asked the firms and their managers to give us their address and phone number. We processed the questionnaires, altogether 46, by means of the Microsoft Excel program.

The main question groups were the following:

- We started with general questions in connection with the businesses.
- In the second question group we tried to map, in an indirect way, if they feel the necessity to form a connection with the University. So we asked if they have any, non-financial problems to be solved or ideas to be realized which they could not accomplish alone.
- The third question group aimed at the innovative activities of the enterprises. We tried to collect data about how much the enterprises accomplish Research and Development activities or if they have an organization of innovation.
- With the fourth question group we intended to see the knowledge and opinions in connection with the University of Szeged.
- Finally, we examined disposition for cooperation with the fifth question group. We wanted to see if the managers would like to form a connection with the university.

1. INTRODUCTION

In the 20th century the role of the university transformed, besides education, research work is coming into prominence more and more. In addition, there is a third function, too, namely marketing the research results.

The European Commission – according to what was said at the summit of Lisbon- regards universities as the heart of the economic development (Shattock, 2009). They say that the

European universities –comparing to the ones in the USA- do not utililize fully their potentials. They consider as the main shortcomings, that the European universities are not able to react to the new challenges, to support economic development and thus, they should be forced to accomplish reforms (COM, 2006(a)).

For this reason, the European universities, so have the national ones, have started to realize technology transfer offices, spin-off firms, regulations on reasearch utilization.

The necessity of these changes has been widely debated by the society so far.

During the research work we assessed the small and middle businesses for the initiative of this kind of the University of Szeged.

Our aim was to make a survey of the entrepreneurial demands, and to see how much the entrepreneurs are disposed to accomplish an innovation or to get to know more professional knowledge in cooperation with the University.

2. SURVEY OF THE SPECIAL LITERATURE

2.1.Explanation of the most important terms on the subject

The term „tech-transfer" is „the flow of know-how, the technical knowledge or a technology from one organizational environment to the other" (Roessner, 2000). Or in other words, it is a so-called umbrella term which contains a lot of activities from elaboration of the technology up to its realization on the market (Doheny-Farina, 1992).

The university tech-transfer can be realized in several channels. Some professionals (Link et al, 2006) distinguish two main types:
  1. Formal – for example, licence contracts, spin-off businesses, academic-industrial research projects
  2. Informal – for example, interaction between friends, joint publication of a company's researcher and a university teacher

The special literature treats the *scientific entrepreneurship* as the synonym of the academic-industrial tech-transfer, and of establishment of spin-off businesses (Klofsten, Jones-Evans, 2000). Hart (2003) identifies the scientific entrpreneurship with the economic growth of universities and their role in the national innovative system, in wider sense, while with the tech-ransfer, in a narrow sense.

Louis et al (1989) distinguish five basic forms of the scientific □ntrepreneurial activity which are the following, in the decreasing order of compatibility with the traditional role of researcher:
  1. large-scale research projects (financed through tenders, applications),
  2. additional income, besides university (eg. Professional, technical advice),
  3. procurement of financial sources by utilizing academic-industrial connections (eg, contractual research work),
  4. patenting the research results, and
  5. operation of (spin-off) businesses established to utilize the research results.

If we examine definitions of the *enterprising university*, it becomes clear that, apart from some common points, there is not a common opinion regarding the explanation of this phenomenon. These definitions are problematic because institutions of higher education are loose leagues of departments and faculties of great autonomy. For this, we can rarely

talk about homogeneus enterprising universities, rather about enterprising researchers, departments or faculties.

On the basis of the examination carried out on the enterprising transformation in American, European and Latin-American universities, Etzkowitz (2004) formulated the following five arguments (CIIHIR) to describe the entrepreneurial universities:

1. Capitalisation, realization and transfer of knowledge for scientific and market purposes.
2. Interdependence, elimination of the ivory tower-behaviour, formation of tight connections with the government and the industrial sector.
3. Independence, since the enterprising university is not subordinated to any other sectors.
4. Hybridisation, because release of the conflict between dependence on the market demand and the institutional independence requires realization of crossed organizational forms.
5. Reflexivity which means that permanent transformation of the connections with the other spheres (eg, industry, government) makes the constant innovation of the inner organizational structure necessary.

2.2. Entrepreneurialism of the Hungarian universities

Research of HRUBOS et al (2004) done between 2001 and 2002 is the most thorough study at present which examines the enterprising transformation of the Hungarian universities. Hrubos and the research team present the philosophy and the way of operation of three Hungarian universities (BME, SZIE, PTE) and four foreign institutions in the form of case studies, on the basis of Clark's methodology and criterion system. Although they chose the three basic types of the Hungarian universities (specialized university, integrated university with more campuses, classical science university) as the object of their analysis, according to the authors it is not representative regarding the entire Hungarian system of higher education.

The team of Hrubos conclude, on the basis of document analysis, and interviews with academic managers and other competent persons, that the main obstacles to the entrepreneurial transformation of the Hungarian universities are the strong organizational decentralization and the autonomy of high level in case of faculties and departments. Disunity of this kind hinders the quick and efficient decision-making, restricts the scope for action of the academic management, and finally, increases disparity between faculties and departments. The authors, similar to the international special literature, establish that certain faculties (information technology, technical or economic-business) have stronger market attitude and connections, due to their features, than the others (faculties of arts and of natural science). Since there is no redistribution of income between faculties in different situation, decentralization is to the advantage of more entrepreneurial departments and it significantly aggravates the operation of the entire university.

3. MATERIAL AND METHOD

We intended to get to know the attitude, motivation and actual problems of small and middle businesses in the region of the South Plain with a questionnaire research. First of all, we asked the managers to fill in the compiled questionnaires separately, online. They were the members of Chamber of Commerce and Industry of Csongrád County (Csongrád Megyei Kereskedelmi és Iparkamara). They were informed about our survey by the

Chamber in the form of Newsletter. Supply of data was voluntary, but in the interest of further availability we asked the firms and their managers to give us their address and phone number. We processed the questionnaires, altogether 46, by means of the Microsoft Excel program.

The main question groups were the following:

- We started with general questions in connection with the businesses.
- In the second question group we tried to map, in an indirect way, if they feel the necessity to form a connection with the University. So we asked if they have any, non-financial problems to be solved or ideas to be realized which they could not accomplish alone.
- The third question group aimed at the innovative activities of the enterprises. We tried to collect data about how much the enterprises accomplish Research and Development activities or if they have an organization of innovation.
- With the fourth question group we intended to see the knowledge and opinions in connection with the University of Szeged.
- Finally, we examined disposition for cooperation with the fifth question group. We wanted to see if the managers would like to form a connection with the university.

4. RESULTS AND THEIR ASSESSMENT

To show the results we present the answers given to the 4th and 5th question groups.

Businesses of the ones who filled in the questionnaires can be characterized by the following (Table 1):

Table 1 Statistic characteristics of the enterprises of those who answered the qustions (n=46)

According to the feature of the enterprise	number	%
Private	16	34,8
Joint	30	65,2
According to the size of the enterprise		
small	11	23,9
middle	3	6,5
micro	32	69,6
According to the ownership of the enterprise		
Hungarian	46	100

Only two questionees have never heard of the University, so the sample number decreased to 44 from 46.

The questionees had to assess the university from 1 to 5 on the basis of some aspects. Table 2 shows the average scores and their dispersion.

Table 2 Assessment of certain features of the university – questionees' opinion (n=44)

Feature	Average score	Dispersion
Theoretical knowledge	4,5	0,586
Know-how	4,4	0,583
Reliability	4,3	0,614
Accuracy	4,1	0,759
Fame, reputation	4,3	0,945

High scores can be seen in the table, so the questionees have a good opinion about our university. This positive reputation helps realize the connection necessary for cooperation.

The nature of this connection was defined in three levels: development, counselling and a possible course, and we asked questions about these possibilities. The answers are shown in Table 3.

Table 3 Questionees from the aspect of connections (n=46)

Development	number	%
Yes	18	39,1
No	28	60,9
Counselling		
Yes	22	47,8
No	24	52,2
Course		
Yes	23	50
No	23	50

Most of them (50%) would like to form a connection in the form of a course. Counselling is required in a similar proportion (47,8%). Much less managers would need professional help to develop their enterprises, only 40% thought so.

Diagrams 1 and 2 give more information about the actual reguired field of counselling and course organization.
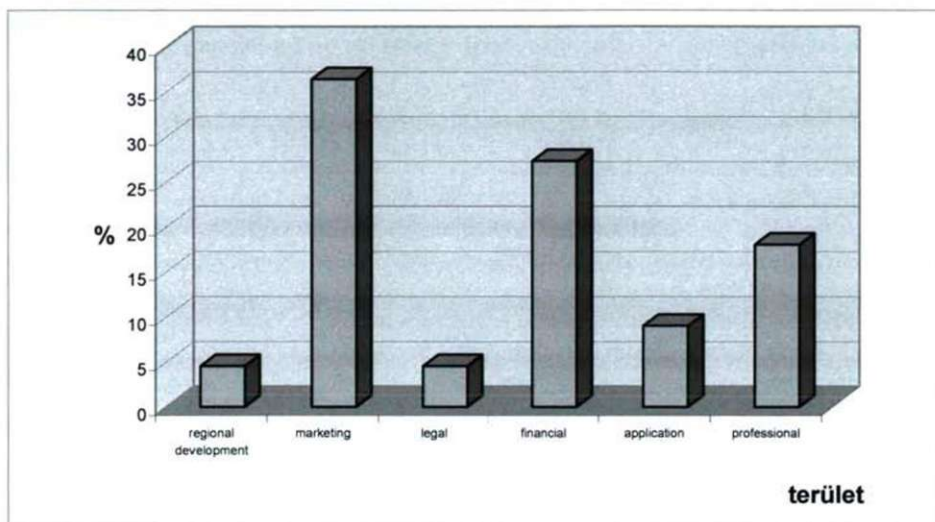
Figure 1 Questionees on the basis of the fields of counselling (n=22)

It can be seen from the answers that most answerers (36,4%) would need marketing counselling. It supports descriptions relating to the questions on actual problems in the second question group. Besides marketing, there would be some demands on financial counselling (27,3%), also the technical field (eg, electronic, technical engineering) would need more information. One person would need counselling on regional development, while the other on legal problems.
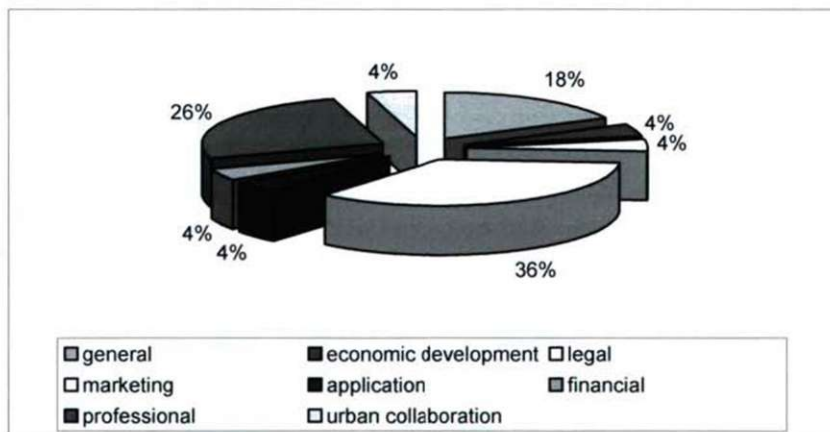

Figure 2 Questionees on the basis of the fields of possible courses (n=23)

Similar to what have been said before, most people would need courses on marketing (36%). Entreprenuers would be interested in professional, technical courses (eg. car

mechanic, renovation of historic buildings, food industry, taxation and financial affairs) (26%), and they would like to get some general knowledge on entrepreneurship (18%).

5. SUMMARY

As an effect of the transformed social and economic conditions, the University of Szeged has headed towards a new direction which is accepted in the USA and in the EU, too: towards the scientific entrepreneurship.

As a first step, we carried out an examination among the small and middle enterprises in the region of South Plain.

On the basis of the subject matters we had an idea about:
- the most important parameters of the enterprises,
- actual problems, ideas to be realized,
- disposition for innovation,
- opinion about the university,
- disposition for cooperation with the university.

The questionnaire was filled in by 46 people. The proportion of filling is quite low, but we can establish some facts even on the basis of these almost fifty answers.

We can conclude from the answers:
- by means of the questionnaire we could get to know the problems to be solved of the answerers, so it was suitable to map the claims;
- in conformity with the special literature, the innovative activity is not significant among the questionees;
- reputation of the University of Szeged is good, so we can assume the positive attitude necessary to form connections;
- the entreprenuers would like to apply for courses organized by the University, or to turn to the counselling provided by the University.

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BEET ROOT POMACE - A GOOD SOURCE OF ANTIOXIDANT PHYTOCHEMICALS

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ABSTRACT

The present study describes the *in vitro* antioxidant activity of ethanol extracts of beet root pomace Total content of phenolics, flavonoids and betalains were determinated after solid-phase extraction. Evaluation of antioxidative activity of beet root pomace extract against stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals was determined spectofotometrically and against reactive hydroxil radicals by electron spin resonance (ESR) spectroscopy. Also, antioxidant activity on hydroxyl radicals after *in vitro* incubation in stimulated stomach model system was observed.

1. INTRODUCTION

Processing of fruits and vegetables results in high amounts of waste materials (by-products) which are economical and ecological deficit problem. These products are also promising sources of bioactive antioxidants and color giving compounds, which could be used as additives in food, pharmaceutical and cosmetic industry. In numerous diets, beet root is a very significant part and represent an important source of bioavailable compounds such as polyphenolic compounds, carotenoids, betalains, vitamins and mineralals. The beet root pomace, waste product generated primarily during juice processing, is a potential source of natural antioxidant compounds for use as dietary or food antioxidant.

2. MATERIAL AND METHODS

Beet root was pulped using a fruit mill and beet root pomace was used in this work.
Sample of beet root pomace (100 g) was extracted with 50% ethanol (1000ml) containing 0,5% acetic acid for 30min. The obtained extract was evaporated to dryness under reduced pressure (m = 8,6661g).
Extract was purified using solid-phase extraction (SPE) with CHROMABOND C_{18} columns. The purified beet root extract was evapored to dryness under reduced pressure (m = 0.1109 g).
Total phenolic compounds in extract were determined spectrophotometrically using the Folin-Ciocalteu reagent (expressed as mg chlorogenic acid equivalents per g dry weight of beet root pomace).
Total flavonoids in extract were estimated spectrophotometrically according to Markham (expressed as mg rutin per g dry weight of beet root pomace).
Total betalain contents (betacyanins and betaxanthins) were measured spectrophotometrically using von Elbe method (expressed as mg betacyanins and betaxanthins per g dry weight of beet root pomace).
Content of phenolic acids and flavonoids was quantified by HPLC analysis. Instrumentation and chromatographic conditions HPLC analysis was performed using a liquid chromatograph HPLC Agilent 1200 equipped with a DAD (Diode Array Detector). A Agilent column, Eclipse XDB-C18, 1,8 µm, 4,6 x 50 mm, was used at a flow-rate of 1

ml/min. Solvent gradient was performed by varying the proportion of solvent A (methanol) to solvent B (1% HCOOH in water). The spectra were acquired in the range 190–400 nm.

Antioxidant activity against stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals was determined spectofotometrically. The hydrogen atom or electron donation abilities of the extract was measured from the bleaching of a purple-colored methanol solution of stable DPPH radical. The influence of different ethanol extract on the formation and stabilization of hydroxyl radicals in Fenton reaction system was investigated using ESR spin-trapping method. The Fenton reaction was conducted by mixing 0.2 mL of 0.3 M DMPO, 0.2 mL of 10 mM H_2O_2, and 0.2 mL of 10 mM Fe^{2+} (control). ESR spectra were recorded after 5 minutes.

Also, antioxidant activity of enriched beet root juice on hydroxyl radicals after *in vitro* incubation in stimulated stomach model system was observed.

3. RESULTS AND DISCUSSION

Table 1. Antioxidant compounds in beet root pomace extract

Antioxidant compounds		mg/g
Total phenolic compounds		117,863
Total flavonoids		54,844
Total betalains	Betacyanins	14,129
	Vulgaxanthins	8,324

Table 2. Content of phenolic acids and flavonoids quantified by HPLC analysis

Phenolic acids and flavonoids	mg/g
Catechin	37,497
Vanilic acid	1,205
Protocatechin	0,598
Cimet acid	0,015
Quercetin	0,006
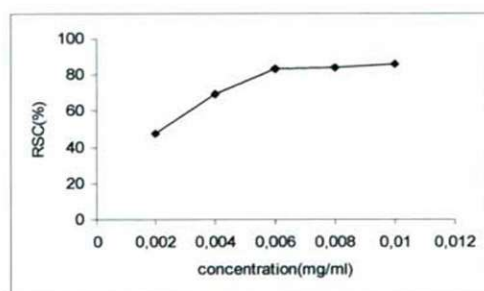
Figure 2. Antioxidant activity of beet root pomace extract against stable DPPH radicals
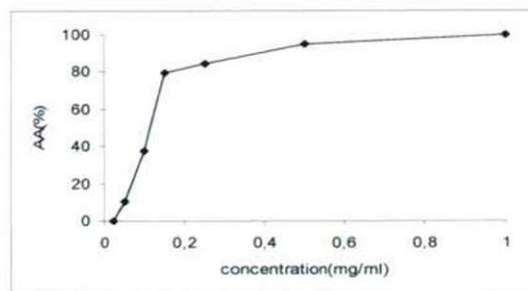
Figure 3. Antioxidant activity of beet root pomace extract against reactive hydroxil radical

Results show that beet root pomace possess considerable amounts of phenolic compounds and betalains. HPLC analysis showed that the most abundant flavonoid was catechin (37,497 mg/g), probably the most responsible component for strong antioxidant activity of extract. The scavenging activity on hydroxyl radicals was increased in the presence of different amounts of beet root extracts.The highest investigated concentration (1 mg/ml) of ethanol extract inhibits completely the formation of hydroxyl radical. The capacity of beet root pomace to inhibit hydroxyl radical generated by the Fenton reaction could be due to direct scavenging effect and/or to inhibit of hydroxyl generation. The second mechanism occurs by ion chelation.
Antioxidant activity against hydoxyl radicals of enriched juice was AA_{OH}=69,38%, and after *in vitro* incubation in simulated stomach model system was AA_{OH}=92,34%.

4. CONCLUSION:

Ethanol extract of beet root pomace has strong antioxidant activity and possess considerable amounts of phenolic compounds and betalains and significant radical scavenging activity on stable DPPH (IC_{50}^{DPPH} was 0,002 mg/ml) and highly reactive hydroxyl radicals (IC_{50} was 0,115 mg/ml). Also, the increase of antioxidant activity on hydroxyl radicals after the *in vitro* incubation in simulated stomach model system suggested the increase of bioavailability of natural antioxidants present in extract. These results show that beet root pomace, waste material after juice processing can be used as a good source of phytochemicals and as a natural additive or functional foods.

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SHOPPING HABITS OF THE INHABITANTS IN A TYPICAL SETTLEMENT OF THE SOUTH-EAST PLAIN

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ABSTRACT

I examined the food purchasing habits of the inhabitants in the settlement by means of a questionnaire. I chose three, relatively busy food stores in the city centre as venues. The survey took three days and was done by interviewers in parallel with each other, in the three stores. Altogether 335 questionnaires were filled in.

Only a small amount of the inhabitants of the farmsteads do their shopping in the above mentioned three stores, though there are no stores in the outskirts, and, as we know, one third of the people of Mezőhegyes live there. I made interviews, altogether 14, with the inhabitants of the outskirts, in connection with their shopping habits.

1. INTRODUCTION

In Mezőhegyes it was the tertial sector that employed the manpower that came partly from the industry and partly from the agriculture. Mainly commercial enterprises (for example groceries) were founded in great number (RUDL J. 2009) for which it was enought to have only a smaller sum of capital. They do not have a big income since people living in the settlement can buy only the basic goods which are necessary for everyday life.

I carried out a questionnaire survey and made interviews to map the shopping habits of the inhabitants of Mezőhegyes. A pecularity of the settlement is that almost one third of its population live in the outskirts which means a fairly great number of consumers so I had to examine not only the habits of the inhabitants in the settlement but the habits of those in the farmsteads.

2. METHODS

I examined the food purchasing habits of the inhabitants by means of questionnaires as it is mentioned in the specialized literature (Bauer A., Berács J. 1999), (Porter, Michael E. 1993), (Tonndorf, Hans G. 1997). I chose three, relatively busy food stores in the centre as venues. The survey took three days and was done by interviewers in parallel with each other, in the three stores. Altogether 335 questionnaires were filled in. The interviewers personally gave them to the customers informing them about the subject of the research. I made interviews with people living on farms.

3. EXAMINATION AND RESULTS

The majority of the customers was skilled worker or pensioner, their age structure is similar to the age structure of the settlement.

To the question which asked how much they spend during one shopping as an average the significant part of the customers answered that a sum under 1.000 Fts (62%), or between 1.000 and 1.500 Fts (34%). They do their daily shopping there (67%). They buy the most important, basic foods in these shops, for example: milk, bread.

20% of the inquired ones go to other bigger settlements to do their bigger shoppings there every two week, while 9% do it on a weekly basis. A part of them (15%) go to the Penny Market to Mezőkovácsháza and to the TESCO to Orosháza. To the question which asked about the reasons most of them said that the TESCO is open non-stop and since they have to arrange their official affairs (at the Job Centre or at the Registry of Title Deeds) in Mezőkovácsháza, they can do the shopping at the same time, too. Some of them go there because of the sales. A few of them go to the market of Tótkomlós every week. 9% of the inquired ones go to Szeged every week or every second week. They are parents whose children go to school in Szeged and they bring or take their children there and in the meantime they buy the necessery goods.

70% of them lived in Mezőhegyes. Some of them came from Pitvaros, Ambrózfalva. Actually, the zone of attraction of these, relatively busy groceries is only as wide.

Only a small part of the people living on farms do their shopping in these shops, though ther are not groceries in the outskirts and as we know, one third of the population of Mezőhegyes live there. I made interviews, altogether 14, about the shopping habits of people there. I applied the interview of mixed type which showed that farmsteads are supplied with the basic foods (eg. milk, bread) by a moving supermarket, besides the service of farm-warden was started some years ago. The farm-wardens, to whom different districts belong, help the inhabitants of the farms not only to buy foods and other consumers' goods but to carry these things home. The „wealthier" people here who have a car can go to the shopping centres of the neighbouring bigger settlements (eg. Orosháza, Mezőkovácsháza) every week. The market of Tótkomlós on Monday and on Saturday is the second source of fresh fruit and vegetables for the people living on farms, after their kitchen garden. Unfortunately, it cannot be disregarded that the solvent demand is very inconsiderable, since the majority of the population has a very low income.

4. CONCLUSIONS

Due to the results of this research we know that the majority of the inhabitants of farmsteads do not do their shopping in the settlement itself but they buy their foods at the moving supermarket and the farm-wardens help them do the shopping. The zone of attraction of the market of Tótkomlós covers both the inner and the outer areas of Mezőhegyes.

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