ANALYSIS OF HEAVY METAL ACCUMULATION FOOD WITH X-RAY FLUORESCENCE SPECTROMETRY

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ABSTRACT

The theme of the study is the examination of heavy metal accumulating ability of commercially available chicken, pork and beef liver samples and comparison with the limits specified by the laws. The measurements were carried out with the Delta XRF device manufactured by Innov-X, which operates on the principle of X-ray radiation. The lead content of all samples of the first and second sampling were beyond the maximum level (0.5 mg/kg) which is required by the Commission Regulation 1881/2006. The measured values were between 2 and 3 mg/kg for both samplings. In case the samples of the third sampling the lead content could not be detected by the applied device. The cadmium contents of the all samples of three samplings exceeded the required cadmium limit in the regulation (0.5 mg/kg). The measured values were between 10 and 20 mg/kg in case of all samples. Tin and mercury contents were not detected in the investigated samples by the applied measurement method. Among the non-toxic heavy metals the samples contained high amounts of iron and manganese, in additional each samples contained small amount of zinc, rubidium and antimony but these does not constitute a health risk due to the minimal amounts.

Keyword: heavy metals, chicken liver, pork liver, beef liver, X-ray fluorescence spectrometry

1. INTRODUCTION

In rapidly developing world, next to the intensive agriculture the increasing industrial activity means more and more problems and causes serious environmental pollution by the increasing metal emission.

The internal organs include in the group of heavy metal accumulating food, but their characteristic is rapidly deterioration. However the traditional test methods are time-consuming in most of cases and it possible to examine just small amount sample from each items. In light of the knowing a development and application of rapid method will be promising solution for determination of heavy metal content of these samples.

The offal such as the liver is one of the most important iron sources for people, because the iron which originates from degradation of haemoglobin, stores in this organs. Many vitamins (C, B, A, D) can be found in the liver and in additional many minerals and trace elements also. Because the liver performs detoxification function the heavy metals are able to accumulate in the liver.

Ayhan (1999) investigated metal contents (Cd, Ca, Cu, Fe, Pb, Mg, Mn, Hg, K, Na and Zn) of three different ages chicken groups (4 weeks, 8 weeks, 18 weeks) in different tissue parts (heart, gizzard, kidney, spleen. liver) with atomic absorption spectroscopy. The results showed varied distributions for analysed elements in different tissue parts. In case of the liver the highest cadmium content was in the four weeks chicken (0.05 mg/kg), the highest lead content was in the eight weeks chicken (0.092 mg/kg) and the highest mercury content was in the 18 weeks chicken (0.084 mg/kg).

A Nigeria research focused the metal contents such as lead, cadmium, copper and zinc in different body parts of chicken. The chicken meat is the major protein source for the people

who live this area, but the metal concentration may increase in the food on the effect of the air pollution and chemicals. The samples originated from the local market of Nsukka and Enugu. As the first step the liver, gizzard and muscles were removed from the body, and after the samples were prepared for the wet ashing. Followed by this the heavy metal content was measured by atomic spectroscopy. The results showed the cadmium content was 1.78-15.32 µg/g, the lead content was 9.7-147.07 µg/g, the copper content was 15.82 -47.79 µg/g and a the zinc content was 0.03 -2.29 µg/g in the samples (Okoye et al.,2011).

A South Korean research had the aim to determine the heavy metal content in some meat products. During the research beef, pork, chicken ham and sausages were investigated. During the investigation wet ashing and microwave technique were combined, but the reproducibility of the microwave measurement was much better than the reproducibility of the wet ashing. The mercury level was determined by mercury analyzer. The lead contents of the metals were 9 µg/kg in beef meat, 10 µg/kg in pork meat, 6 µg/kg in chicken meat, 7 µg/kg in duck, 5 µg/kg in ham and 9 µg/kg in sausage. The cadmium contents were 0.4 µg/kg in beef meat, 4 µg/kg in pork meat, 0.5 µg/kg in chicken meat, 12 µg/kg in duck, 1.5 µg/kg in ham and 1.9 µg/kg in sausage. The arsenic contents were 16 µg/kg in beef meat, 4 µg/kg in pork meat, 21 µg/kg in chicken meat, 10 µg/kg in duck, 14 µg/kg in ham and 18 µg/kg in sausage. The mercury contents were 0.713 mg/kg in beef meat, 0.902 mg/kg in pork meat, 0.710 mg/kg in chicken meat, 0.796 mg/kg in duck, 1.141 mg/kg in ham, 1.052 mg/kg in sausage. The results were compared with the values published by FAO/WHO, which shown the heavy metal concentrations in food were below the harmful level so healthy damage can not occurre during the consumption of these products (Hwang et al., 2011).

2.   MATERIAL and METHOD

Materials
During the investigation the heavy metal contents of the chicken, pork and beef liver were determined. The sampling was implemented three times over three consecutive weeks from the same butcher shops (Chicken liver: ChM: Maxim Sándor, ChW: Wippi és Társa Kft.; Pork liver: PM: Maxim Sándor, PSz: Szabóhús Mix Kft.; Beef liver: BL: Lázár és Társa Kft, BSz: Szabóhús Mix Kft.).
The pulping of the samples was carried out with blender so the samples become into proper for filling of the sample holder. The samples were compacted into the sampler holder to the bubble-free state. The filled with samples jars were covered with a special (mylar) film what was stretched out by a clamping ring on the samples surface.

Method
The determination of the accumulated in liver samples heavy metal contents were used X-ray fluorescence spectrometer (XRF). The used equipment is a brand InnovX, portable Delta XRF device, whose measurement period was 105 sec in case of the investigated samples. The X-ray fluorescence spectrometry as an instrumental analytical method is able to determine elemental composition of solid and fluid samples from minimal prepared sample size, additionally this method can be used for direct analysis of solid and liquid materials as well. In the course of the process the sample is shot by the X-ray thus the atoms within the sample got into excited position so typical characteristic radiation for particular elements is emitted. Energy (wavelength) of these characteristic radiations changes element by element and this fact is considered as the bottom line of the qualitative element analysis. The intensity of characteristic radiation of the element is commeasurable to its concentration which permits of the qualitative analysis.

3.   RESULTS and CONCLUSION

The measurement results of the samples of first sampling showed the lead contents were greater amounts by the permitted by the legislation value (0.5 mg/kg). The same could be observed by the cadmium content, by which the approved level is 0.5 mg/kg too (1881/2006 EC Regulation).
Another group of heavy metal includes those metals which are essential for the human body such as the iron, which could be found in all samples. But it can be observed the pork and beef liver included higher amount the chicken liver. The manganese and zinc have important role in functioning of the human body because the absence of manganese and zinc can cause bone development problems. These elements were significant amount in all samples (Fig.1).
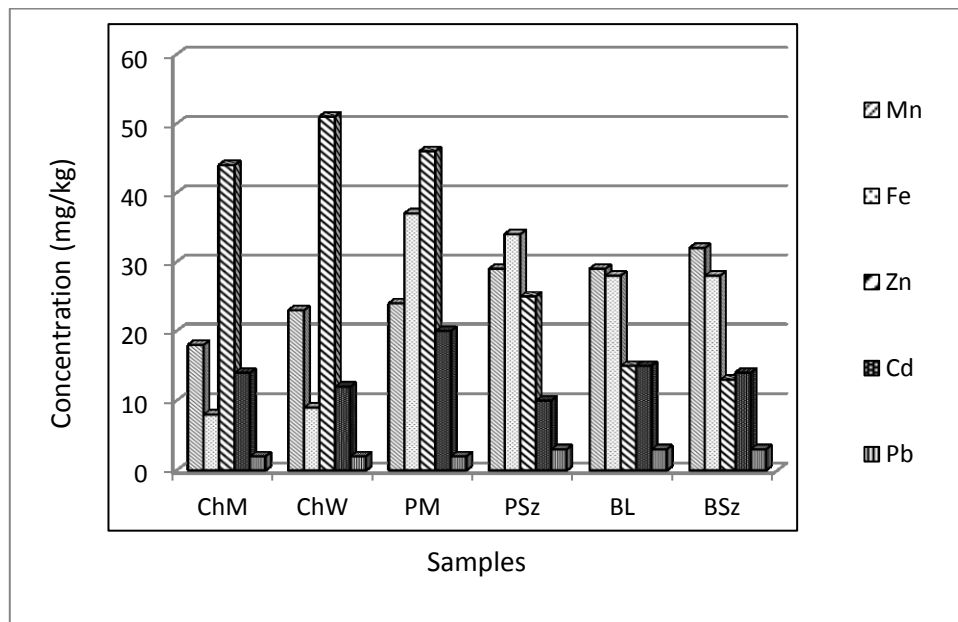

Figure 1 Measurements result of the first sampling

The results of the second sampling showed the lead and cadmium values were higher than the required by the legislation levels (0.5 mg/kg). The iron content of the pork liver was extremely high compared with the iron content of the chicken and pork liver and relative to the results of first sampling too. The distribution of the manganese was relatively uniform as samples, but the manganese contents of the samples of the second sampling were five times more than the manganese contents of the samples of the first sampling (Fig.2).
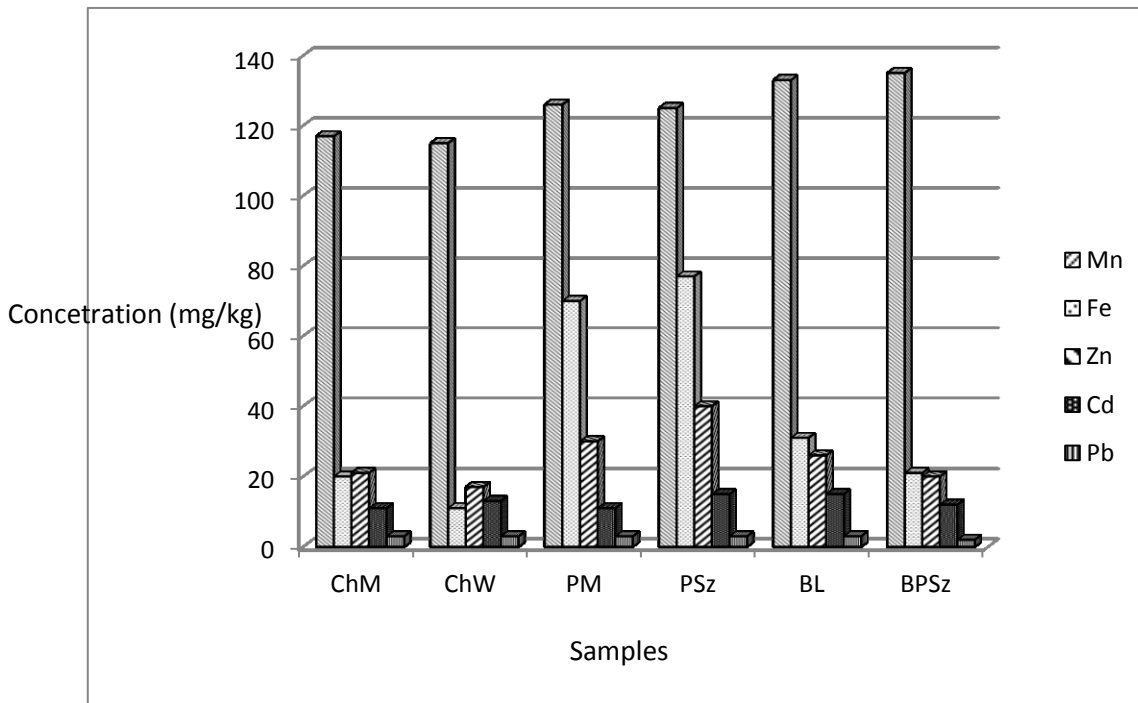
Figure 2 The measurements result of the second sampling

In case of the third sampling the same can be concluded, so the cadmium contents were above the limit. In these samples lead contents were not detected by the device. The iron was found large quantities in the samples, especially by one of beef lives the iron content was 303 mg/kg. Based on the data the manganese was the smallest amount in the samples of the third sampling (Fig.3).
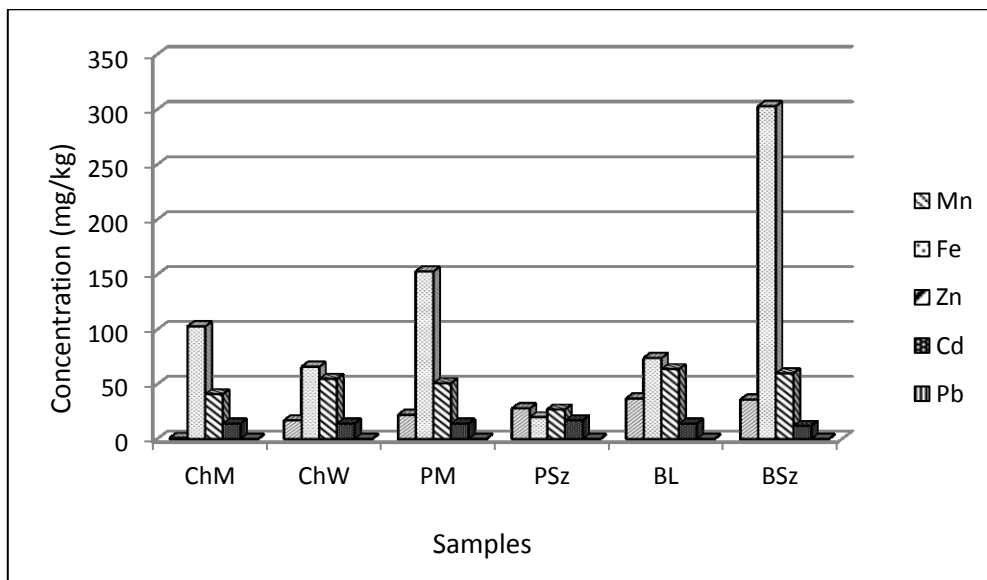

Figure 3 The measurements results of the third sampling

Based on the experimental results it can be said that among the highly poisonous, toxic heavy metals the lead and the cadmium could be detected above the limits all of samples which can cause metal toxicity in long term consumption.

Among the non-toxic heavy metals the samples included iron and manganese, further all samples included zinc, rubidium and antimony, however their minimal amounts does not constitute health risk.

The advantage of the XRF measurement technique is that the analytical test can be completed quickly, which is great advantage in case of the perishable samples. The measurement does not destroy the structure of the samples and the technique is able to analyse large amount samples.

The possible disadvantages of this method are that the instrument calibration per elements may be necessary, and the device is sensitivity for the matrix effects and the surface inhomogeneity during the measurements.

It would be worth to compare the results with other analytical methods, but the realization raises serious problems because the device does not distinguish between the compounds so in case of the tripping based analytical methods some portion of the differences may result from the sample preparation.

Significant difference was observed between the concentrations of some elements in case of some samples, so it would be worth to continue the investigation with more detailed exploration of the origin of the liver samples such as the examinations of the feeding and housing conditions effect.

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ANALYSIS OF THE DIFFERENT FILTRATION PARAMETERS OF WHEY BY TUBULAR AND VIBRATORY FILTRATION SYSTEMS

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ABSTRACT

The largest quantities of by-product of the dairy, namely whey comes from the cheese making. The whey proteins are used by the agriculture in animal nutrition, and by the human nutrition as well; dry soups, infant formulas and supplements. The aim of our experiments was the separation of the lipid fraction of whey. During the measurements 0.05 μm, 0.2 μm and 0.45 μm microfiltration membranes were used in vibrating membrane filtration equipment (VSEP) and in a laboratory tubular membrane module. During the microfiltration, analytical characteristics, the fouling and the retention values were examined. Using the VSEP and the tubular module made possible to compare the effect of vibration, the static mixer and/ the airflow on the separation parameters.

Keywords: whey, vibratory filtration, static mixer, tubular filtration, airflow

1. INTRODUCTION

Liquid whey contains lactose, vitamins, protein, and minerals, along with traces of fat. During the degreasing cream can be skimmed from whey. Whey cream is more salty, tangy, and "cheesy" than ("sweet") cream skimmed from milk, and can be used to make whey butter. The other reason of the degreasing is the further processing of the whey for dry powder/nutritional supplement. The membrane degreasing methods are new ones and the biggest gap of it is the low flux and high resistances. These effects could be mitigated by used membrane modes of us, i.e. static mixer, aeration and vibrating.
Newtonian fluids such as an aqueous solution, - are being turbulent flow in most industrial applications, but within a short pipe section this turbulence is not enough to equalize temperature or concentration in-homogeneities. The use of static stirrers was made better amalgamation than increase the speed or the pressure during the process. The flux is increased and the operating cost is decreased at tubular membranes with static mixer (Krstic et al. 2002). Similar result was obtained with an alternative design equipment to increase turbulence and other type of membranes as well (Bellhouse et al. 2001, Costigan et al. 2002). The fouling of the membranes was possible to decrease at the introduction of gas into the liquid (Laboire et al. 1998, Cabassud et al. 2001, Cui and Wright, 1996). The introduction of a specific gas - in this case air - directly into the fluid created a two-phase gas/liquid flow. The efficiency of the separation is influenced by the position of the membrane (vertical or horizontal) and the direction of the flow (up or down). The aeration method is limited by the gas distribution and the management of this process (Derradji, 2000). During the vibratory shear enhanced process (VSEP), the filtering parameters (flux, retention and resistances) were investigated by the effects of the vibration. This is another solution to decrease fouling (Frappart et al. 2008,

Hodúr et al. 2013). The shears strengths at the surface of the membrane can be increased by vary the frequency of the vibratory membrane module. The polarization layer, the resistance values, and the fouling were measured by the effect of vibration, and the evolution of retention values were measured by the effect of increase of vibrational amplitude (Ahmadu et al. 2009, Hodúr et al. 2009, Kertész et al. 2010).

2. MATERIALS AND METHODS

Sweet cheese whey was used for measurement which came from Soma Budapest Ltd. Its basic analytical parameters are: fat content: 0.18 m/m%, protein content: 0.33 m/m%, milk sugar content: 2.61 m/m%, dry materials: 3.72 m/m%, total protein content: 0.47 m/m%. The degreasing process was made by membrane separation. These basic parameters were measured by Bentley milk analyzer equipment.

The air injection and/or static steering method were implemented by tubular and hollow fiber membranes with 0.45, 0.2 microns, 0.05 microns cut off value. The tubular membrane was 250 mm length, and it was included 1 tube which has an internal diameter of 7 mm.. The applied static mixer was a 250 mm length *Helix* type metal static stirrer with a pitch of 0,006 m and an inner radius of the stirrer of 0.0035 m. (KenicsTM, Helix).. The *KenicsTM* type static stirrer (made by plastic material) was used also with a length of 241 mm, and a thickness of 1 mm, a diameter of 6.35 mm. The flux was performed on 100 L/h recirculation flow rate, on 0.2 MPa transmembrane pressures and on 20 L/h air injection rate. In all measurements the initial amount of feed was 2 L of sweet whey. The temperature was a permanent 30°C degree during the tests. The airflow was introduced into the fluid flow before the membrane module.

Vibratory filtration equipment set marketed by New Logic International Corp. and this equipment was used at L-mode (L: laboratory methods: the module comprises one disk-shaped membrane with an active filter surface 503cm2). The VSEP system consists of disk-shaped flat-sheet membranes. This laboratory module attached to a central shaft. The shaft was rotated a short distance at a frequency of 54 Hz. 0.2 μm cut-off values membranes (made of polyethersulfone) were used during the measurements, on a transmembrane pressure at 0.3 MPa. In this equipment the initial amount of feed was 10 L of sweet whey.

The samples were taken at different intervals during the measurement from retentate and also from permeate.

3. RESULTS AND DISCUSSION

The tubular membranes were used during the measurement at a pore size of 0.2 microns. The retention of the fat component was important in our research programme, and we were able to retain more than 50% at low pressure with using static mixer.

The flux values were measured at 0.2 MPa transmembrane pressures and at 100 L/h recirculation flow rate by a 0.45 μm tubular membrane. The flux values are started at 60 L/m^{2}h. The flux values were showed 17-18 L/m^{2}h values during the normal filtration process, and with combined the air injection, the flux was decreased slight by the air flow on a 0.2 μm membrane. When the *Helix* static mixer element was used in the filtration process, the flux values were increased two times greater extent, from 18 L/m^{2}h to 40 L/m^{2}h when the *Helix* static mixer was used with air injection.

The increase of the flux is holding until the 0.2 MPa transmembrane pressures; because on higher pressure values this increase of the flux is started to show a strong deceleration (1. Figure). When the air injection process was used alone, the flux values remained very low;

therefore the air injection method itself is not a recommended method for whey processing. When the *Helix* static mixer was used alone in the equipment under the same parameters, the flux values were showed higher values than the experiments with air injection, but above 0.2 MPa transmembrane pressures values, the flux was strongly decreased, therefore it was justified to use the lower transmembrane pressure.
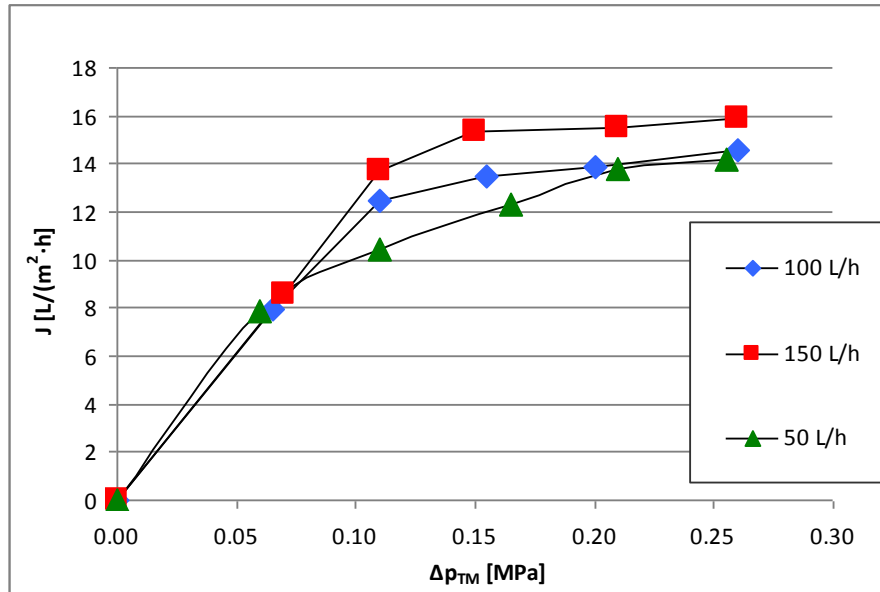
1. Figure The changes of whey flux (J) as a function of trasnmembrane pressure at different recirculation flow rate

The 0.2 microns membrane was used with *Kenics* type static mixer in second period of our research programmes. The flux values (J = 45 L/m^{2}h) were increased by the *Kenics* static mixer, but the increasing was not as high as using the *Helix*-type static mixer (J = 53 L/m^{2}h). Our experiments were continued by a 0.05 microns pore size tubular membrane to comparing the received data with the other tubular membranes different data. The flux was increased 50-80% during the filtration process by using a 0.05 microns pore size tubular membrane with a *Kinetics* static mixer. The flux was decreased strongly after 0.3 MPa transmembrane pressures. The vibratory shear enhanced membrane filtration was examined by a 0.2 µm pore size microfiltration membrane, on 0.3 MPa transmembrane pressures with using vibration at 54 Hz vibrational frequency and without using vibration (Figure 2.).
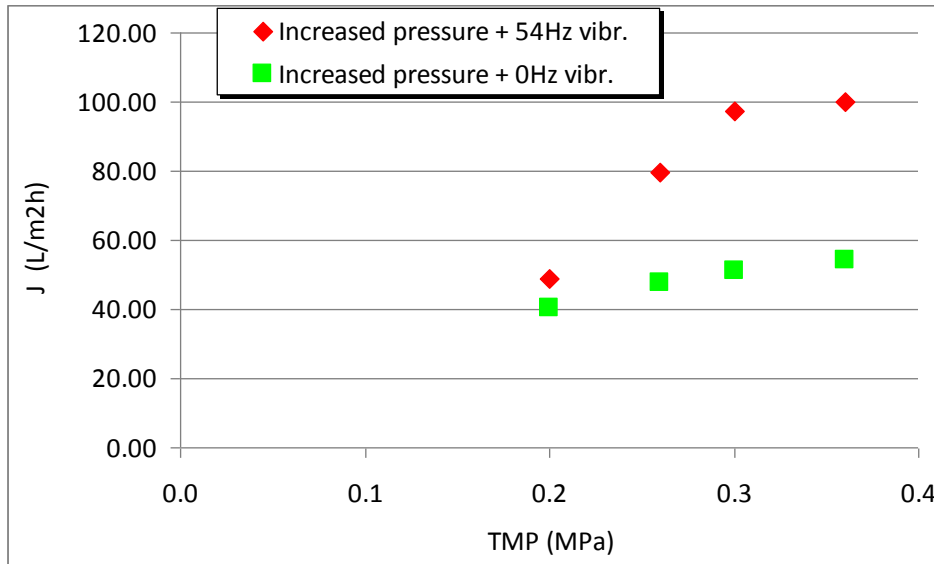
2. Figure The changes of whey flux (J) as a function of trasnmembrane pressure at vibrated (54 Hz) and non vibrated methods

The retention values were measured only from the fat molecules. The examination of the resistance values was showed that the gel layer and the membrane resistance values showed the same magnitude values. The fouling resistance was showed an order of magnitude lower value than the two other determinative resistance values before.

In non-vibrating mode, not only the total resistance value was showed differences, but its structure and distribution as well. Without using vibration during the separation process, the flux values were showed four times lower; the total resistance value was showed one order of magnitude higher; and the fouling resistance values were showed two orders of magnitude higher values.

The drag resistance values were decreased by the vibration, therefore this change was allowed the fat molecules to move and accumulate on the membrane surface (3. Figure) The flexible fat molecules were moved into the capillaries of the membrane under pressure and without vibration, where due to their sizes (3.5 microns), these molecules were fouled inside the membrane capillaries. The increased retention values and their absolute magnitude were been significant by fat content. The retention values of the small components were increased by the fouled pores.
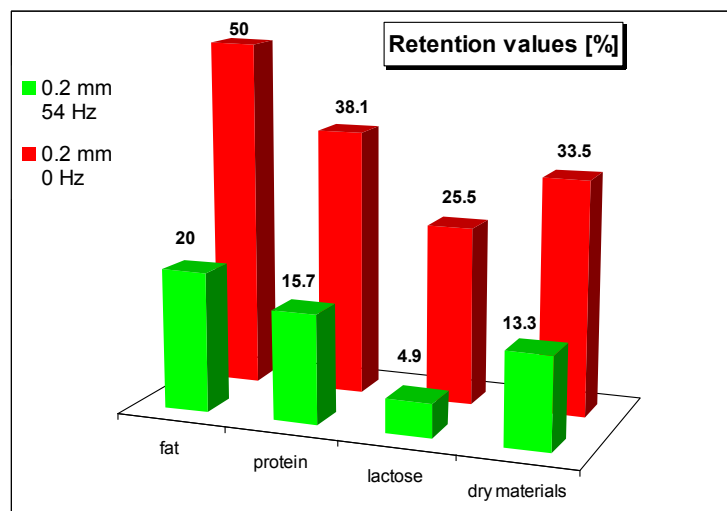
3. Figure The retention value of most important components of whey

4. CONCLUSION

The experiences showed that the 0.45 microns pore size membrane could slightly hold back the fat molecules, due to their larger pore size. The desired filtration results were achieved by the measurements of 0.2 MPa and 100 L/h.

The 45 % higher flux values were measured by Helix static stirrer against the normal filtration process, but the combination of the static stirrer and the air injection were made the highest flux values (30 % higher than the filtration process by the Helix static stirrer) under the same conditions. Comparing the two different static stirrers, it was found, that the 15 % higher flux values were measured by Helix static stirrer than the Kenics stirrer. This means that the separation of the fat content was easier and more effective by using the combination of static stirrer and air injection.

The vibratory shear enhanced process was showed that not only the retention values of the fat content were increased without vibration, but the other elements retention values too. 300 % higher flux values were measured by 54 Hz vibration than without vibration.

5. ACKNOWLEDGEMENTS

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COMPARISON OF DIFFERENT SOLVENTS FOR ISOLATION OF ANTIOXIDANT
COMPOUNDS OF HORSERADISH

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ABSTRACT

Horseradish (*Armoracia rusticana*) is a perennial herb belonging to the *Brassicaceae* family and contains biologically active substances. Since horseradish has long been used as a spice for meat and fish products, the Food and Drug Administration (FDA) approved it as seasoning, spice, and flavoring and affirmed it as Generally Recognized As Safe (GRAS). Scientists are interested in horseradish because it is a rich source of peroxidase, a heme-containing enzyme that utilizes hydrogen peroxide to oxidize a wide variety of organic and inorganic compounds. Also horseradish is rich in other valuable substances – vitamins, minerals, phenolic compounds and also isothiocyanates.
The aim of the current research was to determine best solvent for extraction of phenolic compounds from horseradish roots showing high antiradical activity. From horseradish roots were extracted with four different ratio of solvent: ethanol/ water (80/20, 70/30, 60/40, 50/50 v/v) using conventional methods and then concentrated to rotary evaporator. Preliminary tests showed that the best solvent ethanol/ water (80/20 v/v) solutions can be chosen.

Keywords: horseradish roots, extraction of phenolic compounds, antiradical activity.

1. INTRODUCTION

Plants provide abundant natural antioxidants, which are vitally important for human health. Phenolic compounds commonly found in plants are biologically active substances having antiseptic, vitamin activity. It is known that phenolic compounds are very effective antioxidants. Based on these statements, it can be concluded that it is very important to develop the best method for extraction of these compounds from plants.(Naczk et al,2006)
Many researchers reported influence of different extraction solvents, techniques on the content of natural antioxidants in extracts (Grigonisa et al,2009). Efficiency of solvents and methods are strongly dependent on plant matrix used. Solvents, such as methanol, ethanol, acetone, propanol and ethyl acetate have been commonly used for the extraction of phenolics from fresh product .The properties of extracting solvents significantly affected the measured total phenolics content and antioxidant capacity in fruits and vegetables.
The highest extract yields were obtained with polar alcohol based solvents(Grigonisa et al,2009). Addition of water to ethanol improves extraction rate, but too high water content brought an increased concomitant extraction of other compounds, and, then to lower phenols concentrations in the extracts.(Szigeti et al, 2008)
Literature data shows that extraction efficiency of solvents is strongly dependent on food matrix and the aim of current research was to determine best solvent for extraction of phenolic compounds from horseradish roots showing high antiradical activity (Tomsone et al. 2012).

Horseradish peroxidase is one of the most used peroxidase due to wide application in various fields such as analytical chemistry, environmental chemistry or clinical trials. The enzyme is used for many purposes and applications are found at reasonable prices. Generally, the enzyme shows a number of features that make its use beneficial to the common catalysts, namely the ability to operate under conditions of mild reactions, as the processes are ecological in terms of environmental development (Shina, 2010). However there are a number of constraints in using the enzyme, being sensitive, unstable and having to be used in water, features that are ideal for a catalyst but undesirable in most syntheses.

Great importance has to be granted to functional supplements based on horseradish used in cardiovascular diseases because cardiovascular diseases are the leading cause of death and disability worldwide, accounting for 17 million deaths each year. Globally, Romania stands in the first 4 places in terms of cardiovascular mortality.

In horseradish, seven isoenzymes were identified of horseradish peroxidase (HRP), among which the c isoenzyme of HRP (HRPc) is the most abundant and has been successfully isolated, purified and characterized. It has a cardiotonic effect and is recommended to the people that suffer from high blood pressure.

2. MATERIALS and METHODS

Materials. The vegetables used for this study: horseradish roots, were purchased from a local market. After the preliminary operations like washing, peeling and slicing, the vegetables were mixed with a centrifugal food processor.

Methods. . From horseradish roots were extracted with four different solvents: ethanol / water (80/20, 70/30, 60/40,50/50 by volume) using conventional   methods and then concentrated to rotavapor, and were as follows:
   • determination of the water content according to the AOAC - 1995 method
   • determination of polyphenols - Folin Ciocalteu method
   • determination of flavonoids – spectrophotometric method, reference substances are rutine and quercetin
   • determination of antioxidant capacity by DPPH method.

3. RESULTS and DISCUSSION

Flavonoids as antioxidants may inhibit the oxidation of LDL cholesterol, reduce platelet aggregation, or reduce ischemic damage. Since flavonoids have good antioxidant property, they are referred to as ―nature's biological response modifiers‖, because they modify the body's reaction to pathogens as well as compounds such as allergens and carcinogens. They are powerful antioxidants giving protection against oxidative and free radical damage. They prevent formation of oxidized cholesterol through antioxidant effects. Flavonoids exert greater antioxidant effects than vitamin C, vitamin E, selenium, and zinc. Epidemiological studies have shown that flavonoid intake is inversely related to mortality from coronary heart disease and to the incidence of heart attacks, and that certain flavonoids can protect LDL from being oxidized and prevent atherosclerosis (Velioglu et al, 1998).

Phenolic compounds, the most important antioxidants, include two groups of substances which show strong antiradical action: flavonoids and phenolic acids, which are both present in horseradish. The results obtained from the analysis of horseradish samples on flavonoid content are presented in Figure 1.

From Figure 1 it is noticeable that, depending on the condition of horseradish samples, the content of flavonoids increases. Horseradish extract obtained by conventional extraction but using different ratio of solvent showed the highest values for both flavonoids (Rutin) and

flavones (Quercetin). In the current research four different ratio of solvents were used and the lowest is 50:50 ratio, but the highest is 80:20 ratio.

Figure. 1 Evolution of flavonoids in different solvents

80 :20 – solvent ethanol/ water; 70 :30 - solvent ethanol/ water, 60 :40 - solvent ethanol/ water,50:50 - solvent ethanol/ water

Phenolic composition of plants extracts is affected by different factors – variety, climate, storage, processing. Extracts of horseradish roots were prepared using conventional extraction, and total phenolic content was determined using Folin-Ciocalteu reagent, that reacts nonspecifically with phenolic compounds.
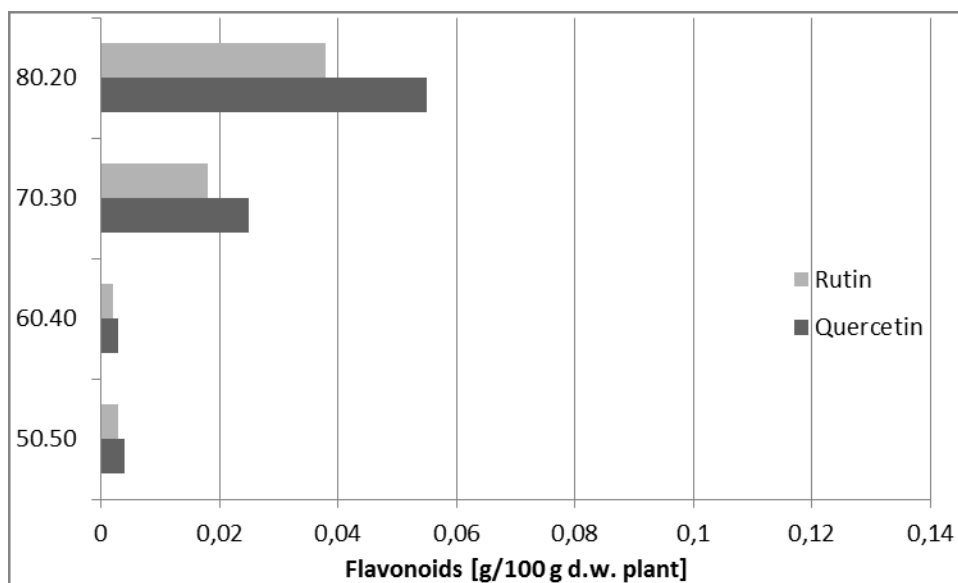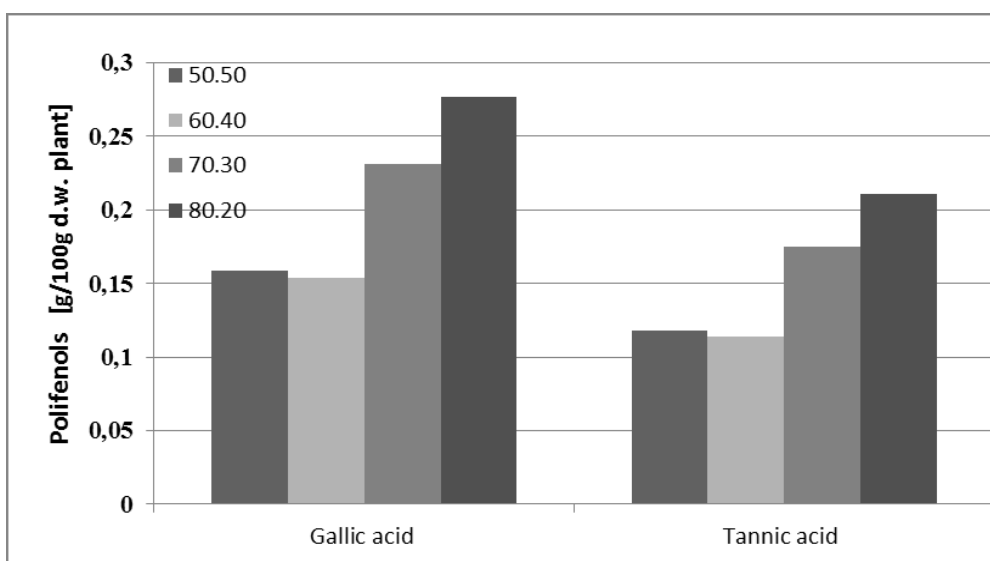

Figure. 2 Evolution of polyphenols in different solvents

80 :20 – solvent ethanol/ water; 70 :30 - solvent ethanol/ water, 60 :40 - solvent ethanol/ water,

50:50 - solvent ethanol/ water

The recovery of polyphenols from plant materials is influenced by the solubility of the phenolic compounds in the solvent used for the extraction process. In the current research four different ratio of solvents were used, and they can be arranged as follows: 50:50, 60:40, 70:30, 80:20. From selected solvents the lowest is 50:50 ratio, but the highest is 80:20 ratio.

Ethanol and water mixtures are commonly used phenols was found in extracted using 80% ethanol, which agrees with horseradish results. This is due to the wide range of phenols that the aqueous ethanol mixtures can dissolve. Furthermore, ethanolic mixtures have acceptability for human consumption models. Contrary results can be found in literature.

The scavenging activity of DPPH˙ radicals has been widely used to determine the free radical-scavenging activity. DPPH˙ is a stable free radical that is dissolved in methanol and its colour shows a characteristic absorption at 517 nm. Antioxidant molecules scavenge the free radical by hydrogen donation and the color from the DPPH˙ assay solution becomes light yellow resulting in a decrease in absorbance. Free radical-scavenging is one of the known mechanisms by which antioxidants inhibit lipid oxidation (Tomsone et al. 2012).

There are variations of antioxidants contained in horseradish roots obtained using conventional extraction. The results showed differences in DPPH˙ scavenging activity between rotio of solvents. Also antiradical activity of horseradish differed significantly depending on different ratio of solvents used and the highest activity was determined in 70:30(Fig. 3) and the lowest is 50:50 and 60:40 ratio.
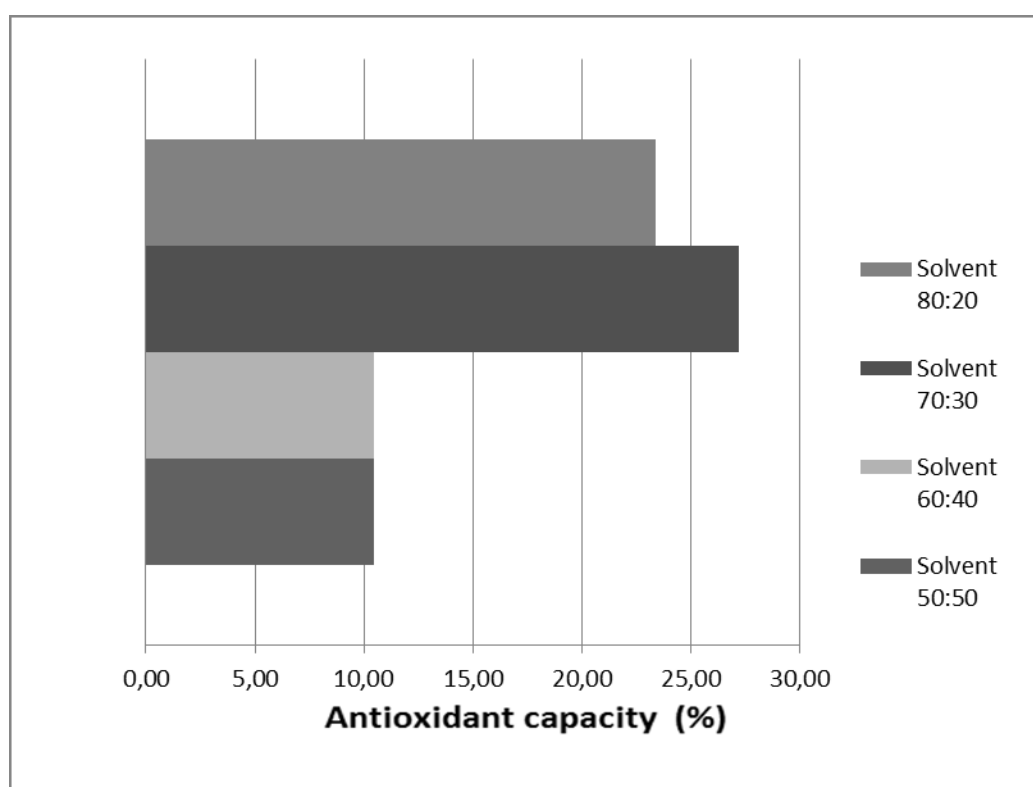
Figure. 3 Antioxidant capacity in different solvents

80 :20 – solvent ethanol/ water; 70 :30 - solvent ethanol/ water, 60 :40 - solvent ethanol/ water,

50:50 - solvent ethanol/ water

Analysis of the phenols, flavonoids and free radical scavenging activity of horseradish extracts showed differences depending on different ratio of solvent used. As the best solvents ethanol / water (80:20)solutions can be chosen.It can be concluded that using conventional

extraction method more compounds that are not effective antioxidants, but react with Folin–Ciocalteu reagent, are extracted.

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DISINFECTION ACTION OF SOME ESSENTIAL OILS ON STAINLESS STEEL

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ABSTRACT

Bacteria can attach to different surfaces and form biofilm. Biofilms can cause a big problem in food industry by contamination of food items and reduction of the effectiveness of machines. In the biofilm bacteria are less exposed to the different disinfectants, than the free living cells. Essential oils (EO) with known antimicrobial effect can also inhibit biofilm formation. In our experiments minimal inhibitory concentrations (MIC) and minimal bactericide concentrations (MBC) of the investigated EOs: cinnamon, juniper and lemon were determined by macro-dilution method on Pseudomonas putida and E.coli. Cinnamon showed the best antibacterial effect with MBC values of 2mg/ml for*E. coli* and 4mg/ml for*P.putida*. Thebactericidaleffect of EOsdependedontheactingtime. We established 80 minutes for*P. putida* and 120 (cinnamon EO) and 240 (juniper EO) min for*E. coli*. The disinfection potential of the EOs were studied on *P. putida* and *E. coli* 1 and 7 days old biofilms formed on industrial stainless steel surfaces. Each of the EO was effective. The number of *P. putida* cells was reduced up to 99% and we had similar result by 1 day old *E. coli* biofilm. The cell number of 7 days old *E. coli* biofilm was reduced by 62.5% with cinnamon EO and juniper EO reduced it by 87%.

Keywords: biofilm, essential oils, MIC/MBC, stainless steel

1. INTRODUCTION

Bacteria can attach to different surfaces and form biofilm, which can contaminate equipment surfaces and food. In the biofilm bacteria are more resistant to disinfection, than as a single cell (Kumar and Anand, 1998). Biofilm formation can cause a big industrial problem mainly in the food industry (Van Houdt and Michiels, 2010), where accumulation of pathogenic bacteria leads to a food safety concern. The efficiency of processes can also be reduced (reduced membrane permeability, corrosion) (Simoes et al., 2009).
Biofilms can be reduced by chemical substances (sodium hypochlorite), natural materials (surfactant) (Simoes et al., 2009) or physical methods (ionizing radiation). By the disinfection EPS (extracellular polymeric substances) have to be removed, because the EPS is a barrier and protects the cells in the matrix. Survival bacteria can build a new matrix and will give the resistance to the other microorganisms. The disinfection action is depending on the temperature, pH, humidity, acting time and resistance(Van Houdt and Michiels, 2010). The used antimicrobials need to be safe, non-toxic and easily to remove from the surfaces(Simoes et al., 2009).
Most of the essential oils (EO) together with other plant extracts are well-known antimicrobials (Burt, 2004). The mechanism of action is coagulation of the cytoplasm, reduction of the integration of cell wall and membrane, leading toloss of cell components and death of the cell (Bakkali et al., 2008).

The aim of our study was to investigatethe disinfection effect of selected essential oils on stainless steel surface.

2. MATERIALS and METHODS

Materials
The biofilm forming Gram negative bacteria:*Escerichia coli* and *Pseudomonas putida*growing on LB (in g/l: NaCl 10; casein peptone 10 and yeast extract 5) or on TGE (glucose 10, peptone 5, yeast extract 2.5 g/l) medium were used. *E.coli* was incubated for 18-20 h, at 37°Cand *P.putida* at 25°C.
Cinnamon, juniper and lemon essential oils were purchased from the Aromax Natural Products Zrt. (Budapest, Hungary).
Stainless steel coupons in the size of 2x2cm from food industryequipments were defatted with EtOH and sterilized at 121°Cfor 20min.
Methods
Determination of MIC/MBC values was done by macro dilution method using essential oils in the concentration range of 1-60 mg/ml. Bacterial suspensions (10^5cfu/ml) were mixed with different concentration of essential oil, and 1% Tween 40 was added to aid dispersion of the oil. After incubation for 24hturbidity in the tubes was examined and clear tubes were declared having the MIC concentration. MBC values were determined by spreading100 µl suspension from the clear tubes on Petri dishes. After 24h incubation colony number was counted andthe concentration where no colony was foundrepresented the MBC value. Establishment of disinfection time: the effect of essential oils in MBC on bacterial cell suspension (10^5cfu/ml)was checked after 20, 40, 60, 120 minutes.
Biofilm inhibition:bacteria were growing on sterile stainless steel coupons in culture medium (*P. putida* TGE broth, *E. coli* LB broth) at 24h and 168h. After incubation coupons were rinsed with distilled water to remove non-attached bacteria from the surface. Coupons were transferred to a disinfectant solution containing essential oils in MBC concentration. After disinfection time established in previous experiments biofilms on the coupons were scrapped off by sterile applicator swab which was transferred to a tube with sterile peptone water. After one hour cotton swabs were gentle pushed out and cfuwas determined by spreading 100 µl cell suspension on Petri dishes.

3. RESULTS and DISCUSSION

All the essential oils had good antibacterial effect (Table 1).In our experiments cinnamon EO had the lowest MIC and MBC values.

Table 1 MIC/MBC (mg/ml) values of the investigated essential oils

Essential oil	*P. putida*		*E. coli*	
	MIC	MBC	MIC	MBC
Cinnamon	2	4	1	2
Juniper	27	54	13,5	27
Lemon	27	54	>27	>54

Lemon EO was excluded from further investigations on *E. coli,* because of the very high MBC.
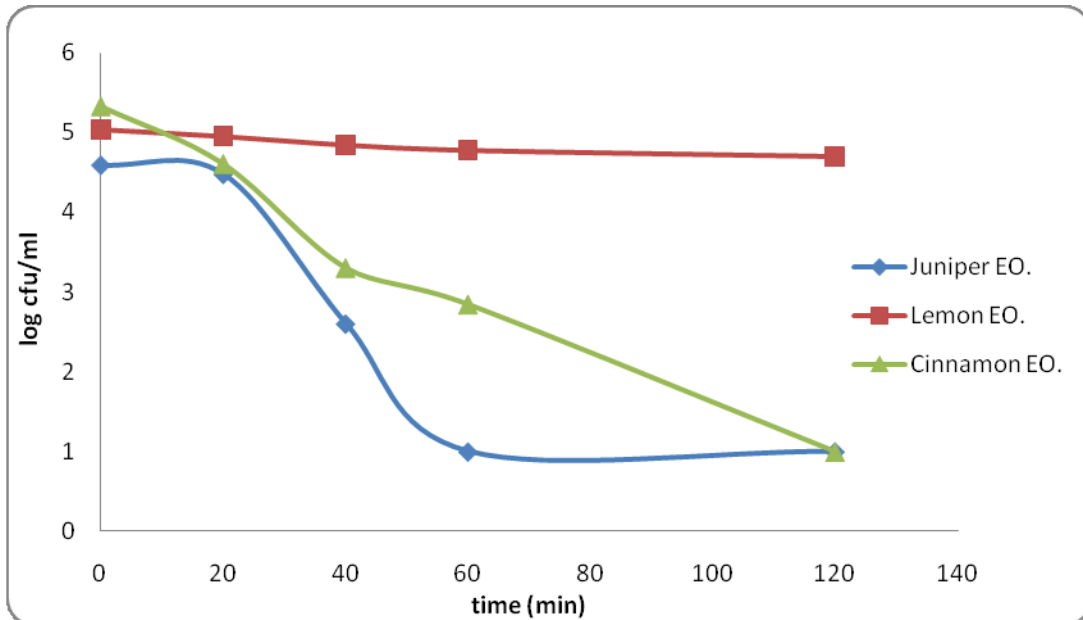
Figure 1 Time killing curves for *P. putida*
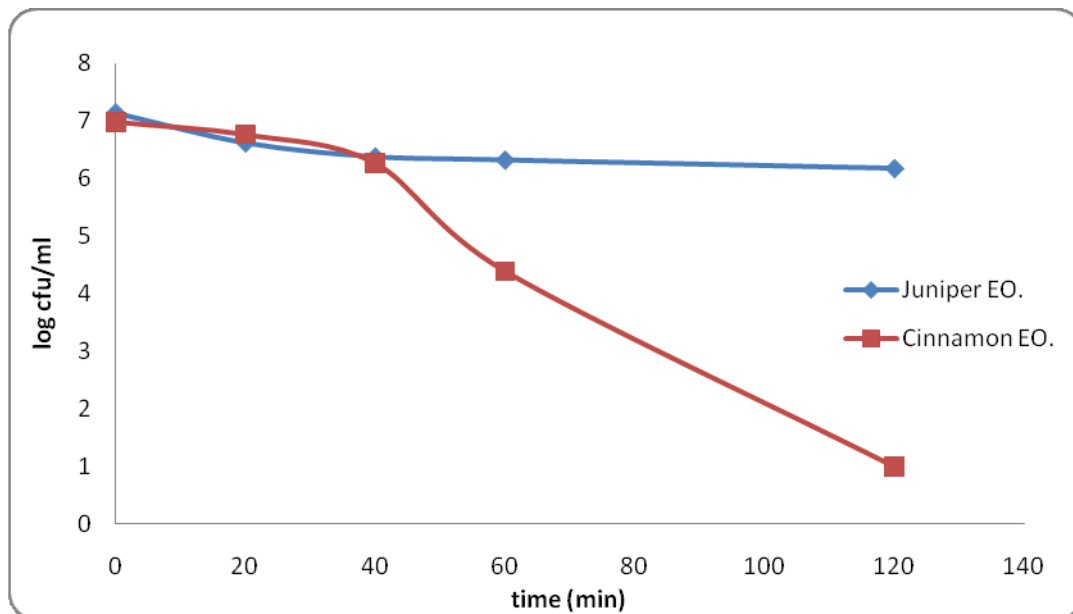
Figure 2 Time killing curves for*E. coli*

On the Figures 1 and 2 you can see the time killing curves for *P. putida* and *E.coli.* It can be seen that juniper and cinnamon EO had the best effect causing a fast linear degradation of the living cell number while lemon EO had only limited effect during the time of investigation on *P. putida.*

For the reduction of young and matured biofilms we used 80 minutes exposure timefor*P. putida* and 120 (cinnamon EO) and 240 (juniper EO) min for *E. coli* (Table 2).

Table 2 Reduction of living cell number of *P. putida* and *E. coli* biofilms [cfu/ml/cm^2]

Bacteria	Biofilm age	control	cinnamon EO	juniper EO	lemon EO
P. putida	1 day	8.8×10^3	7.5×10^1	<10	<10
	7 days	2.5×10^4	1.4×10^2	2×10^2	2.5×10^2
E. coli	1 day	2.6×10^3	<10	<10	-
	7 days	5×10^3	1.9×10^3	6.5×10^2	-

Table 2 shows the biofilm disrupting potential of essential oils.It can be seen that matured biofilmshad limited sensibility to the EOs.*P. putida* biofilm (24h and 168 h old) was reduced by 99% after 80 min disinfection time. We got smaller percent by 168h old *E. coli* (cinnamon EO 62.5%; 120min, juniper EO 87%; 240min treatment), but the younger biofilm had same reduction, than *P. putida*.

Our result was compared with the other study, where *Listeria monocytogenes* biofilm was reduced by lemongras EO. 3h old biofilm colony decreased by 40.28% after 15 min treatment, after 60 min this percent was 44.58, by 240h old biofilm this number was lower (26.59% 15min), but after 60min it was 72.51% (de Oliveira et al., 2010).

In the future we will extend our investigations on mixed culture biofilms and it is also planed to use essential oil mixes instead of single oil. In this way we can establish the interaction between different EOs or between EOS and other plant-derived components.

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ECONOMY AND POLITICS IN HUNGARY DURING 2^(ND) ORBÁN GOVERNMENT PERIOD

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ABSTRACT

The 2nd Orbán government and the more than two-thirds parliamentary majority behind a relatively heavy heritage took over in the summer of 2010. The left-liberal governments of GDP in 2006-2009, reaching 12% of the size of austerity (expenditure cuts and tax lifting) as a result of Hungary's policy is not developed in a similar situation as the crisis in Greece. The most difficult years of the crisis – between March and June 2009 – the international debt financing market premium for loans fall from six percent to two, the euro exchange rate is reduced from 270 to 315 HUF. The 2nd Orbán government's so-called unorthodox economic policies – which happened to break with the IMF and serious political disagreements with the EU has been associated with – as a result of increased to HUF exchange rate of 300, the premium at the end of 2011 exceeded 6% again; currently around 3%, although the EU abolished the excessive deficit procedure against Hungary, and the sixth year of the current account is positive. Hungary's GDP after a 6.7% decline in 2009, in 2010 – faster than expected – increased by 1.2%, in 2011 was only 0.7% in 2012 and 1.7 % drop. Accelerated use of the 2007-2013 periods, EU investment funds due to a 1-1.5% in 2014 and expected in 2013 2-2.5% growth. The Hungarian economic performance in the last decade since EU accession has been at average of less than 0.5% per year increased. The durable and – at least – from 2.5 to 3.5% growth per year have failed to materialize in the domestic political economy foundations between 2010 to 2014.

Keywords: macroeconomics, 2nd Orbán Government, unorthodox economic policies, deficit

1. INTRODUCTION

Goal of the study is to make a draft explore of 2nd Orbán government's economic policy. Events in the period between the summer of 2010 and the end of 2013, based on the literature studied. We sought to fill the great political events information gaps with logical conclusions.

On the parliamentary elections in the spring of 2010 the Fidesz-Christian Democratic Party (KNDP) alliance won a great victory, from 386 representative electors it won 263, so the two-thirds constitutional majority has also gained more parliamentary seats.

During the election campaign, the winners shared very little part of planned economic policy for voters. The general principles were – of course – well known. For example, those that FIDESZ wants to break the previous eight years, left-liberal restrictive policies. Reject the property tax, the health care system through private funds to operate; the higher education tuition is underutilized railway branch lines and small post office closures. It intends to support the domestic micro, small and medium-sized enterprises, as well as the children. Aims to significantly are to reduce domestic currency, like the forint interests.

2. MATERIALS AND METHODS

Economic Policy and journal articles exploring web resources and thematic processing, and drawing conclusions.

3. THE 2ND ORBÁN GOVERNMENT'S ECONOMIC POLICY PHASE FROM 2010-2013

The study, 2nd Orbán government's economic policy between 2010-2013 divided into five sections named

Fist phase (since summer 2010) goals and tools are next:
The 2009 crisis was over, the current year's state budget deficit of 2-3 percentage point increase 4-6% in 2011 spun from 3-4 and then from 2013 up to the economic growth, about 'grow out of debt', ie high growth rate reduce the general government deficit to GDP ratio of around 80%. The European Union rejected the plan and insisted in 2009 Gyurcsány and Bajnai governments signed agreements. Paradox that then nicked the first time in the negotiations with the IMF out well (portfolio.hu 2010) – precisely not concluded with any revolving credit agreement – the IMF did not insist, contrary to the EU rigidly in early 2009 – even the Gyurcsány government – number of linked credit agreement. The IMF is likely to have been held admissible in a 1 to 1.5 percentage points higher than the deficit, even if it is for example, aims to increase the competitiveness of enterprises, state or additional expenses due to substantial structural reform of its public service systems caused.

Second phase (since autumn 2010): 'The main enemy - is now in the short term - the debt,' so the government meet the 2010 target of 3.8%, the proportion of GDP fiscal deficit target of below 3% assumed in 2012 and 2013 (MTI 2010). For the purposes of the performance has been introduced in July 2010, the special bank tax – approx. HUF 180 billion (Független Hírügynökség 2010), the crisis taxes – approx. HUF 160 billion in the energy and telecommunications sector, and wholesale chains (Kormánykrónikás 2010). Nationalized the private pension compulsory membership paid 360-380 billion HUF per year, and the funds accumulated under 14 billion fortune in 2650. The HUF 360-380 billion pension fund assets and half of the current fiscal expenditure in 2011, with the introduction of a flat-rate personal income tax loss of approx. For HUF 400 billion in tax cuts and rebates and other additions (e.g. reduction of corporate tax, increasing tax relief for children) to replace the amount lost was translated, and the previously privatized assets – e.g. Reserves by buying back – MOL shares and EON Hungarian gas business, and the other half, which was lying in government securities, and debt reduction translated. As a result, 82% of the accumulated government deficit to GDP ratio immediately decreased by 5 percentage points for 2011 year the government closed a 4.2% surplus. That said, the long term of our debt – so-called structural debt – and increased the value of the total pension fund assets and current payments. (ecoline.hu 2011) The government - of course he knew – that in 2012 no longer available in the pension fund, so the spring of 2011 produced a structural transformation of large state systems aiming Structural Reform Plan, and mainly based on this convergence year stipulated in the EU program.

Third phase (since autumn 2011, the IMF and the EU fails again after talks) - so is perhaps summed up by legislation obliged the banks to allow debtors to the amount of the final repayment of a fixed rate of exchange retail foreign currency loans. The deadline of the end of January 2012, according to PSZÁF data 160 thousand fully repaid. (index.hu 2012) That caused banks around HUF 210 billion in losses, according Mihaly Patai. (Patai 2012) As a result, I had to count the domestic and international credit markets narrowing, significant increases in interest rates, the country's international repeated downgrades of the rate of economic growth and investment loss. Domestic investments already – before the adoption of the Law repayment – the second quarter of 2011 were 6.5% lower compared to the same period last year. (KSH 2011) The only one – albeit a very important positive – exports also grew dynamically in 2011, and the annual trade balance surplus amounted to EUR 7 billion (mfor.hu 2011).

Fourth phase (since 25th November 2011 until the end of 2012) Rating downgrades, the European Commission adopted sanctions under the excessive deficit procedure era. The Ministry of National Economy, a week before the Moody's downgrade – hoping that as a result of the downgrade might not take place would be – the initiative for the resumption of negotiations with the International Monetary Fund. 'A grade, from Ba1 to Baa3 earlier down the ratings on Hungary's debt Thursday night's decision by Moody's Investors Service. This classification was the Hungarian Investment Grade (i.e. junk) category after 1996 again. The new classification will continue to place a negative outlook rating.' (Portfolio.hu 2011) 'Deprived of investment – grade debt advised Hungary on Wednesday (21st December 2011) by Standard & Poor's. The international credit rating Wednesday evening announced in London to a degree , 'Minus / A – 3 BBB' from the previous one notch to "BB plus / B ' modified long and short-term, foreign currency and forint Hungarian government debt classification, which further downgrade given indications of possible negative long-term view. The Standard & Poor's said: in my opinion the measures taken over the past year – which affects more than one service sector – can hamper economic growth by reducing the banks' lending and business investment readiness. The S&P to be particularly imposed on the telecommunications, energy, financial and retail sectors, temporary taxes in pressure in the short term investment and job creation. (mno.hu 2011) 'In today's day (30th January 2012) at dawn, the Japanese also took aim at us, Rating and Investment Information from the east of the island country, or shorter and better known as R&I also downgraded Hungary's sovereign tax classification, thus a lower setting, the BBB minus was classified. A lower level of a country is no longer there, so you can say that we are the lowest level of investment grade. The Japanese was deemed necessary by the downgrade because the negotiations with the IMF and the European Union are conducted by a very slow pace' (hir.ma 2012). In the spring of 2012 against Hungary's EU cohesion funds put the prospect of suspending the payment of part of the 'excessive deficit procedure' carried out since 2004. The corrective steps taken in 2012, excise taxes, as well as the 25% VAT rate to 27% increase in the academic frame numbers and budget narrowing of the introduction of the telephone tax, etc. (hvg.hu 2013). However, it declined this danger. The general government deficit to GDP ratio in 2012 has been only 1.9%, while the GDP due to the constraints 1, 7% decrease over the previous year.

Fifth phase (since January 2013) It was eliminating the overhead reduction and completion of the excessive deficit procedure. On 21st June 2013, the EU lifted against our country's current excessive deficit procedure since 2004 because they saw improvement in the government balance between HUF 450-480 billion in 2013 introduced measures – including the introduction of a bank transaction tax, will be raising this toll-utility tax, etc. – sufficient to keep a share of GDP government deficit below 3%. In two phases in 2013 – reduced the total to 20% of the government price of retail electricity, gas and district heat – 1st January and 1st November inclusive; 1st July – from 10% decrease public water utilities and waste disposal fees. In all cases, the burden of price cuts to providers must wear.

4. RESULTS AND DISCUSSION

The Fidesz-KDNP party alliance in 2010 year's parliamentary election strategy is built not sold in any significant during the election campaign – especially meaningful austerity – planned economic policy elements. After the victory in the spring, before the 2010 municipal elections in the autumn only positive measures have been taken to the society. In June 2010, announced 29-point program of the 'new economic system' (hvg.hu 2010), almost everyone – not just promised something, but for autumn 2010 has been partly fulfilled as well – especially the little people and the SME sector. The measures reflect widespread and popular views on freedom of speech also contained hidden references. 'They went to the tanks arrived

on the banks. 'Let the rich pay' – i.e. the banks and multinationals. The 'honor' productive work rather than financial activity based on speculation. If you can, on their own, local production of our products consume 'Three children, three-room, four-wheel'. – Viktor Orbán proverbial switch blocks, which have been associated with 2000 tax incentives enhanced discount rate home loans - helping the fundamental aspirations of the members of family formation in preparation for the middle class etc.

'From the special taxes and private pension funds nationalization of more than 700 billion forint surplus revenue, and 2,650 billion nationalized private pension-fund assets and the 1-2% economic growth resources based on 2010 and 2011, the budget deficit targets numbers. They were relatively easy to be satisfied, and made it possible to flat-rate personal income tax and the income tax related family discount introduction. They maintained from 2012 only significant economic constraints – and the introduction of new taxes and reducing government spending – was possible. The ten-year Hungarian government bond yield rate in November 2011 was higher than the Romanian papers and Romania - it is true that 'only' a 40%-to-GDP budget deficit - the 'junk' category, but there is behind the IMF credit line. (index.hu 2011). The government securities rates of return of around 10-12% in the medium term is difficult to be paid in would have been a burden for our country, so in November 2011, the IMF and the EU for the conclusion of the credit agreement seemed inevitable. The European Central Bank – mainly due to the Italian and the Spanish economy's difficulties – between December 2011 and February 2012 to 1,200 billion euro loan interest rate of 1% to 500 European Banks. (ecoline.hu 2012). The abundance of money as a result of significantly reduced the rate for the Hungarian government bonds, so it is still only took up loans market.

The European Commission's 'real transition rules' adopted by a two-thirds majority – many clause found incompatible holds the EU democratic principles and expects to change them – media law, the new so-called 'Easter constitution' and the associated 'cardinal laws'. Government disagrees and revolutionary changes to the constitutional turned against the EU and the IMF 'war of independence'. The EU has no effective enforcement tools in these areas, so sometimes the economic pressure by means of living. The European Commission in 2012 excessive austerity measures forced out to the 3% target, so the gap has only 1.9%.

The EU Member State to the other controversial economic regulation (e.g. special taxes. Reducing overhead) issues, however, it is clear that in fact do not deal with any insurrection, as those of the European Court have the final verdict.

It is clear that II. A clear political aim - - income grouped into 15 to 20% in addition to the Hungarian society in the midst of the Orbán government debt fight against the austerity measures. Government sources in the absence of overhead expense reductions already implemented the service be economic benefits created for the lower middle class. Created by the Bank concessional loans, and accelerated the use of EU funds in 2014, up by 2.5% in the reach of economic growth.

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ENVIRONMETAL FRIENDLY METHOD IN THE SUGAR-BEET PRODUCTION FOR THE COLOURANTS REMOVAL

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ABSTRACT

Despite the fact that the sugar industry is one of the causes of the environmental pollution, not enough has been done on its improvement. According to CEFS, specific energy consumption was 31.49 kWh/100 kg sugar beet. While the overall water used is about 15 m^3/t sugar beet processed, the consumption of fresh water is 0.25 – 0.4 m^3/t sugar beet processed, or even less in modern sugar factories. The separation operation deserves special attention because of its significant consumption of water end energy. Ultrafiltration could be one of the solutions for energy saving and more effective separation of coloured compounds (which during the crystallisation build into the sucrose crystals) from intermediate products from which sucrose directly crystallises.

The aim of this experimental work is to determine the influence of operating parameters on the efficiency on coloured matter removal in high concentrated syrup. In this work syrup solution, which is an intermediate product in the phase of sucrose crystallisation, with 60% dry matter content, is the main feed. Experimental investigations were performed on 20 nm ceramic tubular membrane. Effects of colour removal on syrup solution are investigated at 60 and 80º C, in the range of transmembrane pressure between 4 and 10 bars. Optimal values of flow rates are chosen between 100 and 400 L/h. For defining the effects of the membrane separation process, permeate flux are determined.

According to mentioned conditions colour is by 35 - 40 % in average, and turbidity is by 80% in average lower according to the feed. The permeate flux could be reached is 45 L/m^2h at flow rate 400 L/h and at 80^oC.

Key words: sugar industry, ultrafiltration, non-sucrose compunds, colour remoal

1. INTRODUCTION

The white sugar is the final product of sugar industry. It has to satisfy specific quality demands and one of them is the colour of the crystal sugar. Ensuring colour quality parameters of white sugar used to be difficult, especially when the quality of the processed beet is poor (Poel Van der et al., 1998).

A purified sugar syrup, which is to be crystallized, contains undesired non-sucrose compounds, diluted in water. Coloured compounds are the most undesirable non-sucrose compounds, due to intensive colour. These compounds tend to build into the sucrose crystals during the crystallisation, so the general tendency is that the syrups from which sucrose directly crystallize should have as low content coloured matter as possible. The removal of the undesired compounds is one of the severe problems in sugar technology. As energy consumption of sugar production is high (200-300 kWh/t beet), environmental pollution needs to be addressed, too. According to CEFS, specific energy consumption was 31.49 kWh/100 kg sugar beet. While the overall water used is about 15 m^3/t sugar beet processed, the

consumption of fresh water is 0.25 – 0.4 m^3/t sugar beet processed, or even less in modern sugar factories (EC BAT 2003; EC BAT 2006). Because of this reason the possibility of application of new separation techniques utilising membranes is thoroughly investigated. Considering the existing technology demands of large investments, our strategy was to find such membrane separation technique which could be inserted in the existing technology process of sugar production. It is stated that the crystallization in ultrafiltered juices is 1.2 times faster than in the juices conventionally purified.

Membrane separation studies were focused on finding the most appropriate membrane material with related properties (Poel Van der et al., 1998; Bubik et al. 1998), as well as optimal process variables which might guarantee the content of undesired compounds in the product to be low as possible (Gosh, Balakrishnan, 2003). As the syrup, sucrose crystallize from, represents a complex system with large and small molecules, the selection of adequate membrane appears to be a problem. Important is to provide easy passing of sucrose molecules and molecules that causes turbidity and colour should be retained. It is impossible to avoid passing the molecules smaller than sucrose through membrane with classical UF process. The working temperature is also important parameter. In sugar industry the working temperature is between 70 - 90°C. Using polymer membranes could not be reached that temperature level. Mineral membranes are stable at higher temperatures (Decloux at al., 2003) .

To make membrane separation process applicable in sugar processing industry, permeate flux should be improved at first place. Ultrafiltration of sugar syrups are characterized by a decline in permeate flux with filtration time because of concentration polarization and progressive membrane fouling (Lipnizki et al. 2006; Gyura et al. 2005).

The final aim of the experiments was to separate high molecular coloured compounds from raw sugar syrup which are subjected to final product crystallisation (Šereš et al. 2010). The aim of this experimental work is to determine the influence of operating parameters on the efficiency on coloured matter removal in high concentrated syrup. In this work syrup solution, which is an intermediate product in the phase of sucrose crystallisation, with 60% dry matter content, is the main feed. Experimental investigations were performed on 20 nm ceramic tubular membrane. Effects of colour removal on syrup solution are investigated at 60 and 80°C, in the range of transmembrane pressure between 4 and 10 bars. Optimal values of flow rates are chosen between 100 and 400 L/h. For defining the effects of the membrane separation process, permeate flux are determined.

2. MATERIAL and METHODS

Row sugar syrup is used for the investigation of coloured matter separation by UF. Its basic characteristics corresponded to regular technological quality, purity is 97.11%, which means that the syrup contains 97.11% sugar calculated to dry matter.

The laboratory UF equipment was set up at the Faculty of Food industry, "Corvinus" University in Budapest. The cross-flow filtration was realized on ceramic tubular membrane. The power of the pump for ultrafiltration was 0.25 kW. The flow diagram of the setup is shown in Fig.1.

The membranes studied were Membralox membranes (SCT, Bazet, France), single channel type, 250 mm long, with 6.8 mm inner diameter. The membranes were of 20 nm pore diameter and were made of a zirconium oxide layer on a aluminium oxide support. The useful membrane surface was 4.62 x 10^{-3} m^2.

The row sugar syrup was diluted exactly to 60°Bx dry matter content. It was investigated the possibility of microfiltration of syrups with high dry matter content.

Experiments were performed in accordance with the plan presented in a Table 1, where the lower and the upper boundaries of the independent variables are given.
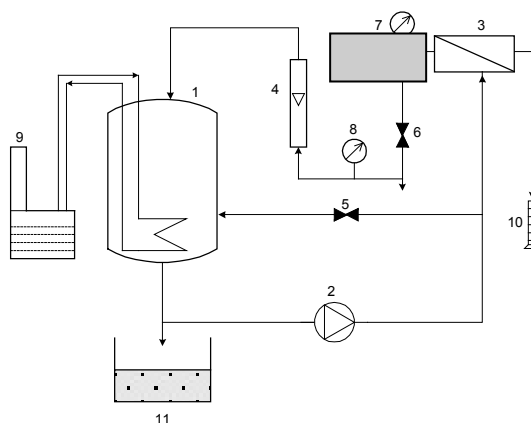
Figure 1. Laboratory setup for ultrafiltration: 1 – feed tank, 2 – pump, 3 – module with membrane, 4 – rotameter, 5, 6 – valves , 7 – manometer, 8 – thermometer, 9 – thermostat, 10 – vessel for permeate, 11 – vessel for retentate

Table 1. Plan of experiments – boundaries of independent variables

Parameters	Membrane 20 nm	
	Lower level	Upper level
q [l/h]	100	400
T [^{o}C]	60	80
TMP [bar]	2	10

A full factorial design was applied and flow rate (q), temperature (T) and transmembrane pressure (TM*P*) were kept at different levels while time was continually measured together with the measurements of three dependent variables: flux (J), colour change (*ΔB*).

The permeate colour change is expressed as a difference between permeate and syrup colour divided by the colour of the initial syrup. The colour is quantified by the absorbance, measured on a spectrophotometer at 420 nm.

As for the reproducibility of the results, only those measurements were repeated several times which gave significantly different values when twice repeated.

3. RESULTS and DISSCUSSION

The removed amount of the coloured compounds from the syrup is the key factor for this investigations. After the analyzing the experimental results in STATISTICA 8.0 a 3D diagram was constructed and presented on the picture 2. the removed amount coloured compounds from the syrup. With ultrafiltration, using ceramic membrane with pore size of 20 nm, for about 35% of color matter could be removed. From figure 2. could be seen that this decolorization value could be reached while pressure is held over 8 bars and flow rate between 300 - 350 L/h.
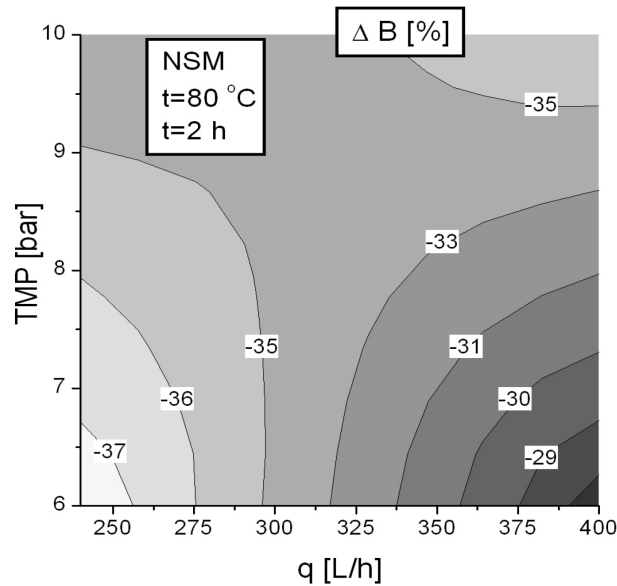
Figure 2. Coloure change depending on trasmembrane pressure (TMP) and flow rate (Q) at temperature of 80°C and after 2 hours of ultrafiltration

On the next figure 3. The influence of the pressure on the coloured compounds removal are showed. The percentage of the removed coloured compunds from the sugar syrup are showed at transmembrane pressures of 6 and 10 bars, flow rate at 250 L/h. It could be noticed that at transmembrane pressure of 6 bars around 10% more coloured compound could be removed according to the removed coloured compound on 10 bars. Reason for it is definetly the high pressure which presses the compounds through the pores of the membrane and more compounds passes through the pores into the permeate, while on lower pressure that effect is not so expressed.
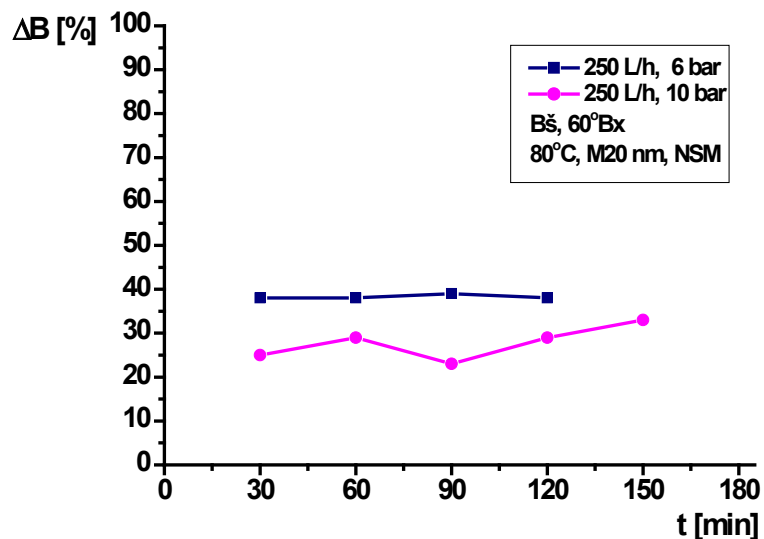

Figure 3. The percantage of the removed coloured compund during ultrafiltration at flow rate of 250 L/h and on different transmembrane pressure

After the investigation about the colourants removal, the permeate flux were observed too. Due to the fact, that sugar factories working temperature are mostly at 80°C and syrups has high viscosity, the influence of the temperature are invetigated on the permeate flux (picture 4.). On the picture 4. can be seen that the highest flux, which could be reachad is at 80°C and it is cca. 20 L/m^{2}h. With the temperature increase, the pereate flux increases too. It is expained by that, with temperature increase tthe viscosity of the syrup decreaases significantly. In this case the sugar syrup with dry matter content of 60 °Bx on 80°C has viscosity about 5.20 mPas, while at 60°C the syrup viscosity increases two times and it is 9,66 mPas.
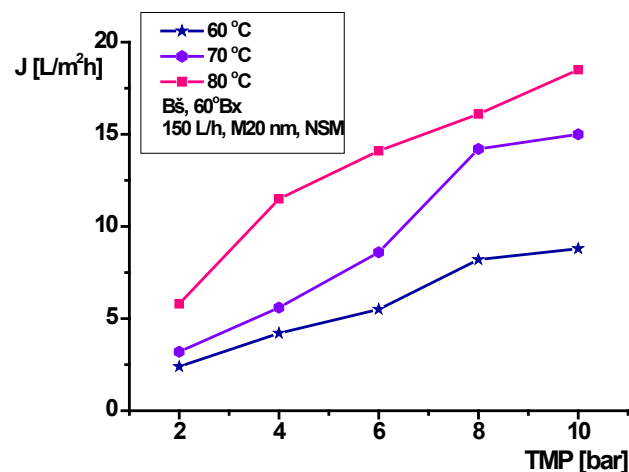
Figure 4. Pereate flux dependence on transmembrane pressure at different tempereratures and flow rate 150 L/h

4. CONCLUSIONS

Based on experiments of UF of row sugar syrup, with dry matter content of 60 °Bx could be concluded the following:

1. The best flux for ultrafiltration with ceramic membranes of 20 nm pore sizes could be reached at temperature about 80 °C, flow rate above 300 L/h and pressure above 8 bars.

2. Decolorization of about 35% could be reached while the pressure is held over 8 bars and flow rate between 300 - 350 L/h.

3. with temperature increase tthe viscosity of the syrup decreaases significantly. In this case the sugar syrup with dry matter content of 60 °Bx on 80°C has viscosity about 5.20 mPas, while at 60°C the syrup viscosity increases two times and it is 9,66 mPas.

ACKNOWLEDGEMENT

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EXAMINATION OF SATISFACTION RELATED TO INVESTMENTS (2006-2011) ACCOMPLISHED BY THE LOCAL COUNCIL IN ABONY

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ABSTRACT

In Abony there was a large number of investments between 2006 and 2011 which involved infrastructure. A significant part of them was realized in the framework of EU subsidies and also with the financial support of New Hungary Development Plan – Central-Hungarian Operative Program. During our research we applied the questionnaire method as a result of which we had 608 questionnaire forms filled in. We aimed to examine if there was a change in life quality and the standards of living of the inhabitants due to the investments and also how much they are satisfied with the work of town development of the local council. We can conclude from the research that the investments were not efficient and successful enough. They did not affect most of the inhabitants positively, and the inhabitants think that these investments were not really necessary. There are several reasons for this opinion, for example lack of workplaces, the bad quality roads and lack of entertainment facilities.

Keywords: investment, infrastructure, standards of living, resident satisfaction, lack of workplaces

1. INTRODUCTION

Abony is located in the south-east part of Pest county in the small region of Cegléd. It can be found 85 kms away from the capital, 320 km from the western border, while 130-140 km from the southern, eastern and northern borders. The settlement borders on Jász-Nagykun-Szolnok county. Its territory is 127.97 km². Avar findings from the 7-8 centuries have been explored around the town which proves that the area was populated even that time. The town belonged to the fortress of Szolnok in the 13th century. The settlement was first mentioned in a written charter which related to the Weseni family between 1450-1472. The name „Aban” mentioned in the charter probably derives from the old-Hungarian family and clan name with a diminiutive suffix „-ny” (Balogh 1974) (Györe 2007).

Abony was declared a town in 1993. Since then it has undergone a huge development which is due to investments. A lot of investments was accomplished between 2006-2011 which involved infrastructure. A number of specialist literature treats with regional development (Kőszegfalvi, Loydl 2001) (Ehleiter 2007) (Rapkay et al., 2013) (Illés, 2014) and infrastructure (Abonyiné Palotás 2006) (Erlich et. all. 2005). All in all, infrastructe is the whole of services which is the system of institutions ensuring production of material needs and provision of the residents, and these institutions are created as a result of different investments.

Several investments in the town were realized by means of EU subsidies within the framework of the New Hungary Development Plan Central-Hungarian Operative Program.

The first of the examined investments which was accomplished with a EU subsidy is the enviromental reconstruction of Kossuth square (stage I). The investment was initiated to create a fresh, energetic town to which the appropriate accessibility, the friendly attitude towards investors and residents, modern and foolproof mechanical infrastructure belong. In addition to it, it was necessary to form a healthy, clean, esthetic and ideal living environment, too. Today the stage II of the investment is being realized which involves reconstruction of the park behind the local government, renovation of a busy road in the town centre, installment of surveillance cameras and construction of a new covered market.

The other bigger investment is a project to improve the connections in the inner-city area of Abony in order to realize a more livable settlement. The reason for this investment is that the condition of roads here is well behind either the national or the county average, since only 36,2% of the roads in Abony are paved, whereas the county average is 50% and the national average exceeds it very much with its 67%. With the realization of the project five roads in the inner-city area got solid pavement, draining ditches and green surfaces which has a significant impact on the living standards of the residents and also on the successful operation of the local economy. On the basis of the present experiences, the objectives have been realized only partly since bigger companies which could ensure working places for the residents have not settled yet.

An important investment in the town was the construction of the new Kostyán Andor Clinic the purpose of which was to improve the general medical care both for children and adults. Due to the clinic patients can utilize several medical services locally in a comfortable way because they do not have to travel a lot and the waiting time has been reduced, too. Perhaps, it was the most successful investment.

It was followed by another investment considered not so useful for everybody which involves establishment of a new creche in Abony with the name „Kreatív Kópévár". The subsidy made it possible construct a completely new creche which gives a lot of help for families with young children as the former institutions could not accept more children lacking the necessary place, so one of the parents has to stay at home with the children and this way he/she could not work. The project is considered successful because the institution works with a maximum capacity.

Another inevitable investment was to organize the collection and draining of rainwater in the north-east part of the town. Inner water and rainwater had caused a lot of troubles in Abony. The inner water destroyed more houses so it was a timely investment to drain rainwater and/or inner water from the inner-city area and to construct an infrastructure in the most endangered areas, as there are residential areas in the town which are temporarily covered with water. As a result of the investment the inner water was drained into an artificial lake made on a plot in the property of the local government, next to the town. This way they avoided the danger of more damages.

At the beginning of our research we aimed to assess the level of satisfaction of the population of Abony in connection with the investments and also to examine the changes in the living standards of the residents. We wanted to see if the residents are satisfied with the work of the local government and if there have been any changes in their quality of living due to the investments.

After making some hypothesis we examined their correctness with a questionnaire survey:

> 1. We assumed that 40% of the population is not satisfied with the work of the local government and the investments meaning they think that there should be other types of investments because the present ones do not improve their living standards.

2. We assumed that 50% of the residents think that these investments are useful for everyone.

3. We thought that at least 60% of the answerers have experienced a positive change in their living standards due to the investments (as they see it).

4. We assumed that more than 40% of the residents think that the local government cannot finance the maintenance of the investments from its own resources.

2. MATERIALS and METHODS

The primary research was conducted with the questionnaire survey which is the most common technique of primary research and information collection. Its purpose is to collect information from people and from a given group or groups of population.

The questionnaire is the most frequent method of information collection in Gallup poll. The Gallup poll works with relatively large samples and asks similar questions. The questionnaire method is directed to the many and not to the individual that is why the essence of the method is that the collected data can be statistically processed and analyzed (Horváth 2004).

Compiling our questionnaire we applied the basic rules:
- One of the most important steps is to call the attention to the fact that it will be completed without asking the name and address, so it is anonymous.
- The questions should not influence the answer.
- The question should be comprehensible for everyone the possible terminology should be explained.
- The answers should be appropriate for further process (Horváth 2004).

The questionnaire consists of 19 questions the larger part of which focuses on the investments and on the level of satisfaction related to them, besides, what effects the investments have on the life of the answerer and his/her environment. At the end of the questionnaire there is a demographic section.

There were some closed questions which have different types:
- with two options: The answerer can choose from two options.
- multiple options: The answerer can choose from more options.
- selective: The answerer can choose from the given options but also he/she has to opportunity to express his/her own opinion.

Besides closed questions we applied open questions as well where the answerer could write his/her own opinion. We used a qualifying scale to assess the changes in the living standards before and after the investments (Végné 2006).

After compiling the questionnaire we had a piloting survey to see if the questions are in a logical order and if they are comprehensible for everyone (Kotler 1999).
The survey took place between 1 June and 31 August, 2012. We found assessable 608 of the 611 completed questionnaires.

3. RESULTS and DISCUSSION

After processing the questionnaires we got the following results in the order of the hypothesis:
1. We assumed that 40% of the population is not satisfied with the work of the local government and the investments meaning they think that there should be other types of investments because the present ones do not improve their living standards. As a result of our research we can say that this hypothesis has been proved since 39%

of the answerers gave mark 1 or 2 to the work of the local government. However, it also means that the bigger part is satisfied.

2. We assumed that 50% of the residents think that these investments are useful for everyone. This hypothesis has to be rejected since only 34% of the answerers thought that the investments would be useful for everyone. 25% could not judge it and 41% thought there would be some people the investments would not have any effect on.

3. We thought that at least 60% of the answerers have experienced a positive change in their living standards due to the investments (as they see it). This hypothesis has to be rejected again as only 22% experienced a certain change while the others did not see either a positive or a negative change. Altogether, only 102 people (16%) of the answerers felt a positive change in the living standards due to the investments.

4. We assumed that more than 40% of the residents think that the local government cannot finance the maintenance of the investments from its own resources. The research supported this assumption. 50% of the answerers thought the same.

All in all, it can be said the hypothesis 1 and 4 have been proved, while 2 and 3 have been rejected which means that the investments did not bring the expected success. They did not have a positive impact on the lives of many people, besides, the residents think that they were not really necessary to carry out.

At the end of the questionnaire we asked the people to suggest what investments would help the further development of the town, which are the ones that could make it more attractive and more livable. Summing up them: most of them need a covered swimming pool which would resolve the problem of winter swimming for children, adults and the elderly. It would be a good chance for relaxation which the residents lack. A lot of people mentioned the construction of a culture and leisure centre where the younger generation could spend their time in a useful way in an esthetic environment under the surveillance of adults for a modest price. The touristic attraction of Abony should be increased by renovating and extending the village museum. For most of the residents investments which create new workplaces would be the most important ones as the level of unemployment is high in the town. More streets and roads should be freed from dust. If there is the opportunity, the town should organize more community programs because the residents really need them. More cameras should be installed in smaller streets, too, to prevent crime.

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EXAMINATIONS CARRIED OUT IN RELATION TO THE SHOPPING HABITS AND SATISFACTION OF COSTUMERS IN THE SHOPS OF COOP SZEGED LTD.

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ABSTRACT

Different shop types have different life cycles: introduction, growth, stagnation and decline. The form of supermarkets is in a stage of decline in each EU country.
For customers coming to the supermarkets of Coop Co., in Szeged is typical to do their shopping every day or more times a week. Shoppers come to do mainly their daily shopping in the shops. The main reasons for choosing them were the wide range of goods and the suitable accessibility of shops. Coop has its own brand which is very popular with customers. There are customers who directly come to the shops to buy products with this brand. Shoppers would extend the range of products with Coop-brand and also would like to see longer opening hours. The customer segment involves people living close to the shops. Our questionnaire survey supports these statements.

Keywords: shopping habits, costumers, supermarket, questionnaire survey, sales

1. INTRODUCTION

Different types of shops have different life cycles: introduction, prosperity, stagnation, decline. The form of supermarket is in the stage of decline in each EU country.

Retail trade (Kotler 1988) involves all the activities which mean the direct transfer of a product or service to the final consumer for personal and not commercial use. By retail trade in shop we mean the way of distribution when marketing is connected to a given place, generally to a shop, and the consumer has to take longer or shorter way to get the desired product. Forms of retail trade are forms with or without a shop, and the form of organization in retail trade.

The form of organization in retail trade can be franchise marketing or chains of shops. Chains of shops include separated small shops which established a joint organization in order to keep their markets or customers. An example for this chain is Co-op Hungary which was created by joining several smaller shops. .

Supermarkets are shops of 400-2.500 m² ground-space located in town centres or residential areas. Supermarkets can be owned by independent vendors or they can be units belonging to a chain. In case of chains both the exterior and interior are positively of high standard, while it shows a varied image in case of independent businesses depending on the age of the building, on the solid capital and taste of the owner. The best-known supermarket chains in Hungary are Spar, Match and Coop supermarkets.

The COOP Szeged Regional Commercial Exclusive Stock Corporation (COOP Szeged Kereskedelmi Regionális Zártkörű Részvénytársaság) was established on 30

November, 1999. The COOP Szeged Co. took over the activity of Dél-Tisza menti ÁFÉSZ, which has been working for more than fifty years. The COOP Szeged Co. takes part in the commercial integration created by the different organizations of ÁFÉSZ both regionally and nation-wide regarding both procurement and marketing. At a national level integration involving procurement and marketing is managed by the COOP Hungary Co. owned by the economic companies ÁFÉSZEK and COOP. The COOP Szeged Co. is a member of the national COOP chain of shops, its shops of retail trade work as its organic parts. Today the COOP Szeged Co. runs twenty-three supermarkets in Szeged and its neighbouring settlements in the categories of COOP Supermarket, COOP MAXI and COOP.

As it has been written in the specialist literature of marketing (Kotler 1991) (Tomcsányi 1973) (Cravens 1987) (Hoffmann 1990) (Lehota, Tomcsányi 1994) (Dolan 1995) (Bauer, Berács, Kenesei 2009) (Illés, Végh, 2010), customers' behaviour has undergone a huge change in the last few years. A demand for comfortable shopping has increased. Nowadays we can experience a growing competition between the organizations of retail trade. Solid capital, flexibility, policies of price and selection, marketing strategy has an increasing importance in this situation. For units with a small ground-space introduction of bigger stores with more solid capital means a serious challenge and danger at the same time, also adjustment to the altered situation needs an increased concentration since they have to find the potential advantages in competition and then to utilize their opportunities.

Our hypotheses are as follows:
- 1. In case of the consumer segment of those who do their shopping in the shops of Szeged Coop Co. shopping on a daily basis or several times a week are the characteristic features.
- 2. Products with Coop-label are getting more popular among costumers.
- 3. Costumers want longer opening hours.
- 4. The consumer segment involves people living within the area of the shops.

The aim of our research is to either support or reject these hypotheses with a questionnaire survey and also to give some suggestions to improve conditions.

2. MATERIALS and METHODS

As primary research we carried out a questionnaire survey. We got 1550 questionnaires filled in in the shops of Coop Szeged Co. between 10 and 30 June, 2010. Our purpose was to assess the customers' habits and level of satisfaction in relation to the shop. We asked the reason for going to the given shop, how often they go there, why they may choose another supermarket, and also what changes they would implement.

Most of the answerers are in the age category of 30-34 and regarding their profession they are mainly intellectuals. More than a half of them go to the supermarket every day or several times a week. We assessed the level of the customers' satisfaction regarding bakery products, meat and meat products, vegetables, fruit, opening hours, the professional competence and friendly attitude of the shop assistants by the means of a five-point scale. We attached different values to each answer so by putting them together we obtained the level of satisfaction. Also, we put emphasize on how much the answers differ from each other so we could calculate deviation and variance (Lukács 2002), as well.

3. RESULTS and DISCUSSION

Most of the customers chose the given supermarket because of the wide range of goods and good accessibility. Other important aspects for them were the offer of goods on sale, and also the relatively cheap brands of the shops. If they choose another place to go shopping, it is because they can buy cheaper products in the big hypermarkets. Another important factor for choosing other shops is that stores of certain companies offer more products on sale.

Lots of costumers consider important that the shops should give a suitable amount of goods on sale. In this case it is worth mentioning the frequency of sales since if the shops do not have special offers on a regular basis, the customers will prefer others. Everybody is satisfied with the frequency and quality of sales in these shops.

The consumer segment expressed their satisfaction in connection with bakery products which gained 4,22 on the five-point scale. The assessment was not so much positive in case of meat and meat products, and the customers were dissatisfied with the price of vegetables and fruit.

The customers are totally satisfied with the employees of the Coop supermarkets regarding both their competence and positive attitude towards them. A lot of customers would support longer opening hours because late in the evening they are forced to do their shopping in retail shops. The consumers suggested a new image, besides longer opening hours.

1. Our hypothesis has been proved because most of the answerers (38%) do their daily shopping in the supermarkets. The other high proportion was of those who come to the shops more times a week (26%).
2. According to hypothesis 2 customers like the products with Coop-brand which has been proved since there are some customers (10%) who come to the supermarkets for these products only, and also would like to see the selection enlarged with more new products.
3. Our hypothesis which says that customers need longer opening hours has also been proved. A lot of them go to Tesco or to other shops because of the short opening hours.
4. With this hypothesis we assumed that the consumer segment involves people living around the supermarket. It has been proved, too, since people living nearby go to most of these supermarkets, apart from the shop number 1011.

It is important that the supermarkets should continuously pay attention to the changes in customers' needs. It is also significant that companies should employ the most suitable ones and also they have to meet the requirements of quality.
Customers do their daily, smaller shopping in the supermarkets of the examined Szegedi Coop Co. They say that prices are too high, so they do their bigger shopping in hypermarkets. There should be a more competitive price strategy so that customers can go for bigger shopping to the given supermarkets.

In case of bakery products the selection of goods should be enlarged. Being aware of modern, more conscious nutrition the consumers prefer the healthier whole wheat products.

Significant changes should be carried out in case of meat and meat products. A lot of people complained about the quality and freshness of products. The quality insurance system should be rendered stricter so that customers cannot get tainted products. Also, the selection should be enlarged. Customers would like to see more red fresh meat and smoked products.

Policy of price of vegetables and fruit should be significantly changed. Customers think that the price of these products is extremely high so they rather go to the market to buy

the necessary products. There should be a bigger vegetable and fruit stand so that everybody can fulfill their needs.

A lot of customers can do their shopping only late in the evening, and since these supermarkets close at nine, they go to 24-hour shops.

A lot of customers like the products with Coop-brand, so the enlargement of their selection would invite more customers to the shops.

As a consequence, it can be said that the chain of shops should improve its competitiveness in order to become successful. Thus, it has to improve its products and services permanently. Unlike the strategy of rivals, new things should be found out by the means of which the chain of stores will be different from the others, so it becomes unique. Changes in customers' needs should be assessed continuously and should be reacted at once. Training of employees is inevitable for the sake of success. It is important to aim at the needs of more consumer segments, at more markets. Price strategy should be elaborated with special attention so that everybody can find the most appropriate product for themselves.

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INFLUENCE OF ABIOTIC DISORDERS ON NUTRITIONAL VALUES OF TOMATO (SOLANUM LYCOPERSICUM)

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ABSTRACT

Susceptibility to abiotic disorders could play a key role in the utilization of landraces of tomato. These races have been abandoned due to non-compatibility to today's intensive agriculture. As there is dissatisfaction on present varieties and hybrids in the context of flavor and nutritional value, landraces could be a viable alternative for the enhancement of these parameters either "per se" or as breeding background. However, frequent occurrence of abiotic disorders causes yield losses. The hypothesis of the present study is that removal of irregular fruit parts positively influences the nutritional profile of tomato in the context of investigated parameters.

In the present study influence of abiotic disorders on total soluble solids (TSS), acid (TA) and lycopene content was investigated on six Hungarian tomato landraces and two commercial varieties. Abiotic disorders occurred were mainly cracking, green shoulder, sunburst and catfacing. Propagation materials were provided by Plant Biodiversity Center Tápiószele. The experiment is supported by Research Institute of Organic Agriculture, ÖMKi.

Our results showed that abiotically disordered plant parts have an impact on TSS, TA and lycopene content, however, in case of investigated accessions and varieties the difference was seldom significant. Only in case of TSS a tendency can be experienced, where all samples showed lower results after the removal of abiotically disordered plant parts. In case of TA and lycopene content no tendencies could have been withdrawn.

Keywords: tomato, abiotic disorders, landrace, nutritional values, lycopene

1. INTRODUCTION

Tomato is one of the most frequently consumed vegetables due to its valuable nutritional contents and versatility (Abushita, 1997). Its effect against certain types of cancers and cardiovascular diseases is likely to be justified mainly due to its carotenoid content (Giovannucci, 1999).

As there is a dissatisfaction on the flavor of present tomato varieties experienced (Powell et al, 2012), landraces comes back to light as considered as having better taste (Casals et al, 2011). Taste is mainly defined by the ratio of total water soluble solids (TSS, sugars) and acid content (TA) of tomato (Stevens, 1977). Flavor intensity, the multiplication of TSS and TA can provide further (Rodríguez-Burruezo, 2005) information about flavor.

Most of abiotic disorders are genetically encoded and less dependent on environmental factors (Male, 1999); due to breeding efforts of the last decades novel tomato varieties are round, deep red and firm without any notable deformation.

Half of dry matter content is given by reducing sugars in tomato. Both glucose and fructose is allocated in locular content and walls as well with a slightly higher amount in the latter. Acid content is mainly given by citric and malic acids in tomato. Two third of acid levels is located in the locular contents, while one third of them is found in the pericarp. Lycopene is a carotenoid in tomato providing the red color of the fruit. Most of this pigment is stored in the pericarp of tomato (Davies and Hobson, 1981). Based solely on literature one could expect that when removing parts of pericarp of an intact tomato fruit, slight decrease in sugar levels, increase in acids and notable decrease in lycopene is observed. However, nutritional content of disordered fruit parts has only been investigated indirectly.

2. MATERIALS and METHODS

Materials

Propagation materials of the investigated seven landraces and one old variety were provided by Plant Biodiversity Center Tápiószele. The number, catalogue number, origin or name and average fruit weight of accessions are listed in Table 1. Production of selected traits was designed at the organically certified experimental field of Corvinus University Budapest, Dept. of Ecological and Sustainable Production Systems. Open field conditions were supported with drip irrigation and agrotextile soil coverage.

Landraces of the trial are of two types with different fruit characteristics. Salad type has an elongated fruit shape with a pointed blossom end. It has a high flesh consistency with a low number of locules, which is explicitly weak in seeds and placental tissue as well. Typical abiotic disorders are radial cracking, green shoulder and blossom end rot. This type is ideal for salad and for decoration.

Canning type has a bigger fruit size with multiple locules surrounded with thick walls. Mature fruits are hard to transport due to their soft structure; ideal for canning due to its fleshy structure and sweet taste. Typical abiotic disorders are radial and concentric cracking, scars, catfacing (irregular blossom end closing), green shoulders and sunscald.

Table 1 Catalogue number, origin, fruit shape and average fruit weight of investigated accessions and varieties

No.	Catalogue no.	Origin/name	Fruit shape
Salad type			
11	RCAT031255	Soltvadkert	Elongated
20	RCAT060349	Nagykáta	Elongated
Canning type			
8	RCAT031091	Pácin	Flattened
15	RCAT057664	Kaskantyú	Flattened
16	RCAT057830	Kóka	Flattened
19	RCAT060348	Nagykáta	Oxheart
21	n.a	Tápláni konzerv	Slightly flattened
24	n.a	Marmande	Flattened

Methods

For the instrumental measurements two fractions of 500g of fruit have been separated in case of each race or variety. Sampling was done on 14 August 2012 after collecting marketable fruits of each trait.

After weighing all of the damaged parts have bee removed from the fruits of the first fraction then homogenized by a laboratory homogenizer for 30 seconds with no dilution, while the

other fraction was homogenized without removing any disordered parts. The edible fraction was weighed after removal of damaged parts as well and cleaning losses have been calculated and expressed in percentage.

The amount of total soluble solids (TSS) was measured with a Hanna Instruments HI 96801 type digital refractometer expressed in $BRIX^o$. Total acidity (TA) was measured by titration with 0.1 M NaOH, and expressed in a citric acid equivalent percentage.

Lycopene content determination was performed as described by Ravelo-Pérez et al. (2008), samples were extraceted by solvent containing aceton (with 0,05% BHT), ethanol and hexane mixture. Supernatant were measured against $\lambda=503nm$, and lycopene content was expressed in mg/100g dimension.

Each instrumental measurement was performed in three replicates.

TSS/TA ratio was calculated by dividing TSS by TA. Flavor intensity (FI) equals to the multiplication of TSS and TA.

Two way analysis of variance model was run with fixed factors *variety* and *treatment* (i.e. the damaged part was removed or not). The normality of the residuals was proved by d'Agostino's test while the homogeneity of variances was tested by Levene's test (p>0.05). In case of significant ANOVA result, Tukey's or Games-Howell's post hoc test was run, according to the Levene's test result. The statistical analysis was conducted by IBM SPSS Statistics ver. 20.

3. RESULTS and DISCUSSION

Cleaning losses of each race or variety were expressed in percentage. A loss of 25-45 percent were registered in case of investigated varieties. Most of the races showed losses around 30 percent, except landrace No. 16 with almost 45 percent loss, which seems to be unacceptable for a grower. The lowest loss (26%) was measured in case of landrace No. 19. Commercial varieties no. 21 and 24 gave not outstanding but average results.

With regards to TSS, the effect of both factors varieties and treatment was significant ($F_{(7;38)} = 111.6$; $p < 0.001$; $F_{(1;38)} = 13.29$; $p < 0.01$) with insignificant interaction (Figure 1). The highest results were shown by salad types no. 11 and 20, respectively. The former had significantly higher levels in both treatments. Lowest results were shown by commercial varieties no. 21 and 24, having the latter significantly lower results from all landraces in both treatments. In case of all accessions and varieties cleaning increased TSS content, except in case of no. 8, where no difference was observed. It suggests that the disoredered fruit part which has been removed –e.g. green shoulders, scars and sunscalded spots- contains relatively less solids within the fruit.

With regards to the total acid content (Figure 2), we detected that the effect of varieties is significant ($F_{(7;38)} = 34.13$; $p < 0.001$) with insignificant treatment effect ($F_{(1;38)} = 0.02$; $p = 0.87$) and significant interaction ($F_{(7;38)} = 4.25$; $p < 0.001$). The pattern of the results is quite diverse. Highest values were given by landrace no. 16 in both treatments, but the values are significantly higher only from landrace no. 19 and 8, respectively. In case of landrace 8 and 11 significant increases were observed for the cleaned treatment. Landrace 16 and variety 21 showed no difference over treatment, while the other traits gave lower results when cleaned. The decrease was significant only in case of landrace no. 20. No conclusions can be drawn from the data observed, but increase of TA is more likely. However, it should also be mentioned, that differences between treatments within a trait are very low in every case.
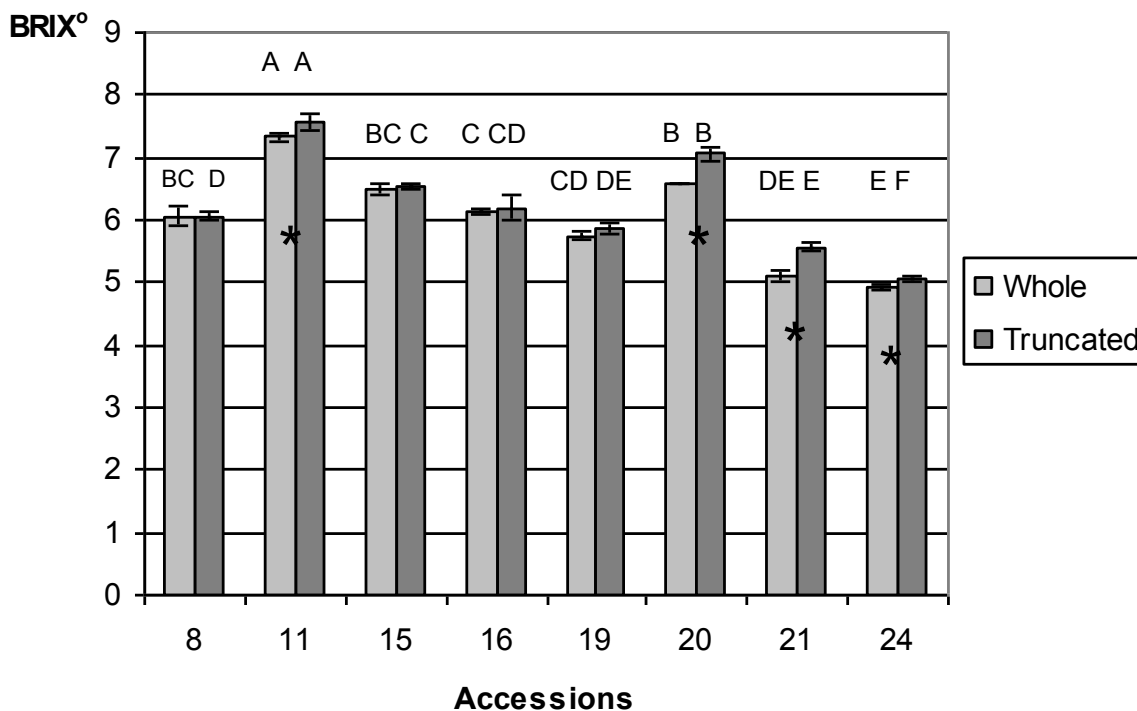
Figure 1 Total soluble solids (TSS) levels of investigated accessions before (grey) and after removing disordered parts (black) Different letters on columns show significant differences between varieties on the p< 0.05 level, according to Games-Howell's post hoc test.
* significant differences between treatments on the p< 0.05 level.

Considering lycopene content (Figure 3), we detected that the effect of varieties is significant (F(7;38) = 20.42; p < 0.001) with insignificant treatment effect (F(1;38) = 0.76; p = 0.39) and significant interaction (F(7;38) = 6.78; p < 0.001). Lycopene content of landraces no. 11, 16 and 20 were outstanding in both treatments reaching 12.66, 9.73 and 7.77 mg/100g values without cleaning, respectively, and 8.66, 7.1 and 12.66 mg/100g after cleaning, respectively. These accessions are therefore suggested for further analysis and for utilization by plant breeding to enhance lycopene levels of future varieties. Impact of treatments showed an increase in five cases, while in three cases a decrease was observed between treatments. Note that the variances were very high which made significant treatment effect difference detection impossible.

Table 2 summarizes the changes of three investigated parameters and of calculated values. The ratio between soluble solids and acids as well as flavor intensity changed in every case. With the exception of landraces no. 8 and 11 the ratio is higher in case of cleaned samples than without treatment. Based on flavor intensity changes landraces no. 8, 11 and variety 21 show considerable increase, while the others show a little positive or negative change. The exception is variety 24, which has a decrease in FI over cleaning.
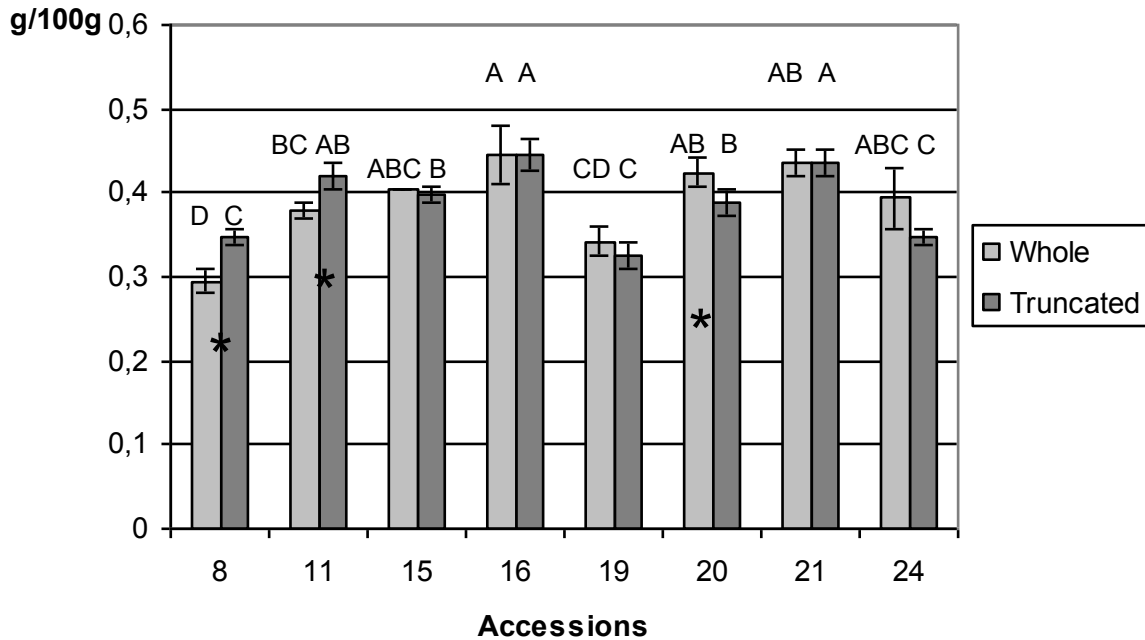
Figure 2 Total acid (TA) content of investigated accessions before (grey) and after removing disordered parts (black). Different letters on columns show significant differences between varieties on the p< 0.05 level, according to Games-Howell's post hoc test. * significant differences between treatments on the p< 0.05 level.
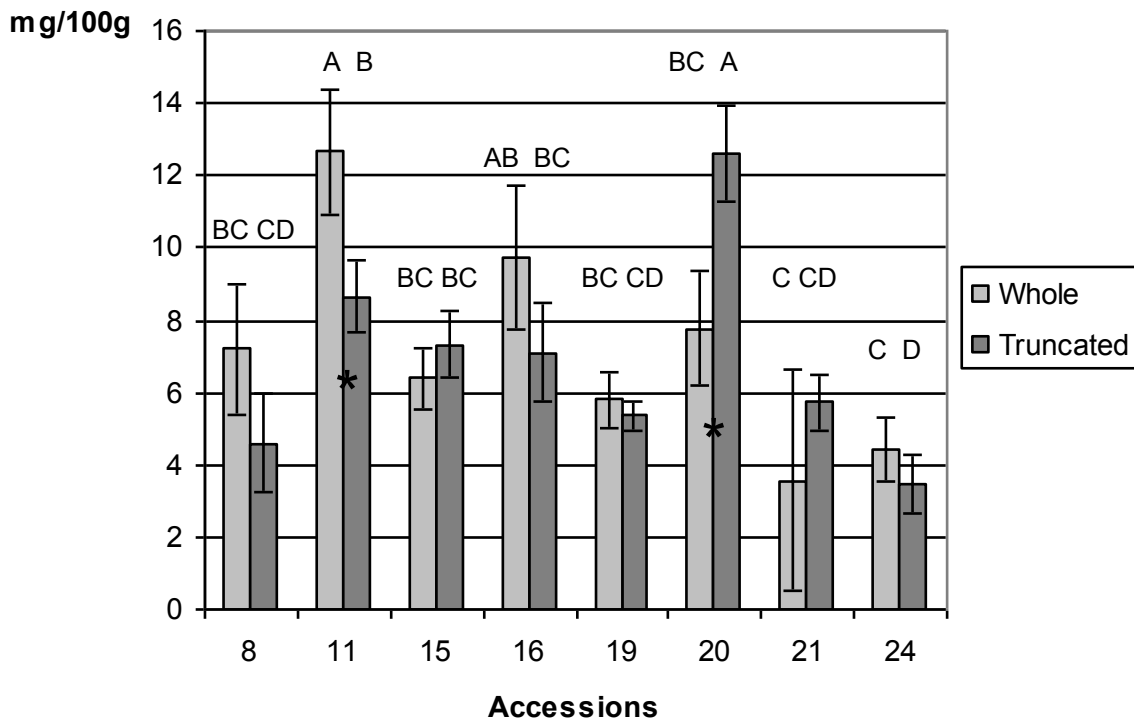

Figure 3 Lycopene content changes of investigated accessions before (grey) and after removing disordered parts (black). Different letters on columns show significant differences between varieties on the p< 0.05 level, according to Games-Howell's post hoc test. * significant differences between treatments on the p< 0.05 level.

Table 2 Differences between investigated parameters of untreated and cleaned samples within an accession/variety. Asterisks indicate p≤0,05, plus sign indicates p≤0,1 significance level.

Variety	TSS	TA	Lycopene	TSS/TA	FI
8	0,00	0,05*	-2,59	-3,07	0,31
11	0,23+	0,04*	-4,00*	-1,36	0,40
15	0,03	-0,01	0,92	0,29	-0,02
16	0,07	0,00	-2,62	0,15	0,03
19	0,12	-0,02	-0,43	1,16	-0,05
20	0,47*	-0,04*	4,83*	2,65	-0,06
21	0,47*	0,00	2,18	1,07	0,20
24	0,13*	-0,05	-0,96	2,07	-0,18

It can be concluded that in case of investigated six landraces and two varieties removal of abiotically disordered fruit parts have an impact on TSS, TA and lycopene content. However, the present study could demonstrate the relatively lower TSS content of disoredered parts within a tomato fruit. This difference was significant in case of landraces 11, 20, and varieties 21, 24. Impact of cleaning on TA is rather low. As a conclusion removal of disordered parts can enhance both TSS/TA ratio and FI, which can develop the flavor of processed products, but reduce the volume of it with an average of 30 percent in case of investigated accessions and varieties.

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KISKUNFÉLEGYHÁZA CITY HOSPITAL AND CLINIC, BATH AND REHABILITATION CENTER DEVELOPMENT AND SOME CONTEXT OF PATIENT SATISFACTION AND LOGISTICS

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ABSTRACT

The study of Kiskunfélegyháza hospital rehabilitation department of the launch and operation are summarized in the light of the results data. Started in May 2005, public investment is achieved, containing functional reconstruction of partial hospitalization as a result of enlargement, was delivered in September 2006, was built to exploit the thermal rehabilitation unit, which includes a 40-bed department on the first floor, the ground floor clinic rooms, the spa offers therapeutic and physiotherapy service rooms and swimming pools, the basement of mechanical rooms. A further problem in question – the subject-oriented guide to healing, health, illness, and a definition of rehabilitation took place – according to the literature. It will be determined in the prevention, injury, disability and concepts of disability in the light of the logistics. Write the process that accompanies the service, taking into account the economic aspects of the market.

Have been processed under the rehabilitated patient population, patient registration data by age between 2007 and 2012. Considering the cases of the total care days are the number of transferees from other classes, social and home placement per capita average care days in the bed occupancy and the number of death cases were surveyed on written questionnaires.

Rehabilitation hospital care is most effective with measurable - which can be seen in the analysis - that of the average length of more than 18 days, the bed occupancy of 100% and a mortality rate of 2%. However, the situation logistical aspects of the process can be improved further by examining the quantitative and qualitative indicators of well. The topic niche processing, rehabilitation domestic situation analysis has been very little. The results are set out proposals to increase the efficiency of operation.

Keywords: rehabilitation, logistics, musculoskeletal rehabilitation, therapy, post operation treatment

1. INTRODUCTION

Kiskunfélegyháza is lucky thermal characteristic features, which provides public bathing facilities for the general public for decades. People - in folk medicine - realized the benefits of, and then this option is left unused for a long time. During the health care systems, is an excellent opportunity offered itself as a mineral water based uptake rehabilitation, intensive development in the city. Since the first of January 2011 has started in Kiskunfélegyháza hospital musculoskeletal rehabilitation clinics funded by the National Health Insurance (OEP) 9 hours a week, which is controlled by two specialist medical doctor.

Direct territorial coverage obligation of consultation covers 52,000 inhabitants in Kiskunfélegyháza and its surroundings, as well as indirectly and partially Bács-Kiskun and Csongrád counties' population. How to get in movement or activities disabled patients – through general medical doctor – to a special rehabilitation center from their home? How many hurdles to overcome not only because of the disability, but the access generally as well? After following the general medical care, or previous clinical care, follow-up examination clinic reference to quotations made by the dispatching computer program to book appointment (exact month, day, hour graduations) for 15-minute intervals to share by your personal contact or telephone appointment negotiation call.

2. MATERIALS AND METHODS

The rehabilitation activities and related logistics processed and a short summary of the literature. Questionnaire survey among patients treated in the hospital department. Summary and some forward thinking wording.

3. SUPPLY OPTIONS, SWIMMING COMPLEX MEDICAL TREATMENT

Offered facilities and by Kiskunfélegyháza City Hospital and Clinic, Bath and Rehabilitation Center

A) medicinal water pool
   Mud pack, carbonic acid bath, water jet massage / underwater jet massage / massage, weight bath, underwater gymnastics group.

B) physiotherapy treatments
   Iontoforésis (using various gels rheumatism), ultrasound treatment, landing, four compartments and other galvanic treatments, TENS therapy to strengthen the purpose of pain, nerve stimulation, diadynamic current, Bemer and magnet therapy.

C) physiotherapy: Physiotherapy is the most special tournaments and the Mc. Kenzei-gymnastics, the suspension grid) and joint use of moving machinery. (A. S. LEON ET AL. 2005; M. F. PIEPOLI ET AL. 2010; E.G. 2012; S. GEROLD ET AL. 2007)

The assigned team members are, physical therapists, physiotherapists, masseurs, lifeguards, specialized doctors, assistants, patients, and last but not least, providing transportation and carrying out staff, patient transport family members by car or public transport, train, bus, and not insignificantly electric wheelchair, using a bicycle take the smooth operation of the unit. Everything has to count the cost of which lies directly or indirectly, but the patient. (Szegedi Z. - Prezenszki J. 2010; Szabó Gy., Renner A. 2004)

The specialist doctor ordered therapy according to the disease, like number and the composition of the treatment and patients get treatment sheet. It is a spa treatments medical prescription. Then, the patient controls the form and the combination of vehicles visiting the dispatcher service for the purpose of accounting for compensation cost and schedule of treatments.

Part o the treatments paid by TB (medical insurance) as a fixed portion and the rest is paid by the patient. In the case of public health beneficiaries, the service is free of charge. Timing of schedule starts, chosen the earliest possible time, leaving no empty space in view of the high degree of efficiency and demand. Generally, waiting for treatment the average of days is between 10 days and two weeks. Having been ready administration treatment logistics starts, using above mentioned tools, and knowledge of the exact dates. Control compulsory for the patient, in order that check efficiency, effectiveness in order to assess the importance of logistics process is repeated test within 3 weeks after completion of treatment.

The above figure shows that over the past six years – during the development of the department's image – an average of nearly 1,000 patients treated per year. Ensuring continuity of patient care mentioned earlier could only be a result of well-organized logistics process. Carefully planned work in liaison with the surgeon and acute departments who want their patients' rehabilitation in Kiskunfélegyháza. Patients that they are the class after a telephone consultation, and may place patients rehabilitated made redundant at the scheduled time of the next patient bed occupancy, in addition to the overall economy is. In addition, home of the patients in the pre-notification ticket is sought, up to one week prior to the recording by phone call. Perform some tests before the shooting – which are essential for successful rehabilitation – outpatient needs to be, that the cost of the hospital's budget is not burdened (x-rays, lab etc.) too. It is important that the available recording time of the patients known drugs, the medication should be smooth. This requires a range of medicines to ensure the accuracy of the hospital logistic processes by which the suppliers created as a result. In the last two years has increased the territorial obligation, since 1st October 2010 from Kecskemét County Hospital to Kiskunfélegyháza 32 musculoskeletal rehabilitation beds have been moved, so increased the capacity of the musculoskeletal rehabilitation department. In the past 20 musculoskeletal beds capacity has increased up to 52 beds and the existing 20 bed cardiovascular unit that has 72 beds, which are the total number of beds in the rehabilitation department. With the number of patients around 1/3-dal increased compared to 2010. (FIGURE 1) However, neither the human nor the technical resources are not increased, thus significantly hard-working staff, which requires using the capacity of the human resources available.
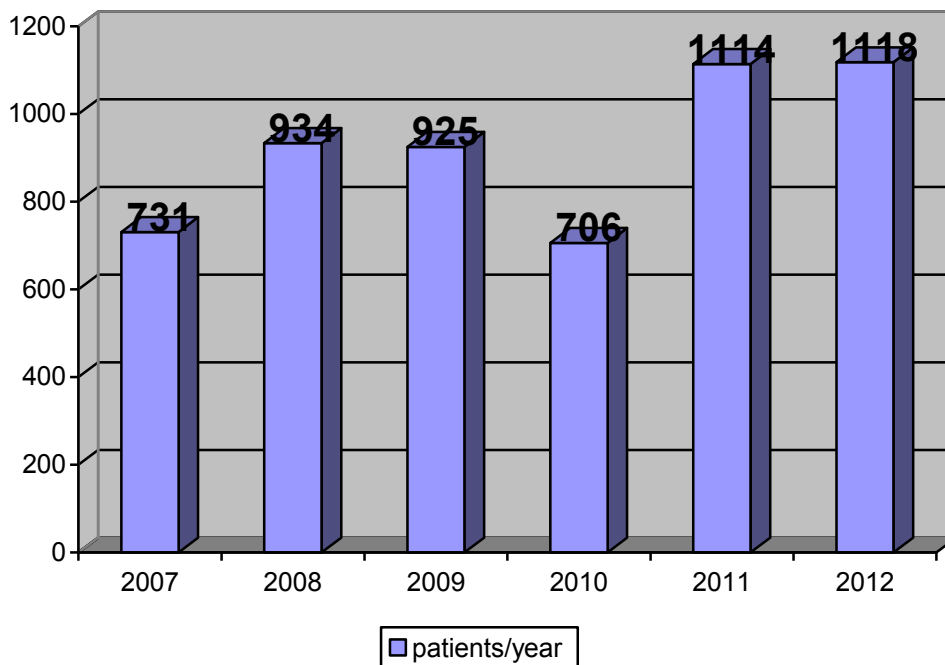

Figure 1 Patient turnover 2007-2012 patient/year
Source: Authors' own data

This is the point where it is very thought-provoking insights to strategically what further action is possible for the department to meet growing patient care needs. Given that the infrastructure does not allow the inclusion of more beds, overcrowding would become inevitable, as is the case in many other domestic institutions is already visible. The increase in

staff numbers, mainly due to known medical deficiency, on the other hand the non- medical staff wage bill increase further undermine the position of the class.

4. A REPRESENTATIVE SURVEY OF PATIENTS REHABILITATION OF A WORKING OF CLASS (SURVEY)

2013 survey done by the department treated patients in order to measure the work quality of the medical staff. A random selection of patients responding occurred, highlighting patients to different age, gender, educational level and social level of the database. 100 questionnaires were issued, of which 61 were processed was because the only answer to all your questions on tax questionnaires could be evaluated. The sampling period was three weeks because he planned to spend three weeks in most of the patients in the ward.

The survey aims to provide a cross-sectional picture of the operation of the department of users of opinion that the standard of the personnel work of the well-being of patients, refer to the state of healing. Received particular attention was in the compilation of the questionnaire aspects simple to use, comprehensible station, clarity, ease of answering and interpretability. The questionnaires were in the days before discharge rates in patients after completion of the final report is handed over we got back.

Specific questions were as follows:

- Why did you choose your class for the purpose of rehabilitation management?
- The x-th time away in our department?
- Satisfaction of operating personnel (doctor, nurse, physiotherapist, physiotherapists, bath with crew), and the efficacy of treatments?
- If you have been lying in our hospital, the present management and the effectiveness of previous treatment how do you judge?
- Does the department received information in a clear explanation of the objectives of the state of the disease, and the results of medical treatment studies?
- Do you want the option to continue rehabilitation at our institution to continue?
- Do you recommend to our class to others?

The answer is choice (yes-no) and 1 to 10 points for evaluation occurred.

5. RESULTS AND DISCUSSION

The 61 interviewed patients, 17 men, 44 women were, this ratio is broadly representative of the patient's circulation is observed, the composition of sex. The mean age of patients 65.7 years, the youngest 31, the oldest was 83 years old. Half of the patients were previously informed from the rehabilitation department (31 patients) or other institution offered or heard in the general population, or read about it in the media. 1/3- respondents (22 patients), other inpatient institute sent after acute events, as cardiac surgery, heart attack, hip nailing, prosthesis implantation them. Sample one-third of the number of cases examined accounts. (The questionnaires were processed with the help of Excel.) Therefore it may be legitimate for sub-acute rehabilitation name. 36 patients it was in order to institute rehabilitation to one care (hospital active clinic department, orthopedics, rheumatology, traumatology, surgery, cardiology, neurology) initiated the referral were a surprisingly large proportion of those (25 patients), whose family doctor suggested to the clinics in the rehabilitation care needs. A number of returning patients are usually among the beneficiaries, on average, three times so far lay there, the answers were between 1 and 10 times. Data presented in the previous section of the paper clearly show that, since the musculoskeletal rehabilitation participants exceeds 50% of cases each year, and cardiovascular patients in 30%.

Positive responses were received almost maximum satisfaction issues. The management staff, they were all satisfied, the potential 10-point average of 9.8 doctors and 9.5 nurses, physiotherapists 9.6, 9.3 physiotherapists, the spa personnel received 9.3 points. The effectiveness of the treatments were mostly pleased with the 9.4 gym, physiotherapy 8.9, the spa treatment was 9.3 points. During the rehabilitation period, 88% (54 patients) felt that they had improved to about 12% (7 patients) left unchanged. To the question that you have received this information due to illness, the state of the tests and their results, the medical treatment, all patients answered yes. Almost all respondents happy to return to and would recommend it to other patients Kiskunfélegyháza rehabilitation clinic department.

6. SUMMARY

Should be aware that the patient's recovery will not be completed for a successful surgery. The patient should be encouraged to her old life, back to work, which requires the help of experts organized within the framework of institutional and outpatient care.

10 years ago there was no rehabilitation unit in the hospital, initially tried to establish the conditions for a successful recovery, within their own wards.

In May of 2005 started, addressed public investment realized, partial hospitalization reconstruction containing functional expansion as a result, in September 2006, was handed over to the thermal-recovery built rehabilitation unit, which includes the 40-bed department participated in the floors, the ground floor clinic rooms, the spa offers therapeutic and physiotherapy service rooms and the swimming pools, the basement of the horseradish rooms and mechanical rooms.

100 questionnaires were issued, of which 61 has been working on, which represented the class works. The respondents were slightly more than a quarter of men, the average age of nearly 66 years, which shows that more were treated in the older age group. Half were treated as described in our institution, which is not considered a bad number ratio. What is also good that, half of the patients directed to other institutes. As to how many times you have been lying in our department, the average was close to 3.5, the majority (34 %) 1-2 times taken advantage of our services. Maximum level of positive responses is to the operating personnel and the efficacy of treatments given. The efficacy of physiotherapy was held just under 90 % of. In connection with their condition has improved to 90 % of the response was yes . Over 90% of new management took effective as it was earlier. 100% of respondents would like to further continue their treatment at our institution and recommend to others.

The investigation confirmed expectations, because their experience has shown that, over the years, the patients took a liking to the institution, regardless of age, gender, social status as to, satisfied with their services. The rate of re-admissions are high, many people are patiently waiting for the subscription period already in excess of half a year now. Currently, the waiting list of more than 800 patients have pre-registered, which is a very large number. The urgent recruitment needs, and suffered an acute event, other regional treatment sites insist to Kiskunfélegyháza hospital. Rehabilitation hospital care is most effective in the analysis – which can be measured by looking at well-defined – that the average number of nursing for more than 18 days, the bed occupancy of 100% and a mortality rate of 2%. Errors, that rehabilitation is very little analysis on the domestic situation, which could increase the efficiency of the operation.

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LABORATORY ASSEMBLY FOR ANALYSIS OF FUEL INJECTION SYSTEMS IN THE MODERN INTERNAL COMBUSTION ENGINES

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ABSTRACT

The complexity of the processes taking place in a system of fuel injection management for an internal combustion engine requires extra effort for a proper understanding of the operating principles. This paper is intended to be an intuitive practical application able to simulate the complex electronic control of injection, through a PC and specialized software. The application provides an intuitive and friendly analysis of the processes occurring during the operation of an injection computer. Moreover, the system allows the determination of the gasoline amount injected by the various types of fuel injectors, in a certain period of time and at different pressures of the fuel, depending on the load, speed and thermal regime of the engine. The laboratory assembly for a fuel injection system is intended as an experimental stand with exclusive didactical applicability. We want to observe the main characteristics of a fuel feeding and injection system, as the identification of components for the control system, data acquisition system and fuel injection system, the analysis of the different types of signals that can be used to actuate the injectors, the establishing the principles of injector operation in accordance with the control electronics, the visualization of the injection cadence and amount injected, depending on the engine speed and load, the programming of injection computers etc.

Keywords: fuel injection, modern internal combustion engines, laboratory assembly

1. INTRODUCTION

Modern fuel injection systems are designed specifically for the type of fuel being used. Some systems are designed for multiple grades of fuel (using sensors to adapt the tuning for the fuel currently used). Most fuel injection systems are for gasoline or diesel applications.

The functional objectives for fuel injection systems can vary. All share the central task of supplying fuel to the combustion process, but it is a design decision how a particular system is optimized. There are several competing objectives such as: power output, fuel efficiency, emissions performance, ability to accommodate alternative fuels, etc. The fuel injection in modern internal combustion engines is currently carried out exclusively under electronic control. In most cases, the control unit is represented by the "injection computer". This unit acts on the execution elements (injectors, spark plugs, motors, valves, regulators etc.) using signals which are influenced by the reaction parameters coming from the position sensors, speed, pressure, temperature, etc. The modern digital electronic fuel injection system is more capable at optimizing these competing objectives consistently than earlier fuel delivery system. We want to observe the main characteristics of a fuel feeding and injection system, as follows:

✓ identification of components for the fuel injection system;
✓ establishing the principles of injector operations in accordance with the control electronics;
✓ visualization of the injection cadence and amount injected, depending on engine speed and load;

The application provides an intuitive and friendly analysis of the processes occurring during the operation of an injection computer. The assembly is designed so as, via a PC running an application in the LabVIEW programming environment. In order to obtain variable pressures on the supply line and on the common rail, the fuel pump was connected to a circuit which, by reducing or amplifying voltage, decreases or increases the pressure.

2. MATERIALS and METHODS

The assembly described below is intended as an experimental stand with exclusive didactical applicability, and is consisting of two distinct parts:
✓ the software (represented by the Labview application, which controls the injector opening), and
✓ the hardware (represented by the fuel circuit and injector rail).
Figure 1 presents an overview of the application hardware. For easier identification of the experimental stand components, we chose a solution that enabled us to easily observe and even disconnect all the components. Based on the geometrical shape of a fuel rail fitted on the Opel Astra G engine, made in 2007, we designed a container in which the injectors supply gasoline, container that enables us to watch the quality of the pulverized fuel flow shape. Moreover, the device contains four tubes for the quantitative determination of fuel consumption, at different regimes of engine operation and various rail pressures.

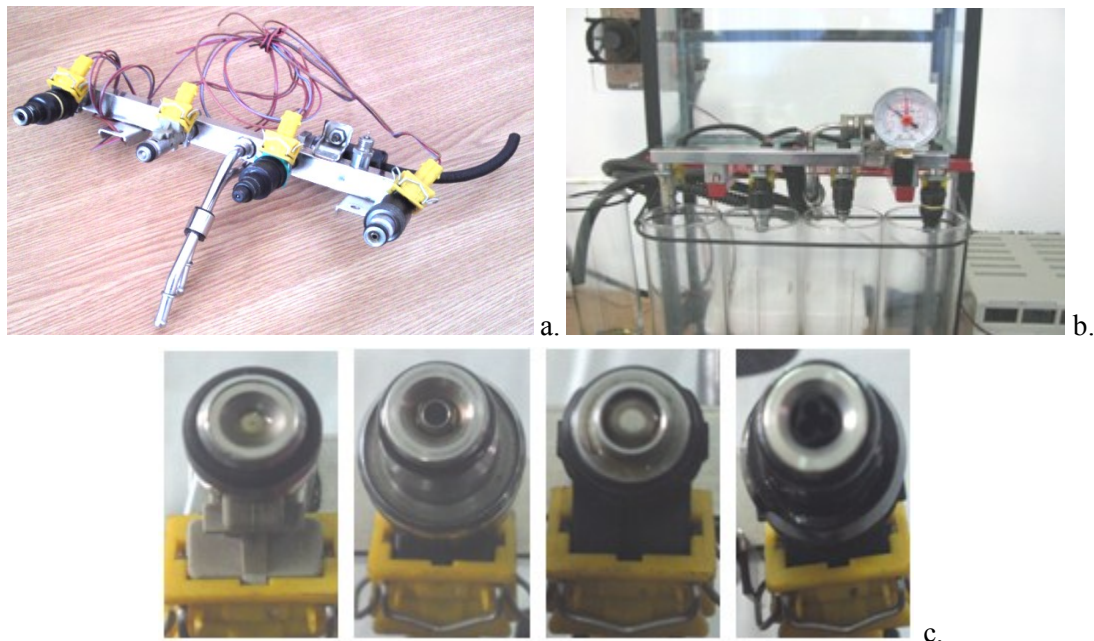**Figure 1** Overview of the application hardware

Figure 2 The rail with the different type of fuel injectors, a– overview,
b – mounted on the stand, c – details of injectors nozzle

To see the shape of the injector nozzle heads, we designed a system that enables the rail to rotate around its horizontal axis (Figure 2). The injectors are placed on the rail, where the fuel is brought from the tank, previously passed through a pressure regulator which is intended to maintain the rail pressure within a certain range. The fuel tank houses the electric fuel pump, the level sensor with mobile buoyant, element that converts the level into a set of electrical parameters in the form of an adjustable resistor with cursor.

When the fuel injectors are electrically activated, a hydraulic valve (consisting of a nozzle and plunger) is mechanically or hydraulically opened and fuel is sprayed into the cylinders at the desired pressure. Since the fuel pressure energy is stored remotely and the injectors are electrically actuated, the injection pressure at the start and end of injection is very near the pressure in the accumulator (rail), thus producing a square injection rate. If the accumulator, pump and plumbing are sized properly, the injection pressure and rate will be the same for each of the multiple injection events.

Figure 3 The accelerator pedals and the front panel of the application
with LabVIEW interface

The entire assembly is interconnected. The command originating from the accelerator pedal was realised through a USB port, providing a signal to a wide range of values, in progression, that increase according to the pedal pushing force (Figure 3). The accelerator pedal will be the frequency control element for controlling the injectors. In contrast with the other parameters of the signals, the signal provided by the pedal is controlled by a physical element, not a virtual one.

We developed four electronic circuits, one for each injector. The voltage of the rectangular continuous signal supplied by the electronic device is 0V, or 5V in case of peak voltage. These rectangular signals (90 degree offset) serve the need to open or close the injectors instantly. The parameters to be set to determine for how long the injectors will be opened or closed, will be determined by changing the duty cycle of the signal that will determine the modification of the opening or closing frequency. To simulate the signals, we used the function "Simulate Signal" found in the LabVIEW library. If the direct control is required, or during the process, the signal simulation parameters can be modified in real time by means of control elements placed on the front panel of the application.

3. EXPERIMENTAL MEASUREMENTS

The behaviour of the injection pump to the supply voltage variations can be established by determining the correlation between the voltage variations and the pressure values of the fuel supplied by the pump. As mentioned, changing the supply voltage of the injection pump leads to pressure change in the injector rail.

The graph presented in Figure 4 shows the variation of the pressure supplied by the pump versus the supply voltage of the pump.
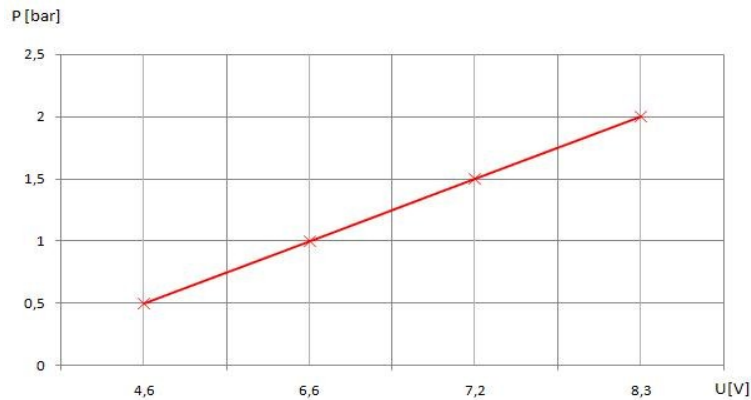

Figure 4 Variation of the fuel pressure versus the supply voltage of the pump

We decided to carry out measurements at a constant 2 bar pressure, at various simulated speeds. The cutting interval was 5 min.
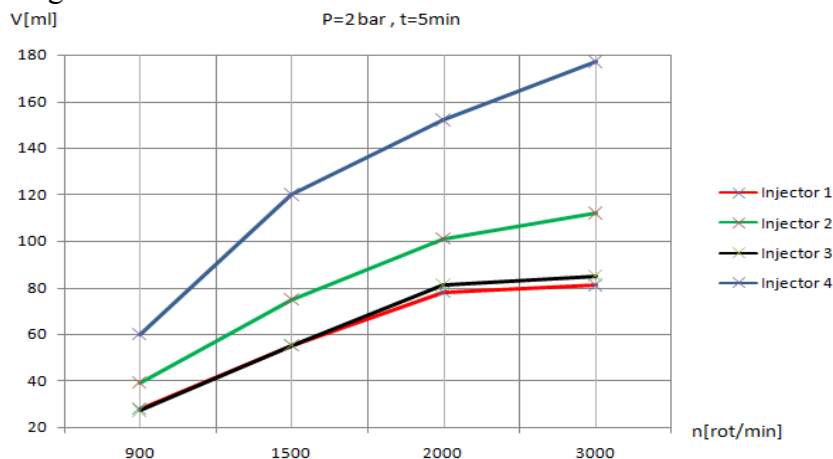

Figure 5 The injected fuel amount versus the injector speed and type

We have measured the amount of fuel injected by each injector, for various speeds, at the same pressure supplied by the pump (Figure 5).
The researches use data collected from the didactical use at the Thermal Machines and Road Vehicles Laboratory of the Faculty of Engineering Hunedoara, in the University Politehnica Timisoara, as well as laboratory experiments carried out on a unique, complex and original assembly.

4. CONCLUSIONS

By making the application presented in this paper, we targeted the following aspects with didactic character:
✓ familiarization with the phenomena related to fuel injection into internal combustion engines;
✓ showing how the simulation of continuous pulsed signals realises the injector control;
✓ being available identical signals to control the various types of fuel injectors, we revealed the structural differences among them in terms of quality and quantity;
✓ possibility to observe, in real–time, the form of the injector control signals in the assigned window, placed on the front panel of the application;

✓ possibility of measuring the flow rate supplied by each injector, by using a set of graduated tubes, in which the injectors are flowing the fuel;

✓ the observation of the fuel flow quality (geometric shape, number of spray holes, etc.) is facilitated by moving the injector rail in the top of the metal frame, where the glass bowl is placed, which is provided with return to the tank;

✓ a LED strip facilitates watching the moments when the injectors are flowing the fuel, the injector operation cadence in terms of speed, and the ignition order;

✓ by using the LabVIEW development utility tool, we demonstrated how to realise complex simulation software without the need for "command line" programming knowledge, but only using diagrams with mathematical function blocks;

✓ in contrast to the similar stands on the market, it also offers a budget solution, the costs being substantially reduced if choosing this option instead of other brand products.

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LABORATORY RESEARCHES UPON THE THERMAL FATIGUE OF THE ORGANS OF MACHINES IN MOVEMENT OF ROTATION, IN VARIABLE TEMPERATURE MEDIUMS

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ABSTRACT

The researches of durability in the exploitation of cast-iron rolls define experimentally an important chapter from the thermal fatigue of the organs of machines in the movement of rotation, in variable temperature mediums. The researches on the durability in exploitation of hot rolling mill rolls represent an important scientific and economical issue. This paper presents original experimental equipment by the help of which the durability of hot rolling mills can be studied. This experimental equipment permits the evaluation of exploitation durability for hot rolls by studying the thermal fatigue phenomenon which appears in the case of machine components. The exploitation durability is evaluated through thermal fatigue cycles up to crack point due to thermal fatigue for each condition and each type of studied material. The study represents a detailed approach of the influence of various technological factors on the durability in exploitation of rolling mill rolls made of different steel and pig iron grades and suggests solutions meant to increase the durability of the rolls in exploitation.

Keywords: organs of machines, thermal fatigue, durability, temperature mediums

1. INTRODUCTION

The rolling mill rolls are the parts most subjected to wear in the rolling trains and they represent a consumption of 0.8 kg/tone of rolled steel. Nationwide, 4.5 million ton steel is being rolled every year. This represents a consumption of 3,600 tone rolls, which imposes researches with an important economic and scientific impact. It is noticeable that approximately 1/10 of the rolls are removed from exploitation because of the thermal shock caused breakings, which cause accidental damage and stoppage, and the losses expand over the rolls cost, as well as production losses, disturbing the entire technological flux.

Currently, many aspects of the thermal regime of lamination are still not enough studied, and also, there are no efficient methods for the determination and adjustment of the rolls temperatures from the industrial rolling mills. The intensification of the lamination process directly influences the rolls durability, these being the most solicited organs of machines from whole ensemble of the lamination equipments. The technological processes of the rolls manufacture, as well as the quality of used materials have a quick extension, materialized in worldwide market competition, through exceptional qualities of rolls. The different high alloy ferrous products currently used in the manufacture of these rolls define an important chapter from the quality assurance of the industrial products.

Poverty of detailed researches, theoretical and experimental, about the thermo-mechanical processes take place during the plastic deformations between the rolling mills rolls, represents a factor that reduces the possibility of rational exploitation of rolling mills. In the context of market economy is necessary a new evolution in the area of scientific researches, in the purpose of modernization of the equipments and metallurgical plants, using the most efficient solutions for obtaining aggregates with performances to the level of world technique.

The durability in exploitation of the rolling mill rolls is little approached in the reference literature, both in Romania and worldwide. Up to this moment, there is no reference publication to minutely deal with the theoretical and experimental aspects of this theme of research. The research on durability in exploitation of hot rolling mills rolls assures relevant conditions for the appropriation of the research methods of the thermal regimes that are submitted the rolls or other organs of machines, that works in constant (symmetrical) or variables (asymmetrical) thermal solicitation conditions. All these phenomena, which are more or less emphases depending on the type of rolling mills, are not taking into consideration in the classic calculus of rolls. If the study of the rolls resistance is extended upon their durability, we must consider the whole complex of tensions with mechanic-thermal influences.

Hot rolling mill rolls are the parts most subjected to wear in the rolling trains because the incandescent rolled material is deformed between the water cooled rolls, at temperatures of $1100\ldots1150^0$C. Hot rolling mills rolls work the in the variable compound solicitations, due to lamination process and which repeat to regular intervals of time. They are characterized by a complex system of cracking of the superficial caliber layer or they simply break because of the thermal shocks caused by the contact of the hot metal with the water-cooled rolls. These rolls must be able to carry out extreme actions: very high thermal stresses and wear, along with mechanical stresses due to normal rolling loads. These actions lead to the development of cracks, which means that sufficiently high fracture toughness is also an important requirement. Our researches are trying to give answers to most actual problems related to the increase of rolling mill rolls quality.

2. MATERIALS and METHODS

The researches use data collected from the industrial use at the Iron & Steel Integrated Plant of Faculty of Engineering Hunedoara (Romania), as well as laboratory experiments carried out on a unique, complex and original installation. Figure 1 presents the construction plan of the installation for determining the durability of the hot rolling mill rolls. This installation provides the possibility of further studiers and also to establish the durability in exploitation for all types of rolls used presently in industrial mills.
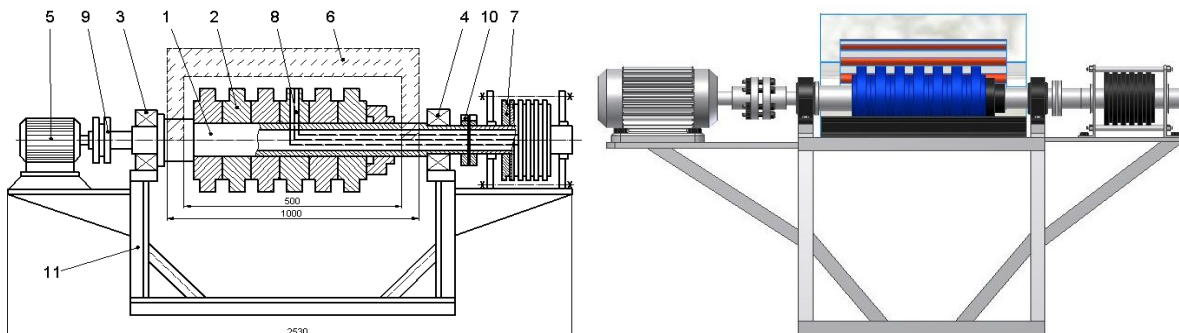

Figure 1 The construction plan of the installation for determining the durability of the hot rolling mill rolls. 1. main axis; 2. experimental rings; 3,4. bearings; 5. asynchrony electric engine; 6. electric resistance furnace; 7. thermo tension collector; 8. pin; 9, 10. couplings; 11. metallic skeleton

The experiments are made on groups of six rings, with a 250 mm exterior diameter, carried out from the studied types of industrial rolls. Having in view the research, three armatures of specimens were made, each with six rings and every ring made of the following materials:
– steel used to manufacture rolls from semi-finished mills (type 65 VMoCr15);
– steel used to manufacture rolls from heavy section mills (type 55 VMoCr12);
– steel used to manufacture rolls from heavy section mills (type 90 VMoCr15);

– steel used to manufacture rolls from heavy, medium and light section mills (type OTA3);
– iron used in the making of rolls in heavy section mills (type FNS2);
– iron used in the making of rolls in heavy and light section and wire mills (type FD2).

These rings were subject to different cyclical thermal solicitations, which, during the period of a rotation of the main axis, on one hand warm up in an electric furnace at different temperatures, and on the other hand cool in different environments, respectively in air, water and carbonic snow jets.

During the experiments, after a certain number of stress cycles, the surface of the sharp sides of the rings presents signs of cracks because of the thermal fatigue. They appear at different intervals during the stress, intervals according to which the number of cycles is to be established. These cycles differ, depending on the type of materials studied. During the experiments the temperature variation is recorded in the ring shaped specimens (samples), as wells as the temperature of the electric furnace with automatic adjustment and maintenance at previously established values. To perform the measurements of temperature variation in the experimental rings, one of them is implanted with a conical pin with initially equipped Pt-Pt/Rh thermocouples. These thermocouples measure temperature variation on the surface of the sample and the $\Delta r = 0$; 1.5 and 3.0 mm depths. They are presented together with the interior assemblage, in Figure 2.

Figure 2 Assembly of conical pin fitted Pt-Pt/RH thermocouplings

The heating furnace of the experimental rings is composed of refractory concrete casing, with a semicircular shaped inferior part and two electrical resistances, each of them with four loops. The diameter of the resistance wire is of 2.5 mm, the section of 4.907 mm^2 and the spiral diameter of D = 22 mm.

Figure 3 presents a scheme for the functioning and thermal fatigue in the durability equipment. In light working conditions, heating can be performed with one resistance, while in heavy working conditions, the heating of the rings is made with both resistances, in an angle rotation interval of $\varphi = \pi$ radians. If the heating is performed with one resistance, then the heating area comprises a 90^0 angle from the furnace's circumference, while for a simultaneous functioning of both resistances the heating takes place on the entire interval of the furnace semicircle, which corresponds to an 180^0 angle from the rings' circumference.
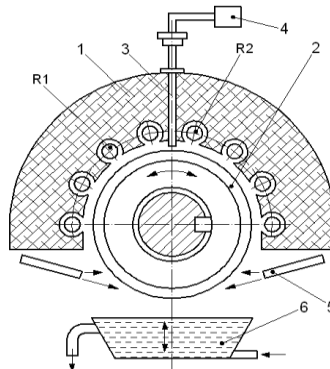

Figure 3 Transversal section through a sample heating furnace and ring axis

The heating time is depends on the engine's number of rotations, respectively ring tryout branch. They increase in heat at every rotation of the axis in the area of the furnace and then cool in different medium outside it (the inferior side). The control command station, with an electrical automat for heating the samples to establish and maintain a certain temperature necessary inside the furnace. The temperature is measured with thermocouple (3), to which it can be imposed, through automatic command, the temperature limit to be maintained during the experiments, this limit having a maximum value of 1000°C.

After establishing the number of stress cycles, until the first thermal fatigue caused cracks appear, durability histograms are done to each type of material, used to manufacture rolling mill rolls and to each type of stress. The results are to be compared with those in the industrial exploitation in the Rolling Mills sectors.

Regarding the temperature of the electric furnace medium intended for experimental rings warming, this has to be as high as possible in order that the tryouts reach a stabilized regime to a maximal possible temperature. In our case, the temperature of the two resistors electric furnace medium, having four curled spirals each, was calculated to 1000°C and we obtained 960°±100°C, but the experiments were effectuated at 910°±100° C.

In order to increase the number of the loading cycles, until the first thermal fatigue cracks appear, we have tried to maintain as high as possible temperature for tryouts, and the cooling fast and accentuated. Each of the three sets of tryouts consisting in six rings were constrained to a working regime, pursuing the calculated moment of the appearance of the thermal fatigue first cracks, registering the number of loading cycles.

Table 1 The experimental regimes

The name of the characteristic elements from the experimental regime	Experimental regimes		
	A	B	C
Rotation number of the tryouts mounted on the main axle [rot / min]	30.6	30.6	30.6
The temperature of electric furnace medium [°C]	910 ±10°C	910 ±10°C	910 ±10°C
The tryouts warming time [s]	0.98	0.98	0.98
The tryouts cooling time [s]	0.98	0.98	0.98
The heat introduction angle [rad]	π	π	π
The cooling evacuation [rad]	π	π	π
The cooling medium [-]	air	circulated water	carbonic snow

Based on the previous data presented, we chose three experimental thermal regimes, having the main elements presented in Table 1. The order of the experiments was regime A, B and C. During the experiments, was registered permanently the temperature of the electric furnace medium in stationary regime (910°C) and the temperature variations to one revolution of the rings, on the exterior surface as well in the superficial layer at $\Delta r = 1.5$ and 3 mm depth.
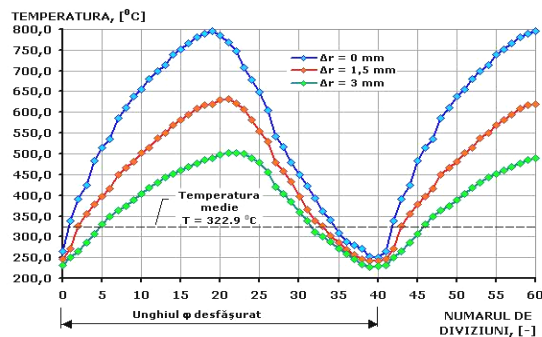
3. RESULTS and DISCUSSIONS

During the durability experiments, after the A, B and C regime, applied separately for each set of tryouts formed of six rings, representing the 6 studied materials, aiming by visualization the appearance of the first thermal fatigue cracks. These values are compared with the results from another series of experiments.

Analyzing the temperature variations diagrams, considered as isochronal estates, during the thermal fatigue experimental estates of the tryouts in A, B and C regime, we can observe that the highest registered temperature on the exterior surface of the rings was 795.3°C, in the A regime when the cooling has been effected in open air. In the B regime, having a recycling water bath cooling system, the temperature variations curves have a less accentuated

downgrade in the area of the cooling angle, reaching the maximal temperature on the rings surface 788.5°C, and the minimal temperature between 160...195.2°C. In the C loading regime was used carbon-dioxide ice blasted in by a distributive collector, the temperature variations curves becoming, in cooling area, even more accentuated, the maximal temperature on the rings surface being 762.6°C, and the minimal temperature in the superficial layer 140°C. The synthesis of the characteristic data for the registered temperature variations in the experimental loading regime A, B and C are presented in the Table 2.

Table 2 Synthesis of the characteristic data for cyclical variation of temperature of the ring type tryout experimentally exploited in A, B and C regime

The experimental regimes	Superficial layer's depth Δr [mm]	Temperature variation in experiments [^{0}C]	
		Maximal	Minimal
Regime A	0	776.7	239.2
	1.5	620.2	231.2
	3	499.2	219.2
Regime B	0	767.4	195.2
	1.5	505.0	180.3
	3	348.3	152.1
Regime C	0	757.2	204.0
	1.5	505.0	180.3
	3	292.6	140.6

Figures 4 The cyclic temperature variations in points, at the surface and in the superficial layer (regime A)
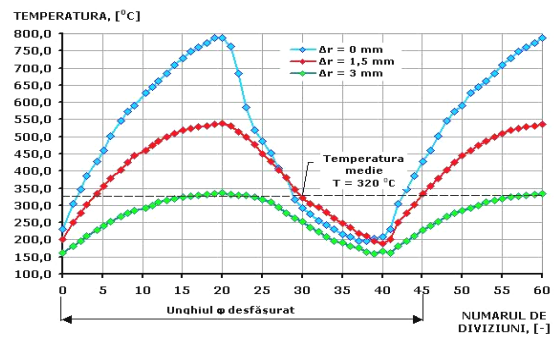
Figures 5 The cyclic temperature variations in points, at the surface and in the superficial layer (regime B)
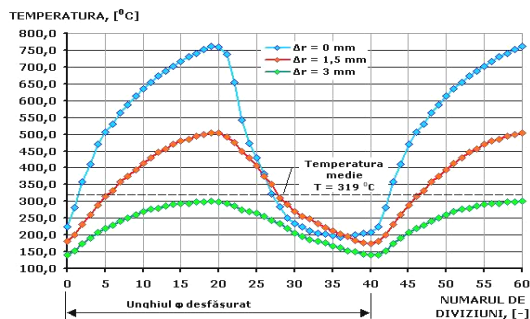
Figures 6 The cyclic temperature variations in points, at the surface and in the superficial layer (regime C)

Table 3 The number of thermal cycles and cyclical thermal solicitation regimes

Type	Number of thermal cycles		
	Regime A	Regime B	Regime C
55VMoCr12	$194 \cdot 10^3$	$181 \cdot 10^3$	$159 \cdot 10^3$
90VMoCr15	$175 \cdot 10^3$	$162 \cdot 10^3$	$148 \cdot 10^3$
OTA3	$245 \cdot 10^3$	$225 \cdot 10^3$	$195 \cdot 10^3$
65VMoCr 15	$186 \cdot 10^3$	$169 \cdot 10^3$	$152 \cdot 10^3$
FNS2	$218 \cdot 10^3$	$182 \cdot 10^3$	$173 \cdot 10^3$
FD2	$178 \cdot 10^3$	$165 \cdot 10^3$	$154 \cdot 10^3$

During the durability experiments, after the A, B and C regime, applied separate for each set of tryouts formed of six rings, representing the 6 studied steel and cast iron marks, aiming by visualization the appearance of the first thermal fatigue cracks. These first thermal fatigue cracks appear on the sharp lateral exterior edges at a Φ250 mm maximal diameter, on each

ring assembled in the packing, after a certain determined number of thermal loading cycles. The visualizations made in order to observe the thermal fatigue cracks were made twice per day, calculating the number of cycles passed after visualizations.

After the experimental exploiting durability tests, evaluated in thermal loading cycles, were made durability histograms, for each loading regime and for each mark of studied material, the results being presented in Table 3.

4. CONCLUSIONS

The research on the durability in exploitation of the hot rolling mill rolls is to be extended further on different brands of steels and irons used for the manufacturing of hot rolling mill rolls, depending on the durability up to the point of fissures and thermal fatigue cracks. Therefore, it is recommended to use the most rational and economical materials, as well as new, more performing materials to manufacture hot rolling mill rolls. In this sense, a few conclusions regarding the results are presented:

✓ uses one regimes of heating-cooling solicitation on the different regimes, subdued the analysis samples shackles from rolling mill, after the realization of the hot-roll campaigns in the roughing stands sectors, having different chemical compositions.

✓ in regime A, the materials under study resisted longest at stress cycles, until the first thermal fatigue cracks appeared (loading regime); in regime B, the first thermal fatigue cracks appeared in a smaller number of stress cycles (medium regime); in regime C, the thermal fatigue cracks appeared at the lowest number of stress cycles (heavy regime);

✓ the type of stress which gave the best results regarding stability to thermal fatigue – studied in stress regime C – is the OTA3 steel type;

✓ types 65VMoCr15, 55VMoCr12 and 90VMoCr15 underwent relatively well to the stress of thermal fatigue in stress regime A and acceptably well in stress regimes B and C;

✓ in the case of the two types of iron used in experimental research, a better behaviour was noticed at FNS2, which underwent to 173,000 cycles in stress regime C, until the first cracks of thermal fatigue;

✓ iron type FD2 behaves acceptably and is used to produce hard rolls from finishing stands.

The research on the durability in exploitation of the hot rolling mill rolls is to be extended further on different brands of steels and irons used for the manufacturing of hot rolling mill rolls, depending on the durability up to the point of fissures and thermal fatigue cracks. Therefore, it is recommended to use the most rational and economical materials, as well as new, more performing materials to manufacture hot rolling mill rolls.

This research is a novelty scientifically for the fundamental and experimental research area upon the hot rolling rolls. The research has contains concrete elements of practical immediate utility in the metallurgical enterprises, for the improvement quality of rolls, having final as aim growth durability and safety in exploitation.

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PHYSICAL PROPERTIES OF DOUGH FOR COOKIES WITH CHESTNUT FLOUR

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ABSTRACT

A challenge for food producers is certainly to find suitable flour that can replace wheat flour in the production of flour–based products. Chestnut flour can be adequate substitute for wheat flour in the production of gluten–free flour confectionary products, due to high starch and sugar content.   The objective of this work was to characterize physical changes, rheological and textural properties of dough for cookies with chestnut flour. The control dough was only with wheat flour. The substitution of wheat flour with chestnut flour for examined dough samples was at three different levels (20, 40 and 60%). Moisture of the dough was 22%.
Dynamic oscillatory measurements describe all dough samples as typical viscoelastic systems with dominant elastic modulus G' over viscous modulus G". The modulus ratio (tan δ=G"/G') decreased with increase in amount of chestnut flour. Also, the dough compliance (J) determined by creep and recovery curves decreased, thus more chestnut flour resulted in more brittle consistency of the dough. Texture determination confirmed the rheological results. Resistance to extension of the control dough sample was the highest, as well as dough extensibility. Application of chestnut flour and increase in its amount reduced these texture parameters for dough samples. Optimal physical properties of dough were achieved with low amounts of chestnut flour of 20%.

Keywords: chestnut flour, cookies dough, rheology, texture

1. INTRODUCTION

Inadequate and unbalanced diet is one of the most important problems of modern life. The intake of functional food products is a way to reduce or eliminate the effects of inadequate diet. Functional food is any food, modified food or food component, which exhibits positive physiological effect on the human health and contributes to reduced risk of disease. Functional food meets the nutritional and health needs of the consumer and does not have any negative side effects. Positive effects of functional food are difficult to observe in the short term, because they are measurable only after a long period of consummation (Miletić *et al.* 2008).
There are many food products that can be classified as a functional food in the daily diet. Natural functional food product may be plant food (fruit, vegetables, grains and nuts), animal products (dairy products, fish, beef) and some drinks (tea, red wine). Confectionary products may represent a functional food, due to addition of certain functional components such as vitamins, minerals, antioxidants, prebiotics, probiotics, or dietary fiber (Gibson and Williams 2000).
Chestnut is characteristic by its low sodium content and it is recommended in the diet of people with kidney and cardiovascular diseases. Also it has significant positive effect in the treatment of inflammation of the blood vessels and veins. Chestnut is suitable in the diet for

patients with rheumatic diseases and celiac disease (Demirkesen *et al.* 2010). Researches that are related to the replacement of wheat flour in the confectionery products with flour of other cereals, which do not contain gluten, indicated that rice and chestnut flours in proper relation are suitable tailor made mixture of flour for production of gluten-free flour based confectionery products with satisfactory quality. Chestnut flour can be adequate substitute for wheat flour in the production of gluten–free flour confectionary products, due to high starch and sugar content (Demirkesen *et al.* 2011).

The objective of this work was to characterize physical changes, rheological and textural properties of dough for cookies with chestnut flour. The control dough was only with wheat flour. The substitution of wheat flour with chestnut flour for examined dough samples was at three different levels (20, 40 and 60%). Moisture of the dough was 22%.

2. MATERIAL AND METHODS

Material

Materials used for experimental work were wheat flour for flour based confectionary products (Type 500), chestnut flour ("Molino Rosseto", Italy), sugar powder, vegetable fat, NH_4HCO_3, $NaHCO_3$, $NaCl$ and water. The compositions of the flours are presented in Table 1.

Table 1 Composition of the wheat and chestnut flour

Components of the flours	Wheat flour (%)	Chestnut flour (%)
Moisture	12.29	5.71
Starch	73.75	45.28
Proteins	9.70	5.54
Reducing sugars	1.83	21.10
Fats	0.84	3.19
Ash	0.45	2.06

Methods
Preparation of the dough for cookies

The dough for cookies was prepared by baking test method. The mass of obtained dough was 350 g. Ingredients for the dough were flour (199.4 g), sugar powder (69.8 g), vegetable fat (41.9 g), NaCl (1.1 g), $NaHCO_3$ (0.6 g), NH_4HCO_3 (0.4 g) and water. The amount of water was added to achieve 22% of dough moisture. The control sample contained wheat flour. Wheat flour was substituted with chestnut flour in amounts 20, 40 and 60% for samples with chestnut flour. The ingredients were mixed in Z profiled mixer (ZD2245, Stephan–Werke Hamelin) for 15 minutes. Dough was pressed manually in a shape of a compact low cylinder. After 2 min of the relaxation the dough stripe was developed by pressing dough twice in either direction between two rollers of the laminator (Laminoir Marchand LA4-500). First lamination was with 10 mm gap and second one was with 6 mm gap. Dough relaxed for 0.5 min after each lamination.

Dough quality determination
Rheological determination
The quality of dough for cookies was defined by determination of rheological parameters (viscoselastic properties, resistance to applied stress and recover ability) and textural properties of the dough (resistance to extension and dough extensibility).

Rheological measurements were performed by rotational viscometer HAAKE RheoStress RS600 (Thermo Electron Corporation, Karlsruhe, Germany) with plate–plate sensor PP60 Ti (plate diameter was 60 mm and gap 1 mm). Viscoelastic properties of the dough were determined by measurements of storage (G') modulus and loss (G") modulus and their ratio tan δ=G"/G'. The measurements were performed in linear viscoelastic regime (LVE) at 30 Pa, where the moduli were observed with increase of frequency from 1 to 10 Hz.

Viscoelastic response of the samples at constant stress, as well as their behavior after removing the stress, were determined by creep and recovery test. The test was performed in the LVE regime in which the deformation amplitude was proportional to applied stress amplitude. The creep time with constant stress (σ=30Pa) was 150 s and the recovery period after removing the stress was 300 s. Creep data, collected under constant stress (σ) over time (t), can be described by a creep compliance (J) function, in terms of shear deformation (γ), using equation $J(t) = \gamma(t) / \sigma$. The creep data were analyzed by Burger's model presented by equation $J(t) = J_0 + J_1 \cdot (1 − \exp(-t/\lambda)) + t / \eta_0$. For the recovery phase the equation of the Burger's model is $J(t) = J_{max} − J_0 − J_1 \cdot (1 − \exp(-t/\lambda))$. The value J_0 is the instantaneous compliance, J_1 is retarded (viscoelastic) compliance, J_{max} is maximum compliance, λ is mean retardation time and η_0 is Newtonian viscosity (Vithanage *et al.* 2009; Sozer 2009; Steffe 1996).

Textural determination

Texture determination of the dough by *Kieffer dough & gluten extensibility method* (Sams, 1999) was performed using Texture Analyser TA.HD Plus (Stable Micro Systems, Surrey, UK). After preparation of the dough, the samples were extended to the elastic limit and to the point of breaking.

The load cell of 5 kg was applied and the measurement parameters were pretest speed of 2 mm/s, test speed of 3.3 mm/s and post test speed of 10 mm/s.

3. RESULTS AND DISCUSSION

Rheological properties

Viscoelastic properties of the dough are very significant because of their influence on the dough properties during the production and on the quality of the final product. The changes of viscoelastic modulus of the dough with increase in frequency are presented on Fig. 1.
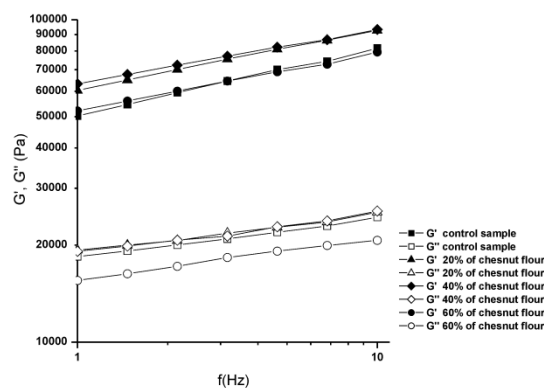

Figure 1 Storage (G') and loss (G") modulus for dough samples

For all dough samples, regardless of the presence or of the amount of chestnut flour, the domination of storage modulus (G') over loss (G") modulus was observed. That is characteristic for the structure of the dough, which is typical viscoelastic system (Korus *et al.* 2009).

Viscoelastic parameter, tan δ, which indicates the contribution of elastic and viscous components of the dough, was less than 1 for all samples. That was conformation that the dough samples were viscoelastic systems with dominant elastic component. Increase in the amount of chestnut flour reduced the values of tan δ (Table 2), which pointed to higher domination of storage modulus over loss modulus and to harder dough consistency.

Table 2 The values of tan δ for dough samples

Dough sample	tanδ= G''/G'
Control sample	0.324
20% of chestnut flour	0.289
40% of chestnut flour	0.282
60% of chestnut flour	0.280

Creep and recovery curves describe the characteristic viscoelastic behavior of dough, with partial ability to recover the previous structure after removing the stress. The influence of chestnut flour on viscoelastic behavior of the dough samples is presented on Fig. 2. Compared to control sample the compliance for all dough samples with chestnut flour decreased. Also, increase in amount of the chestnut flour reduced the compliance of the samples.
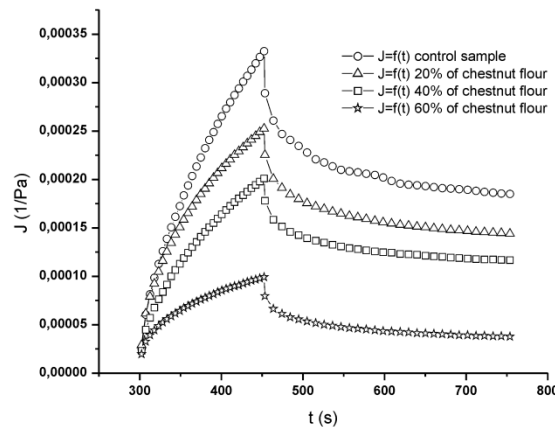

Figure 2 Creep and recovery curves for the dough samples

The values of parameters from the creep and recovery curves defined by Burger's model are presented in Table 3.

Table 3 The parameters of Burger's model

Creep phase					
Sample	J_0 (Pa^{-1})	J_1 (Pa^{-1})	η_0(Pas)	λ_1 (s)	J_{max} (Pa^{-1})
Control sample	$2.8 \cdot 10^{-5}$	$11.2 \cdot 10^{-5}$	$1.3 \cdot 10^6$	196.8	$3.4 \cdot 10^{-4}$
20% of chestnut flour	$2.7 \cdot 10^{-5}$	$7.4 \cdot 10^{-5}$	$2.0 \cdot 10^6$	196.8	$2.2 \cdot 10^{-4}$
40% of chestnut flour	$2.7 \cdot 10^{-5}$	$6.7 \cdot 10^{-5}$	$2.2 \cdot 10^6$	196.8	$2.0 \cdot 10^{-4}$
60% of chestnut flour	$1.9 \cdot 10^{-5}$	$3.3 \cdot 10^{-5}$	$4.6 \cdot 10^6$	196.7	$1.0 \cdot 10^{-4}$
Recovery phase					
Control sample	$3.2 \cdot 10^{-4}$	$7.1 \cdot 10^{-5}$	$3.5 \cdot 10^6$	327.7	/
20% of chestnut flour	$2.0 \cdot 10^{-4}$	$4.4 \cdot 10^{-5}$	$5.7 \cdot 10^6$	327.7	/
40% of chestnut flour	$1.8 \cdot 10^{-4}$	$3.7 \cdot 10^{-5}$	$6.6 \cdot 10^6$	327.7	/
60% of chestnut flour	$0.8 \cdot 10^{-4}$	$1.2 \cdot 10^{-5}$	$20 \cdot 10^6$	327.6	/

The values for all compliances (J_0, J_1 and J_{max}) for observed samples were reduced with increase in amount of chestnut flour. The instantaneous compliance for creep phase was reduced in the range for 3.57–32.14% by addition of chestnut flour and by increase in amount of the flour, and the viscoelastic compliance in the range for 32.73–70%. During instantaneous compliance bonds stretch elastically when stress is applied and recover instantaneously when stress is removed, whereas in viscoelastic compliance bonds break and reform in different rates (Onyango *et al.* 2009). Maximum compliance decreased in a range for 35.29–70.88% with addition of chestnut flour and with increase in its amount, while the values of Newtonian viscosity (η_0) increased.

Thus, all creep and recovery parameters pointed that addition of chestnut flour and the increase in its amount reduced the compliance of the dough, its extensibility and recovery ability.

Textural properties
During textural determination of the dough samples, the resistance to extension and extensibility of the dough were measured. Obtained values are presented in Table 4.

Table 4 The textural parameters of the dough samples

Sample	Extensibility±SD(mm)	Resistance to extension±SD(g)
Control sample	8.01±0.72	15.58±0.53
20% of chestnut flour	6.22±1.1	14.32±1.55
40% of chestnut flour	4.15±1.07	10.05±1.34
60% of chestnut flour	/	/

The resistances to extension and dough extensibility are dependent of content and quality of the gluten. For all dough samples the addition of chestnut flour reduced these textural parameters of the dough compared to control sample, because of decrease of gluten content. Also, the textural parameters were reduced by increase in amount of chestnut flour. The dough extensibility decreased for approximately 25% by increase of chestnut flour for 20%. The sample with 60% of chestnut flour could not be measured, because of the significant amount of chestnut flour and poorly developed gluten network.

These results are in accordance with rheological determination of the samples. Textural parameters confirmed the fact that gradual substitution of wheat flour with chestnut flour caused the increase in hardness of dough consistency and reduced the flexibility of the dough. Less gluten content in the structure of dough samples with chestnut flour caused decrease in

degree of association. Also significant content of sucrose in chestnut flour amplified the sucrose–starch interaction that resulted in brittle consistency of the dough with chestnut flour. Optimal physical properties of dough were achieved with low amounts of chestnut flour of 20%.

ACKNOWLEDGEMENTS

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RE-USE OF OSMOTIC SOLUTION

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ABSTRACT

In this paper the re-use of osmotic solution after osmotic treatment has been studied. A large amount of used osmotic solution remaining after the process is one of the major unsolved problems of osmotic treatment process. This problem has both ecological and economic aspects that should be concerned.

Pork meat cubes were treated in three different osmotic solutions diluted with distilled water (R1 -sugar beet molasses, R2 – solution of salt and sucrose and R3 - combination of R1 and R2 solutions in a 1:1 mass ratio). Osmotic process has been observed during 5 hours, at temperature of 35°C and atmospheric pressure. Osmotic treatment has been performed simultaneously in concentrated solutions and diluted solutions (dilutions were obtained by mixing the solution and water in the mass ratio of 7:1 and 3:1). Parameters monitored during osmotic treatment were: dry mater content (*DMC*), water loss (*WL*), solid gain (*SG*) and osmotic dehydration efficiency index (*DEI*). Maximum values of these parameters were obtained in the dehydration with concentrated solutions, while recorded values in diluted solutions were much lower.

The results show that the least effect on the osmotic process efficiency, when the osmotic concentration is lowered, has been observed for solution R3. This conclusion indicates that molasses is good osmotic solution with the possibility of re-using in successive processes of osmotic dehydration, with minimal treatment of reconstitution to original values of concentration.

INTRODUCTION

Many traditional techniques and their combinations, such as salting, drying, cooking, smoking and marinating, are used to prevent spoilage of meat its products by reducing water content. Common step in these processes is placing product (meat) in contact with concentrated solution (salt, sugar, acids, seasonings, etc.) (*Filipović, 2013*).

Osmotic dehydration process has proven to be a good method for obtaining minimally processed fruits, due to the high similarity between the sensor and dehydrated fresh produce, although the specificity of the process compared to other drying processes, reflected in a solid gain as a secondary mass transfer accompanying the transfer of water from the primary tissue in osmotic solution.(*Lerici et al., 1985; Sousa et al. 2003*)

Osmotic dehydration is used as a pre-treatment for many processes, to improve nutritional, sensorial and functional properties of food without changing its integrity (*Nićetin et al.,2012*). This technique also is interesting because it provides partial water removal from a food product, with low energy consumption and mild heat treatment (*Vieira et al., 2012;*

Manivannan et al.,2011). Sugar beet molasses is an excellent medium for OD, primarily due to the high dry matter (80%) and specific nutrient content (*Ćurčić et al.,2012*).

Ability to re-use osmotic solution for osmotic dehydration process is important from an economic point of view, and also in terms of environmental protection, has more and more influence in the overall evaluation of any process (*Valdez-Frugosoa et al., 1998*).

Analysis of the impact of equal measures of dilutions of various osmotic solutions on the parameters of osmotic dehydration may indicate a different behavior during reducing concentration of osmotic solutions that could occur during the re-use of osmotic solutions, and also, it may indicate on different levels of required treatment of solution before use (*García-Martínez et al., 2002; Rahman, 2007*).

The main objective of this paper was to investigate the possible use of molasses in comparison to other osmotic solutions, concerning the possibility of re-using in successive processes of osmotic dehydration with minimal treatment of reconstitution to original values of concentration.

MATERIAL AND METHODS

Materials

For the experiment, fresh pork (*M.tricepsbrachii*) was purchased on the local butcher shop, shortly before use. Before the osmotic treatment, fresh meat was cut into cubes, dimension of approximately 1x1x1cm. Concentrated sugar beet molasses from sugar factory Pećinci was used as one osmotic solution (R1). Ternary solution (R2) was prepared by mixing three components, commercial sugar in the quantity of 1200 g/kg water, NaCl in the quantity of 350 g/kg water and distilled water. Combine solution was obtained by mixing molasses and ternary solution in range 1:1. The material to solution ratio of 1:5 was used during experiments.

Methods

All experiments were carried out under atmospheric pressure at the temperature of 35°C. The process was performed in laboratory jars. Samples of meat were dipped into all three solutions, and the immersion lasted for 5 hours. On every 15 minutes meat samples was manually agitated to provide better homogenization of the osmotic solutions. After 5 hours meat samples was taken out from osmotic solutions and then lightly washed with water and gently blotted with paper towels to remove excessive water from the surface.

From the obtained data, *DMC*, *WL*, *SG* and *DEI* were determined at different time intervals, according to the following expression (*Filipović, 2013*):

$$DMC = \frac{m_d}{m_i} \cdot 100\% \qquad (1)$$

$$WL = \frac{m_i z_i - m_f z_f}{m_i} \quad \left[\frac{g}{g \; fresh \; sample} \right] \qquad (2)$$

$$SG = \frac{m_f s_f - m_i s_i}{m_i} \quad \left[\frac{g}{g \; fresh \; sample} \right] \qquad (3)$$

$$DEI = \frac{WL}{SG} \qquad (4)$$

where: m_d dried sample weight (g), m_i and m_f are the initial and final weight (g) of the samples, respectively; z_i and z_f are the initial and final mass fraction of water (g water/g sample), respectively; s_i and s_f are the initial and final mass fraction of total solids (g total solids/ g sample), respectively.

RESULTS AND DISCUSSION

The effects of dilution of osmotic solution were studied by its influence on kinetic parameters of osmotic dehydration (*DMC*, *WL*, *SG* and *DEI*). The results of osmotic treatment for all three solutions are presented in Table 1. Concentrated solutions achieved maximums in the dehydration process, while the dilution introduced the observable decrease in kinetics parameters compared to the maximum value in concentrated solutions (dilutions were obtained by mixing the solutions and water in the mass ratio of 7:1 and 3:1). Water activity (a_w) obtained in dehydrated meat, using concentrated osmotic solutions was lower, compared to a_w gained using diluted solutions (Table 2).

Table 1 Influence of dilution of the osmotic solution on osmotic dehydration parameters

	DMC (%)	WL (%)	SG (%)	DEI (%)
Concentrated R1	0	0	0	0
Attenuation: R1:water=7:1	-10.97	-16.66	-8.98	-8.38
Attenuation: R1:water=3:1	-16.90	-24.95	-11.03	-14.72
Concentrated R2	0	0	0	0
Attenuation: R2:water=7:1	-3.94	-13.57	-8.24	-6.89
Attenuation: R2:water=3:1	-12.52	-20.00	-18.66	-2.30
Concentrated R3	0	0	0	0
Attenuation: R3:water=7:1	-8.23	-9.45	-5.54	-4.66
Attenuation: R3:water=3:1	-12.69	-11.73	-7.76	-4.04

The largest decreases in monitored kinetics parameters were noticed in the most diluted solutions. Dilution of osmotic solutions decreased the final dry matter content of dehydrated meat in varying degrees. The largest reductions was observed in *DMC* values for R1 solution, while the reducing of *DMC* value in R2 and R3 were at almost similar level (reduction of 12.52% and 12.69%, compared with dehydration in concentrated R2 and R3, diluted to 3:1). The most pronounced decrease in *WL*, due to dilution, was observed in R1 osmotic solution (24.95%), followed by R2 (20.00%). The most acceptable value is gained, using R3 solution; *WL* is decreased 11.73%, which was the lowest value compared to R1 and R2 solutions. Similarly, *SG* was reduced to a minimum level, when using R3 osmotic solution (7.76%) compared to R2 (18.66%) and R1 (11.03%). Osmotic dehydration efficiency index showed the least decrease in value when using osmotic solution R2 (2.3%), while the observed decrease when using R3 solution was 4.04%. The largest decline in *DEI* was observed when using R1 solution (14.72%).

When concentration of osmotic solutions is reduced, the increase of a_w is observed (higher a_w is gained for diluted solutions).

The most appropriate results, i.e., the lowest increase the a_w value, due to dehydration in diluted solution were observed, when using solution R3 (a_w increasing percentage was 7.89%), compared to the a_w values in concentrated solution. The increase of a_w in diluted solution R2 reached 9.82%, and the largest increase in a_w value of dehydrated meat is noticed in the meat dehydrated in dilute solution R1 (11.60%) compared with a_w of dehydrated meat, in concentrated solution R1.

Table 2 Influence of dilution of the osmotic solution on a_w of pork

	a_w(%)
Concentrated solution R1	0
Attenuation: R1:water=7:1	+9.08
Attenuation: R1:water=3:1	+11.60
Concentrated solution R2	0
Attenuation: R2:water=7:1	+8.94
Attenuation: R2:water=3:1	+9.82
Concentrated solution R3	0
Attenuation: R3:water=7:1	+6.41
Attenuation: R3:water=3:1	+7.89

After the comparison of results shown in Table 1 and Table 2, it can be concluded that R3 is the best osmotic solution regarding possible re-using in successive processes of osmotic dehydration. Decreasing of *DMC* in diluted solution is similar for R3 and R2 solution, but the *WL* and *SG* decreasing are much more acceptable when using R3 as osmotic solution. The *DEI* ratio is a bit better when using R2 solution, but a_w is more acceptable for R3 solution.

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THE CONSUMER JUDGEMENT OF THE PRICE OF THE TRADITIONAL FOODS

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ABSTRACT

Price strategy is a peculiar aspect of the marketing model called Marketing Mix. Pricing related decisions usually constitute the hardest and most sensitive set of decisions that entrepreneurs have to make. The Hungarian consumers' high price sensitivity coupled with a high demand for low-cost products and services indicates the significance of pricing in Hungary. Pricing is crucial in raising interest and winning new customers. Prices might reflect product quality, brand strength and recognition, just like product differentiation or the image of a product or its producer. Consumers of traditional region-specific horticultural and agricultural products are willing to pay a higher price in appreciation of the high quality and special character of these products as this consumer segment tends to assign emotional functions to certain product features instead of solely focusing on the functionality and usefulness of the goods.

Keywords: price setting, pricing strategy, willingness to pay, customer perception

1. INTRODUCTION

Throughout history, prices have usually been determined between the sellers and buyers in price negotiations (bargains). Traditionally, consumer decisions and purchase decision making processes largely depend on price. However, non–price factors, e.g. product features, place of origin, communication, have been gaining significance in purchasing decisions over the past decades. Of all the aspects of the Marketing Mix, price is the most flexible one and it is the only one which creates sales revenue (Radnai, 2010). Excessively cost-determined prices or failure to frequently analyse and vet pricing, thus promptly respond to changing conditions on the market are just a few of the most common mistakes, which are, in a broader context, the symptoms of ignoring the importance of treating price as part of the positioning strategy, hence setting a price that does not complement the other elements of the Marketing Mix (Törőcsik, 2007). No single economically or psychologically well based price setting method can be established for traditional and region-specific foodstuffs due to the heterogeneity of the subject product group (Hofmeister-Tóth, 2008).

2. MATERIALS and METHODS

Materials

Market research: the opinion survey refers to information collection, whereby a small section of a group of numerous individuals or institutions is selected via professional sampling and this selected section is then interviewed.

The primary market research consists of the gathering of original, previously uncollected information and data, whereby the collection is undertaken with a specific purpose. I sought the answer to various questions during recording, therefore each answer can be registered as a variable as they can take varying values within a certain number interval. These are the dependent variables because, depending on the respondents, the result will be different, too.

The questions (variables) remain the same throughout the questionnaire and the interviewees (respondents) are referred to as cases.

Methods
Paired t-test analysis
For paired t-tests, the same respondents are tested repeatedly, thus test series are conducted on the same respondents and the paired t-test is used to examine the differences. A variable for the differences observable in the pair is created (marked as D) and then the average and variance of this variable is calculated. Subsequently, the t-statistics is established. The degree of freedom is "n-1", where "n" stands for the even number of the examinations.
Pearson's Chi-squared test
The exact significance test is based on two hypotheses; one is referred to as null hypothesis and the other is as alternative hypothesis.
Confidence interval calculation
During the evaluation of questionnaires, representing the results simply in percentages is often insufficient or even misleading, given that the resulting differences do not reflect reliably whether the variation is significant or not.
The answers to the particular questions in the examined population helped me identify both the percentage of the positive answers and their confidence-intervals, the latter values revealing the real differences. The calculation of the confidence-intervals is inevitable for the establishment of a reliable conclusion on our hypotheses, especially in cases where the number of sample elements significantly differs.

3. RESULTS and DISCUSSION

3.1. Assessment of the importance of price for traditional region-specific foodstuffs

Purchasing decisions are seldom resolute; consumers are exposed to a certain level of risk in the purchase decision making process (Kőszegi, 2013). The perception of the risk depends on the consumers' personality, the nature of the product or service and predominantly on the price. Our research investigates the consumers' perception of the price of traditional region-specific foodstuffs. The respondents have been segmented on the basis of their sex (Fig.1), age (Fig. 2) and educational attainment (Fig. 3) in order to examine whether the different segments respond differently. Price obviously plays a key role in the purchase decision making processes; and as the products in the focus of our research are special quality ones, many consumers perceive their prices as a reflection of their heightened quality.
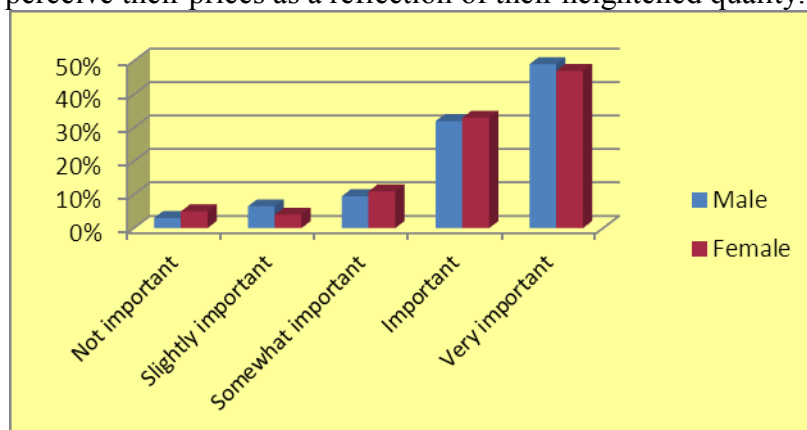

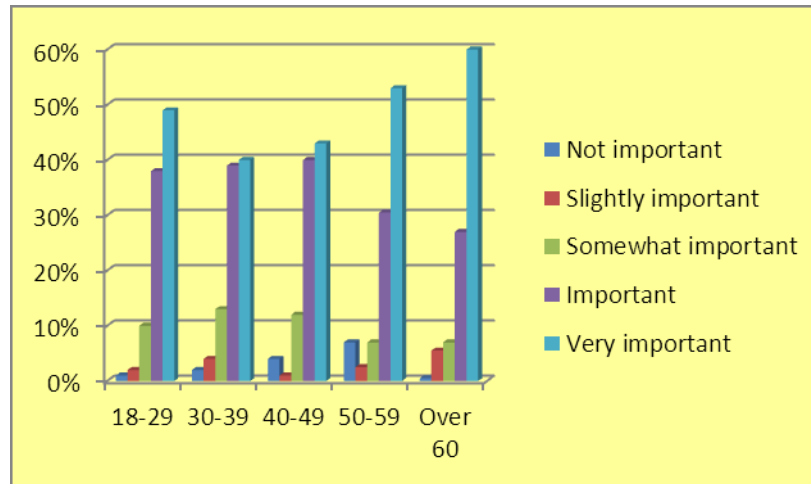**Figure 1** Assessment of the importance of price by gender

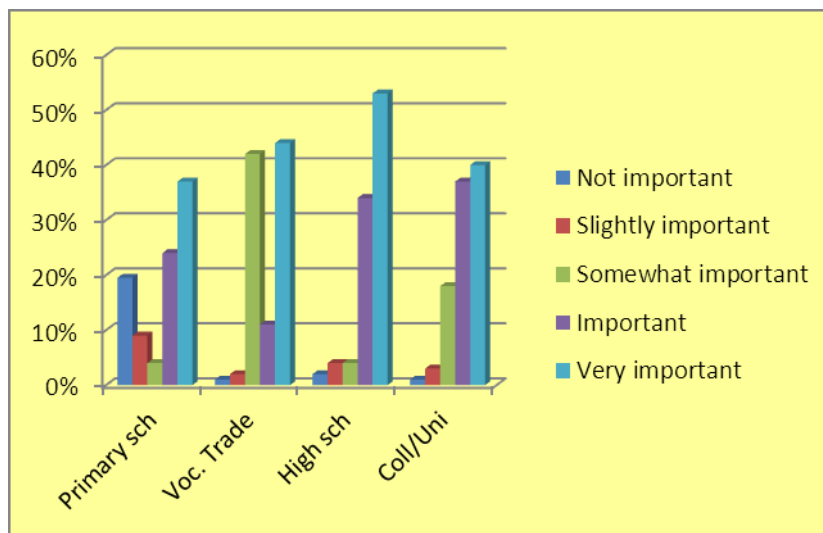**Figure 2** Assessment of the importance of price by age group

Figure 3 Assessment of the importance of price by educational attainment

The findings of our research are on the system of values and preferences that seem to determine foodstuff purchases. Apparently, the influential factors for female customers are the price and product mix, whereas male customers seem to primarily focus on the producer; however, members of both sexes mainly find the price „tolerable".

Willingness to pay extra for Hungarian foodstuffs. The research examines and assesses the willingness to pay extra for Hungarian products. Seven mathematical and statistical analysis methods have been deployed to evaluate the responses (Fig. 4 and Fig. 5). Generally, the respondents are willing to pay extra solely for certain products and Hungarian foodstuffs that are perceived as prestige goods constitute such exceptions. There might be a correlation here with the fact that the main target group of these Hungarian products is customers who are more affluent than the average Hungarian consumers.
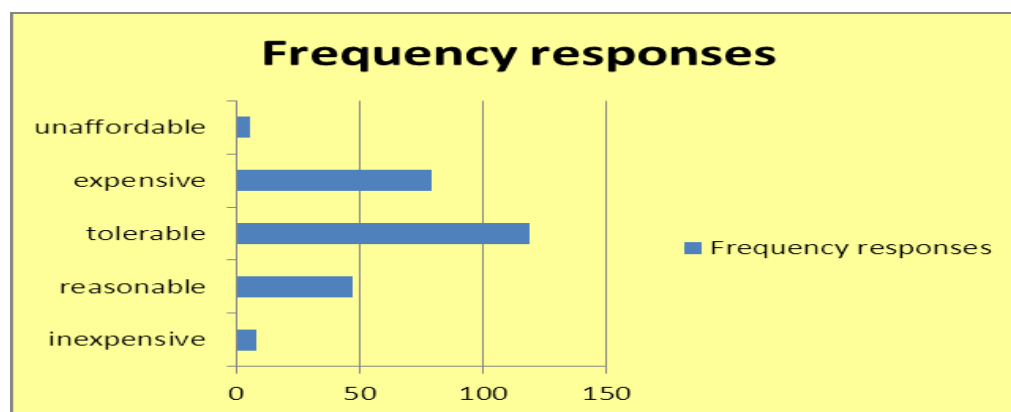
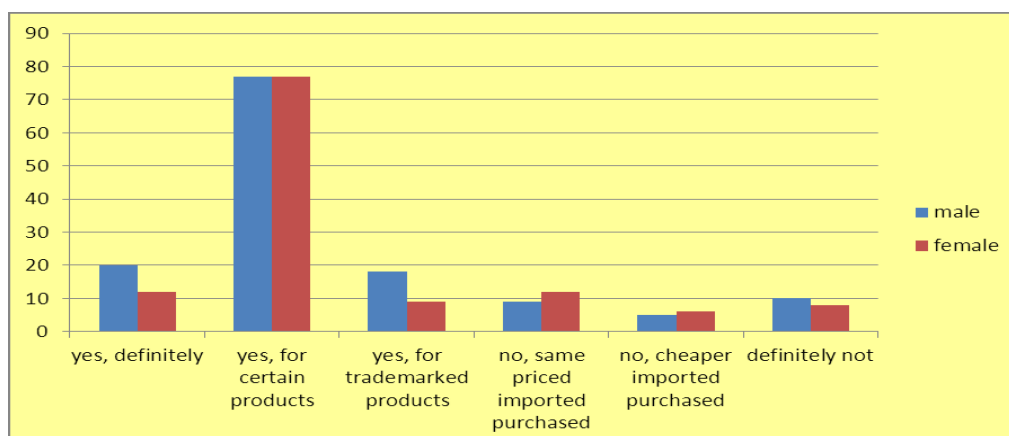**Figure 4** Assessment of the price of Hungarian foodstuffs

Figure 5 Willingness to pay extra for Hungarian foodstuffs

Agri-food industry is an immensely diverse and colourful sector in Hungary. The specific ecological conditions in Hungary enable the cultivation of special high quality agricultural products. Only safe and high quality products with added value can meet the high international quality standards. The natural and social values of the traditional region-specific products have great market potential; the optimal exploitation of this potential, however, requires the enhancement of the competitiveness of these products as well as the intensification of the marketing activities that help the products enter the market and preserve their positions there. The Hungarian consumers' high price sensitivity coupled with a high demand for low-cost products and services indicates the significance of pricing in Hungary. Pricing is crucial in raising interest and winning new customers. Prices might reflect product quality, brand strength and recognition, just like product differentiation or the image of a product or its producer.

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THE PUFF-PASTRY MAKING PROPERTIES OF TRITICALE FLOUR

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ABSTRACT

The flour (100% Tc) of the triticale variety GK Szemes bred at the Cereal Research Non-Profit Ltd. was tested for food purposes, namely, for puff-pastry making properties. The control dough was made of BL 55 plain wheat flour (100% BL). Flour mixtures (flour mixtures I and II) were prepared by mixing wheat flour and triticale flour to different ratios. The flours, their mixtures, and the puff-pastry made of them, respectively, were analyzed according to the terms of the Hungarian Food Codex for the following rheological traits: gluten content, falling number, farinograph water absorption, and extensibility. The data reflected that the triticale flour and wheat flour mixtures had advantageous baking industrial properties. The dough of flour mixtures was easier to handle manually than the control. The dough on flour mixture II basis was ranked higher than that of flour mixture I in terms of sensory properties. Therefore flour mixture II had been chosen to bake Chelsea bun-type puff-pastry with savoury (pizza cream) flavouring. Triticale has favourable agronomic traits and beneficial nutrition value and therefore it is expected to become a valuable food component.

Keywords: triticale, flour mixture, puff-pastry

1. INTRODUCTION

Triticale (x triticosecaleWittmack), the outcome of the crossing of wheat and rye was created at the end of the 19th century. In Hungary the cultivation started in the late 1980s, mainly for the use to feed animals. Nowadays as healthy eating has gained importance, it is more and more often used as human nutriment. The registered triticale varieties of the Cereal Research Non-Profit Ltd. (GK Idus, GK Rege, and GK Szemes), have excellent agronomic characteristics, which means, that they would become important elements of agricultural production. Some nutritional parameters fall between wheat and rye values, in some cases, even exceeding these values which can establish the use of human nutriment. The gluten composition of wheat improves the technological properties, the pentozans of rye improve water absorption and preservation which all, increase nutritional value. Triticale bread can cover 60% of the necessary daily fibre intake while this is only 30% in case of white bread. Bread made of triticale is richer in minerals (Ács and Bóna, 2013). Further studies were carried out abroad to find out whether the antioxidant content of triticale allows the use of triticale as supplementary or functional food (Hosseinian and Mazza, 2008). They led us to examine how triticale could be used in producing bakery, and to examine what are the parameters when used in itself or mixed with wheat flour.

2. MATERIALS AND METHODS

In our work the flour (100%Tc) of the triticale variety GK Szemes bred at the Cereal Research Non-Profit Ltd. was tested for food purposes, namely, for puff-pastry making properties. The control dough was made of BL 55 plain wheat flour (100% Bl). Flour mixtures (flour mixtures I. and II.) were prepared by mixing wheat flour and triticale flour to different ratios. The Flour mixture I was 60% BL-40% Tc, the Flour mixture II was 40% BL-60% Tc. The flour mixtures were analyzed according to the terms of the Hungarian Food Codex for the following rheological traits: gluten content (MSZ EN ISO 21415-2:2008, washing machine), falling number (MSZ EN ISO 3093:2010, HagbergPerten's definition), water absorption (MSZ ISO 5530-1:2003, With BrabenderFarinograph), extensibility (MSZ ISO 5530-2:2007, with Brabenderextenzograph). Puff-pastry base were made of different flour samples (FodorJózsef Food Industry Vocational High School, Szeged). The puff-pastry base was made without flavouring. The main ingredients were flour, margarine, yeast, salt, sugar, milk powder, egg powder, and water. The laminated dough was prepared by the usual rolling and folding method (1 simple, 1 double). It was baked at 180°C for 10-–15 minutes in rotating tray oven. The baked product was evaluated by a group of students (15 students) by simple descriptive sensory methods. They evaluated the positive and negative attributes of the product, namely the colour, shape, aroma, flavour and tunes. Flavoured dough (sweet and savoury) was made of the best mixture. As a control sweet and salty puff-pastries were prepared from wheat flour (100% BL). The baked products were evaluated by 50 people (GK Fórum, Szeged) the evaluation was based on sensory, 20-point weighing factor method. The group scored the shape, crust, crumb, aroma and flavour of the product from 1-–5. Weighing factors were assigned to the results to stress the differences of the characteristics.

3. RESULT AND DISCUSSION

The flour and flour mixtures were qualified by flour testing methods. The results are shown in Table 1. The results show that if we mix triticale flour to good quality wheat flour, then the baking indicators of the mixtures may significantly improve compared to the values of triticale.

Table 1 Results of flour quality tests of triticale, wheat and their mixtures

Type	Gluten spreading (mm/h)	Ns (%)	Water abs.(%)	Dough dev.tim. (min)	Stab.ICC (min)	Value num. (-)
100% BL	1.75	30.2	59.8	4.4	1.7	74.4
Flour mixture. I.	1.5	26.9	61.4	3.1	1.9	56.6
Flour mixture II.	1.75	25.2	62.2	3.7	0.6	42.4
100% Tc	2	18.4	63.9	2.2	0.4	19.5
Type	Fall. num. (sec)	E (cm^3) 135 (min)	Tenacity (BU)	Extensibility (E) 135 (mm)	Max (135 min) (Rm)	Elasticity 135-Max (-)
100% BL	556	117	390	157	565	3.6
Flour mixture. I.	509	76	290	149	362	2.4
Flour mixture II.	487	53	238	136	266	1.9
100% Tc	408	37	224	113	235	2.1

The wet gluten (Ns) content shows the baking suitability of flours, and 26% gluten content is an acceptable value. If the gluten content is lower, technological changes should be applied. In the flour mixture wet gluten content was surprisingly good. On the basis of falling number (556-408) (Fall.num.), the samples can be put in enzyme poor categories. Probably this might be due to the fact that there was hardly any rain in 2012. From the point of view of the current research these falling number values are acceptable. According to the farinograph, water absorption (water abs.) influences the economy of bakery productions. The triticale flour (100% Tc) had very high water absorption, therefore the mixture improved by increasing the amount of triticale flour. The dough development time (dough dev. tim.) is an indicator which relates to the quality of the protein, in case of strong flour it is longer, while in case of weaker flour is shorter. Thus in the samples that contained triticale flour the dough development time was shorter (flour mixtures I. 3.1, flour mixtures II. 3.7). One of the most important parameters determined by farinograph is stability which refers to the quality of flour. Continual kneading softens pasta. The sooner this happens, the less the dough can resist mechanical effects. Flour mixture I had the best stability (Stab. ICC) (1.9) and the least the triticale flour (100% Tc) (0.4), so triticale flour was found to soften earlier. This shows that bakery products made of triticale flour need shorter working/kneeding, because the dough reaches optimal consistency in shorter time, however, it also loses its consistency within a shorter time.

The bakery values of flour shows for what type of bakery products it can be used, if it can be used at all. Extensograph results show that triticale flour mixed with good quality wheat flour has better quality parameters than triticale flour in itself. In the present research, the extensogram (I., II.) of the flour mixture shows better optimum diagram than the wheat flour extensogram (100% BL). That is, the ratio of the maximum point of the diagram (Rm) and the territory under the diagram (E) is better at flour mixtures (I., II.). The examination of the quality of flours shows that the flour mixtures have good properties, because they have constant dough stability, which is typical of wheat, and short development time, which is typical of triticale and this results in significant energy saving. From the results of extensograph it is clear that the manual work with the dough is easier.

The results of making and processing puff-pastry base were as it was expected on the basis of examining flour quality. The kneading time of pasta containing triticale flour was shorter and the development of dough was quicker. The dough made of triticale flour (100% Tc) was softer, more extensible and less elastic. Working with that dough was more difficult than with the dough containing wheat flour (100% BL). The dough made of Flour mixture II was elastic and strong.

According to the sensory judgment, the puff-pastry made of Flour mixture II was unambiguously the best. This product showed all the standards of puff-pastry. Based on the results it can be established that although Flour mixtures I and II are usable for baking, for the baking of puff-pastry only Flour mixture II is recommended.

Further research with the winning flour (Flour mixture II) was carried out. Pizza pastries were prepared and were compared to the control (100% BL) sample. The sensory judgements of flavoured snails showed that there was very little difference between the A (control) and B (flour mixture II.) samples, that is the judges could not differentiate the two samples (Figure 1.).
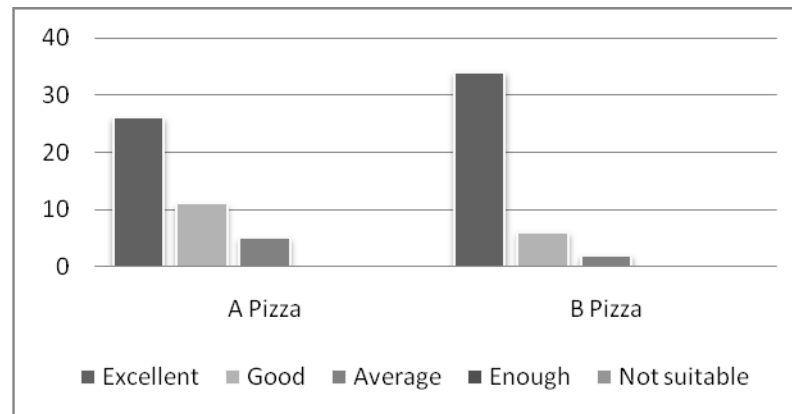
Figure 1 Result of the sensory judgement of flavoured puff-pastry

As for crumb and flavour properties results, pizza flavoured pastry made of Flour mixture II savoury snail results were better. The results showed that the triticale flour on its own is not suitable for bakery use, but mixed with wheat flour it can be used for bakery products and pastries of good properties. In case of laminated pastry, the results with mixed flour were better than that of the pastries made from 100% wheat flour.

In the present research high quality wheat flour was used, but further studies are needed with low quality wheat flour applications. It would be necessary to carry out nutritional studies for the further production of baking goods.

ACKNOWLEDGEMENT

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THERMO-ACID PRETREATMENT OF STARCH BASED KITCHEN WASTE FOR ETHANOL PRODUCTION

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ABSTRACT

Recently, research on the alcoholic fermentation of kitchen waste has been accelerating for both ecological and economical reasons, primarily for ethanol use as renewable biofuel. Present work deals with the fermentative production of ethanol from different starch based kitchen waste. Kitchen waste from local students restaurant was separated by basic component as: peas, green beans, beans, rice, potato, wheat bread and corn. Thermo-acidic pretreatment of these raw materials was conducted by the addition of HCl up to pH of 1, and by autoclaving at $120^{\circ}C$ for 30 min. From the experimental result, maximum ethanol yield was obtained from wheat bread (0.11 g/g). The highest ethanol yield per starch of 0.36 g/g, which equals to 64% of the theoretical value, was obtained for peas. From the overall analysis, the examined thermo-acid pretreatment was the most efficient for hydrolysis of wheat bread, while it was least efficient for green beans. In order to enhance the efficiency of conversion of starch from kitchen waste into ethanol, pH lower than 1 is highly recommended. The results demonstrated the potential of different food waste as a promising biomass resource for the production of ethanol.

Keywords: bioethanol; kitchen waste, thermo-acid pretreatment

1. INTRODUCTION

Biomass-derived ethanol is an alternative transportation fuel which is one of the most important renewable fuels contributing to the reduction of negative environmental impacts generated by petroleum-based source of energy (Kim et al., 2011). Although sugarcane or cereal grain are the predominant feed stocks that are used for industrial ethanol production today, projected fuel demands indicate that new, alternative, low priced feed stocks are needed to reduce ethanol production costs. Kitchen waste or so called food waste is a kind of organic solid waste discharged from restaurants, cafeterias and households, and accounts for a considerable proportion of municipal solid waste in (Yan et al., 2011). Food waste is a low cost complex biomass containing carbohydrate as high as 65% of its total solid including various components such as starchy, fatty, and cellulosic materials. A portion of kitchen waste from restaurants is collected and used as animal feed. However, some of these residues are perishable and sometimes

moldy. Therefore, its implementation as animal feed is a gate for the entrance of mycotoxins into the human food chain, and raises severe health problems (Ebrahimi et al., 2008). Most food residues are land filled or incinerated, resulting in ground water contamination or emission of noxious gases and dioxins (Hong et al 2011). Hence, the food waste management has been an important issue for protecting the environment as well as for conserving resources. A pretreatment is required to hydrolyze the food waste and produce monomeric sugars. The fermentable sugars then can be used as substrates for the fermentative production of ethanol. The pretreatment for biomass can be carried out in different ways such as acid hydrolysis, heat treatment, and enzymatic hydrolysis (Kim et al., 2011).

In this study, we focus on ethanol production from kitchen waste collected from dining halls from students restaurant. The present paper is the preliminary study regarding ethanol production from different kinds of starch based kitchen waste, which are always on the daily menu. Fermentation of thermo-acidic pretreated different kitchen wastes was conducted to compare the concentration of ethanol that could be produced.

2. MATERIALS and METHODS

Materials

Kitchen waste (KW)
Starch based kitchen waste from local student's restaurant was separated by basic component as: peas, green beans, beans, rice, potato, wheat bread and corn. Each KW sample was ground using the laboratory blender to obtain mash with diameter of particles smaller than 3 mm. KW samples (44.0 g dm) were poured into an Erlenmayer flask (0.5 l) and mixed with distilled water, keeping the dry matter to water ratio (hydromodule) at 1:5.

Yeast strain
Commercial pure-culture yeast *Saccharomyces cerevisiae* (Anchor WE372, Anchor Yeast, Johannesburg, South Africa) was used as a producing microorganism for ethanol fermentation. Yeast was activated by hydration in 0.1% sterile peptone prewarmed to 35^oC, and then inoculated into the fermentation medium (0.25g/kg).

Methods

Thermo-acidic pretreatment
Thermo-acidic pretreatment of the KW mash samples was conducted by the addition of 1 M HCl up to pH of 1, and by autoclaving at 120^oC for 30 min. Afterwards, the pretreated KW were cooled at room temperature and neutralized with 1 M NaOH up to pH 5, in order to obtain optimal pH of the fermentation medium.

Iodine Test
In order to test if starch hydrolysis was complete the iodine test which is a qualitative estimate of starches present was conducted. Three drops of iodine were added to 1 ml of each neutralized KW sample to test for starches. The presence of starches is denoted by a blue color due to the starch-iodine complex. Dextrins present produce a brown color.

Ethanol fermentation
After inoculation the flasks were fixed on a rotary shaker (GFL, Germany, Type 3015) at shaking frequency 120 rpm and shaking diameter 30 mm, and placed in a thermostat at 30°C. During the fermentation, the weight loss due to CO_2 release was measured at various time intervals from the beginning of each fermentation batch. At the end of each batch fermented liquid was distilled.

Analytical methods
Dry mass, starch and protein content of the KW samples were estimated as per the standard AOAC methods. The ethanol concentration was determined based on the density of alcohol distillate at 20 ^{o}C by pycnometer method (AOAC methods, 2000). Electrical resistivity, conductivity and total dissolved solids content (TDS, g/l) of fermentation medium were determined using laboratory multi-parameter analyzer Consort C863 (Consort, Belgium).

Fermentation parameters
The ethanol yield ($Y_{p/kw}$, g/g) was calculated as grams of ethanol (P) produced per gram of kitchen waste dry matter (DM g). The ethanol yield per starch ($Y_{p/s}$, g/g) was calculated as grams of produced ethanol (P) per gram of initial starch (S_u). The fermentation efficiency ($E_{p/s}$, %) was calculated as percentage $Y_{p/s}$ of the maximal theoretical ethanol yield per starch.

3. RESULTS AND DISCUSSION

The quality parameters of KW are shown in Table 1. As expected, the highest value of dry matter content was obtained for wheat bread (68.2%), while for other KW from cooked meals were more than twice lower. KW on the basis of cooked potato had dry matter content of only 16,4%, suggesting that high ethanol concentration from this raw material can not be expected. The highest starch (88.5% dm) and protein (28.9% dm) content in KW dry matter was obtained for corn. The peas had the lower starch content (31.2% dm), while potato was the poorest in protein content (6.2% dm).

Table 1 Quality parameters of kitchen waste

Kitchen waste	Dry mater (%)	Moisture (%)	Starch (% dm)	Protein (% dm)
Peas	19,3	80,7	32,1	21,8
Green beans	12,8	87,2	42,1	20,1
Rice	37,6	62,4	64,6	7,3
Wheat bred	68,2	31,8	69,9	13,2
Beans	25,4	74,6	48,1	24,1
Potato	16,4	83,6	74,9	6,2
Corn	25,3	74,7	88,5	28,9

The results of iodine test lead to the conclusion that the hydrolysis of starch from all examined KW samples to fermentable sugars was not complete, but was partly accomplished by the thermo-acidic pretreatment. Incomplete hydrolysis could be due to many factors including time of autoclaving, temperature and pH. In order to enhance the efficiency of starch hydrolysis, pH<1 can be one simple possibility. In conclusion, breaking down the starch to fermentable sugars was a critical step. It is well known that the shape, size and physicochemical characteristics of starch granules are particular to each plant species. Hence, the efficiency of starch hydrolysis was different for each kind of examined KW.

TDS are the total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water. The most common chemical constituents are usually cations calcium, magnesium, sodium and potassium and the an-ions carbonate, bicarbonate, chloride, sulfate and, nitrate which are found in substrates (Basha et al., 2008). Table 2. depicts total dissolved solids content and electrical resistivity of KW samples after thermo-acidic pretreatment and neutralization. As shown, highest TDS concentration was found in fermentation substrate based on peas (11.2 g/l), while lowest was for Corn (4.53 g/l). Electrical conductivity of substrates is directly related to the concentration of dissolved ionized solids in the substrates.

Table 2 Total dissolved solids content and electrical resistivity of KW samples after thermo-acidic pretreatment and neutralization

Kitchen waste	Total dissolved solids TDS (g/l)	Electrical resistivity (Ω/cm)
Peas	11,12	51
Green beans	8,18	64
Rice	7,07	78
Beans	7,7	72
Wheat bred	8,83	63
Potato	7,83	71
Corn	4,53	119

Table 3 summarizes the fermentation parameters obtained for different starch based KW. Based on the results shown in Table 3 KW can be considered as convenient raw materials for ethanol production. Under these experimental conditions, maximum ethanol yield was obtained from wheat bread (0.11 g/g), while minimum was obtained from green beans (0.02 g/g). However, ethanol yield per starch in the substrate was highest for peas (0.36 g/g), while it was lowest for corn (0.08 g/g). Although initial starch content in peas was the lowest of all examined KW (Table 1), its conversion to ethanol was highest (64%). On the other hand corn based KW had highest initial starch content, but its conversion to ethanol was only 13%. On the basis of observed differences it can be surmised that applied thermo-acidic pretreatment was most efficient for peas starch hydrolysis, while corn starch hydrolysis was quite poor as a consequence of

physicochemical characteristics of starch granules. Experimental results showed that breaking down the starch to fermentable sugars was a critical step.

Table 3 Fermentation parameters obtained for different starch based KW

Kitchen waste	Ethanol yield $Y_{p/kw}$ (g/g)	Ethanol yield per starch $Y_{p/s}$ (g/g)	Fermetnation efficiency $E_{p/s}$ (%)
Peas	0,07	0,36	64
Green beans	0,02	0,09	16
Rice	0,03	0,10	17
Beans	0,06	0,16	27
Wheat bred	0,11	0,27	48
Potato	0,08	0,18	32
Corn	0,04	0,08	13

Because of the low initial content of starch in the fermentation substrates and high water content, low ethanol concentrations were achieved in conducted experiments. However, taking into consideration significant process parameters such as ethanol yield and fermentation efficiency it can be concluded that higher ethanol could be produced in the fermentation step by increasing the initial dry mass and consequently starch content in the fermentation medium. In this way, ethanol can be produced inexpensively using a KW feedstock that is otherwise thrown away. Results presented here confirmed the potential of different starch based food waste as a biomass resource for the production of ethanol.

Acknowledgment

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WIRELESS SENSOR NETWORK BASED LOCALIZATION IN INDUSTRIAL ENVIRONMENTS

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ABSTRACT

The use of wireless devices has greatly increased in the last decade, and it has been one of the most widely used medium of information transmission. Within the wireless devices the wireless sensor networks are the most contemporary and most commonly researched field. The work deals with the industrial use of wireless sensor networks and more precisely with monitoring and controlling industrial assembly lines. The focus of this study is localization by the use of wireless technology in the above mentioned environment. In the experiment wireless sensors are placed on the base elements of currently being assembled products. The developed system is able to specify the precise place of the product in the assembly line and record the time of localization. By the use these information the time of assembling the product can be monitored. For determining the place of the product the Received signal strength indication – RSSI has been used. The current position of the product is calculated by a neural network. The use of these sensors makes possible the measuring and recording of the influences on the product during the assembly, such as the effects of temperature, humidity, or if the product has been hit or damaged. By the use of these wireless sensor networks the quality of the assembled products can be improved and the process of assembly can be optimized.

Keywords: Fingerprint location, WSN, Received Signal Strength, Mobile sensor

1. INTRODUCTION

The outdoor localization is widely used thanks to the highly developed GPS. Numerous devices contain elements for receiving and processing GPS signs. One's position can be determined on each spot of the Earth with an accuracy of 2 cm. To obtain this level of accuracy, we must possess the right devices and be in an open field since this type of localization can work only in an open field. As for the indoor localization, more solutions are possible by using different technologies. The most common way to determine an indoor position is the processing of an RF sign. This localization is called the fingerprinting method (Radu *et al* 2005, Mustapha *et al* 2009). This work presents a localization method which uses the Wireless Sensor Network – WSN for indoor localization even in an industrial environment.

More precisely, the work presents the results of two experiments. During the first experiment WSN sensor modules were placed on permanent positions (anchor modules). The room was not of an ideal structure because it was equipped with furniture, computers, there were more windows and doors on the walls. With the help of a mobile WSN module measurements were done on certain spots of the room. The RSSI (Received Signal Strength Indicator) values were measured between the mobile and each anchor. These results were collected in a database, and were used to find some correspondence between the changes of the RSSI signs and the position

of the mobile sensor by using neural networks (Kermani *et al* 2005). The given database was used for teaching a neural network which is then capable of determining the position of the mobile sensor based on a new measurement result. The neural network testing was done in a simulated environment. The second experiment is the repetition of the first one in an industrial environment. The experiment aimed to prove the effects on the accuracy of localization of the magnetic noise in industrial objects. The process of localization is an element of a system that is continuously following the position and the environmental effects on the products being assembled.

2. WIRELESS SENSOR NETWORK

Wireless sensor networks are useful because there is no need for wires and this provides the possibility to measure quantities which were not possible in the past. Measuring in highly explosive risk areas was a problem due to the potential levels of grounds. Highly corrosive vapours in the air damage the cabling of sensor networks requiring frequent maintenance. Wireless sensor networks are successfully used in forest fire detection systems, monitoring of agricultural microclimate, monitoring of traffic structures and their load (Gogolak *et al* 2010). The Crossbow IRIS (Fig. 1) wireless sensors nodes compliant with IEEE 802.15.4 standard were used for measurement of the RSSI values. Crossbow technology has compact wireless modules with complete software support. The 2.4 GHz modules have an 8bit low power microcontroller on-board and a wireless stage. The Atmel 1281 microprocessor is easy to program and has wide software support.

Figure 1 The Crossbow wireless mote

Crossbow provides complete source code for different types of wireless networks. The XMesh network stack is free, self organizing, provides support for low powered synchronizing of nodes, sleep modes. ZigBee and over-the-air programming are also supported. The radios provide a line of sight communication up to 500m without an additional amplifier. The direct sequence spread spectrum radio which is resistant to RF interference and provides inherent data security. The XServe application is used to query the node's power states, consumed powers, SNRs, transmit powers and the topology of the self organized node network. A gateway is also used to gather the

measurement data into a database. The modules are supported by TinyOS. TinyOS is an open source wireless sensor network system written in GCC, and is programmed in NesC.

3. EXPERIMANTAL MEASURING AND DATABASE PREPARING

Any localization algorithm needs a measurement database according to which it can determine a position. The bigger the database is, in other words the more information it contains, the more accurate the localization is. It is important to determine the target area, the room where the localization is needed. The structure, environment of the indoor space is an important factor which can affect the accuracy of the fingerprint localization, because it affects the quality of the wireless data transmit (Mao *et al* 2007, Gogolak *et al* 2011). The room where the measurements were done is a laboratory with tables, chairs and computers. The aim of the measurement and data collection was to be in a realistic environment. The most complicating factor during the data collection was the reflecting glass of the window, but it had an insignificant effect on the accuracy of the localization. A grid was set up in the room which contained 24 x10 positions and had a resolution of 60 centimetres. In the experiment 5 fixed positioned WSN motes (Anchors) were used. The positions of the Anchors were optional, taking into consideration their equal distribution. The positions were placed in a distance of 60 centimetres from each other, and the RSSI values between the Anchor and the mobile mote were recorded on them. On each of the 5 Anchors 100 RSSI value samples were recorded. That means, 500 readings belong to each position. To obtain higher accuracy, the measurements were done in the other direction of the communication as well, to record the signal strength of the mobile mote in the Anchor motes. Since the grid consists of 240 positions, there are 12000 results in the mobile-anchor RSSI measurement and 12000 in the anchor-mobile RSSI measurement

After the recording of the data there are 24000 values in the database. The smallest RSSI value is 2, while the biggest is 14. This way we can differentiate 12 RSSI levels. This resolution is relatively small, and probably has a great effect on the accuracy of the localization, however, the Crossbow Iris sensor can measure signal strength only with this sensitivity. Since the environment of the room is not ideal, disturbances may occur in the wireless signal (János and Matijevics 2010). Fig. 2 shows the distribution of signal strength in the room for the anchor no. 3.
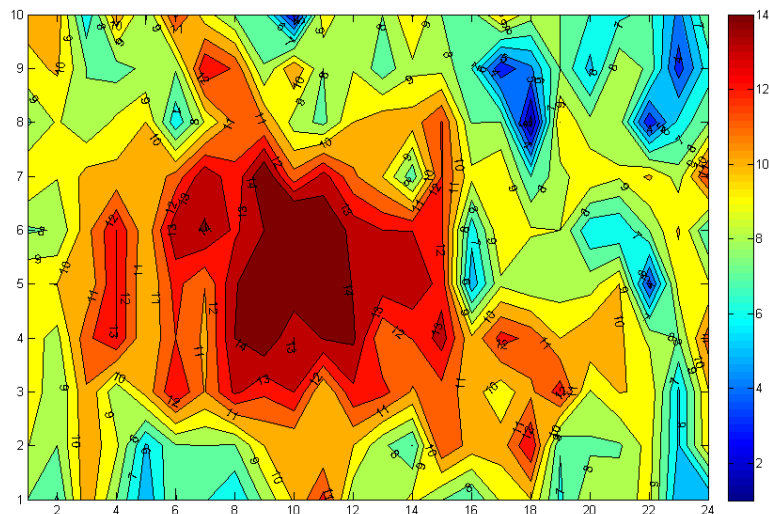

Figure 2 The RSSI values of anchor no.3 for the every position

Since some of the 100 samples are damaged due to loss of package, these are corrected with mean values. The data collected during the measurements will be used for the training of the neural network, so it is important that they are properly prepared. During the process we have worked with two databases. One contains the raw data, while the other contains the statistical values of the RSSI values for each position. In the latter the mean, median and standard deviation values of the RSSI values are shown.

4. THE INDUSRIAL LABORATORY

In the second phase of our experiment the process of localization was done in industrial environment, in an industrial laboratory equipped with an assembly line for assembling water pumps. This industrial laboratory provides the conditions of an industrial environment for studying wireless communication and localization processes (Toman *et al* 2009, Sárosi 2012). Fig. 3 shows the industrial laboratory.

Figure 3 The industrial laboratory

The assembly line contains the following elements:

- Assembling stations

- Conveyor belt and palettes for conveying the base element

- Assembly devices

- Industrial BOSCH robot

In the presented laboratory setting up a wireless sensor system is necessary for localization. For successful localization it was also necessary to create the RSSI map of the assembly line. Finally, similarly to the test laboratory, in the case of the assembly line setting up anchors with fixed positions is needed.

For creating the RSSI map the recording of the RSSI values is necessary between the anchors and the measuring sensor, which is done in characteristic measurement stations. The bigger the recordings of the RSSI values are, the better the quality of the RSSI map is. The RSSI values are saved in a database with the positions of the measurement stations. In case of the assembly line, the distance between the measurement points is 10 cm.

5. TEST RESULTS

The aim of our work was to prove that the process of localization with the „fingerprint" method can be realized in an industrial environment as well and can be applied with any production line or assembly line for developing different applications. For comparing the results the cumulative distribution function – CDF was used which shows the probability of the accuracy of localization. First the accuracy of localization was tested in those spots where the RSSI values were recorded. We selected some elements of the RSSI map as test values and they were studied with the help of the algorithm. Fig. 4 shows the CDF function for these "known" test dots.
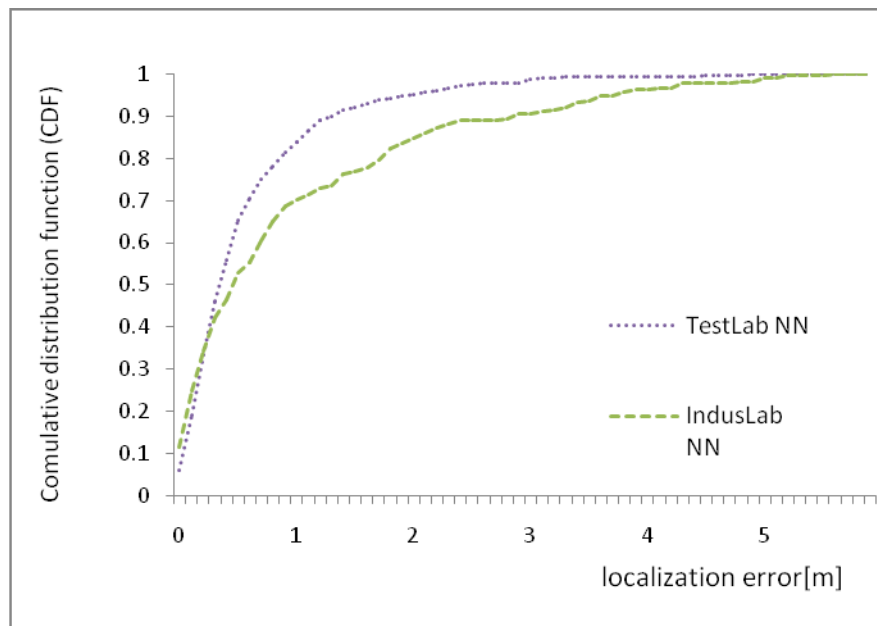

Figure 4 Probability distribution functions

As the curves on Fig. 4 suggest, the localization was more accurate in case of the test laboratory The bigger the rise of the curve is, the better the results are, which means that the localization is more probably precise. As it can be seen, the 0.5 metre accuracy can be determined with the same probability in both cases. After this the curves are distanced from each other. The accuracy on 1 metre can be determined with a 0.9 probability in case of the test laboratory, while in the industrial laboratory the probability is 0.7. Although the success of the localization in the industrial laboratory is markedly different from the test laboratory, it cannot be called unsuccessful. The accuracy on 2 metres can be determined with a probability of 0.9, which is acceptable for industrial use. This result can be corrected by changing the structure of the sensor network and by the use of different localization algorithms.

6. CONCLUSION

This work aimed to study the use of wireless sensor networks in industrial environment. We presented a „fingerprint" localization process which makes indoor localization possible in a closed room. The experiment was done in both a test laboratory and in an industrial laboratory. A neural network was used for localization, and the accuracy of the localization was measured by a CDF function. The results show how the accuracy of the localization differs in case of a test laboratory from an industrial environment. According to the results the process of localization based on wireless sensor network can be pronounced successful. In our further studies we aim to apply the wireless sensor networks for monitoring and controlling of industrial assembly lines. In addition, we also aim to study the environmental effects on the product on the assembly line. We think that by developing a system like this the quality of the product and the manufacturing can be both improved.

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