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PRELIMINARY STUDY REGARDING POSSIBILITY TO USE UV-C RADIATION ON MEET PRODUCTS

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ABSTRACT

In a world where food safety not only can no longer be ignored but new rules appear, experts in the field are looking for new and new solutions. Sometimes we return to the ideas that were abandoned in the past due to the economic efficiency. Given that the production of electricity is becoming cheaper due to renewable resources, the pasteurization of meat products through UV-C radiation can be one of the solutions.

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INTRODUCTION

Food safety challenges are present in many ways. Possibilities for contamination occur throughout the entire supply chain, including harvesting, processing, storage, and transport to consumers. Contamination causes significant food loss and waste. (Verma, 2019) To reduce the content in contamination microorganisms, including pathogen bacteria there are a lot of alternative methods for decontamination such as high hydrostatic pressure, gamma irradiation (US FDA, 2011), pasteurization steam and thermic pasteurization ((Wani, Jagpreet, Joseph, Jeremy, & Ian, 2015), meat sterilization etc. These processses have a negative effect over the phisico-chemical and sensorial meat properties. Nowdays there are a real interest regarding nonthermal treatments of food products. (APHIS, 2012). Meat is usually marketed as raw material; thermic treatments are not preferred due the negative effect over the quality. Chemical methods, especially chlorine treatments to clean meat surface has been used in technological practice to decontaminate meat surface for food borne.Anyway, recent studies show that this methodsleave a high concentration in chlorine products on the meat surface. On the other hand, researchers has evaluate non thermal technologies to decontaminate foods at the room temperature, keep in integrity meat chemical composition, without any residual substances. Ultraviolet-light (UV-light) is one such non-thermal technologythat is approved for surface treatment of food (Guan, Fan, & Yan,2012; US-FDA, 2011). The germicidal effect of UV-light (UV-C) isbetween 245 and 285 nm (Yaun, Sumner, Eifert, & Marcy, 2003),thus it may be an alternative surface decontaminant to be used for inactivating bacteria and viruses. However, the inactivation of microorganismsby UV-light depends on the UV dose (EPA, 1999).Therefore, researchers currently are focusing onfinding potential antimicrobial blends that can enhance foodpreservation and at the same time satisfy green consumerism(Hyldgaard et al., 2012).

MATERIALS AND METHODS

Pork sausages in frozen form are considered belong to category “ready to eat-ready to heat”. Meat products – pork sausages- has a special advantage for

the consumers and producers. For human body frozen pork sausages are considered as friendly products due the tradition recipes used in preparation and high content in proteins, lipids, and mineral substances Fe, Ca, K, S, Mg. No preservatives,colorants, taste potentiators or other chemical components where added to the recipe.

Pork sausages was obtained in laboratory, based on receipt used in meat factory. All the machine from meat factory where used in a small laboratory scale. The technological flow, the order of operations, the manufacturing recipe, the working time for UV-C radiation where respected and could pe translate to the industrial level.

Sausages production

The laboratory production recipe and method are presented in table 1.Raw and auxiliar materials was provided by local suppliers. Brat preparation consist by mixing 1.2 kg of minced meat with 30 g of salt. When the mixing process is ended the brat have been left to maturation for 2 hours. Water from brat composition was added to permit mixing of all the components. Pork fat after cutting into cubes was added to permit brat emulsification.

Table 1.

Raw material and auxiliary materials used in meat sausages laboratory production

RAW N=MATERIALS		AUXILIAR MATERIALS	
TYPE	**MASS (kg)**	**TYPE**	**MASS (g)**
Bradt	1,4	Peper	1
		Nutmeg	0,6
Pork solid fat	0,6	Paprika	1
		Garlic	1

Figure 1. Blending process

Figure 2. Filling process and presentation of the natural sausages

a.

b.

Figure 3. UV-C treatment for pork sau sages: a. in natural membranes; b. in artificial membranes.

The filling was performed using the filling machine and is shown in Figure 2

Filling the composition regardless of the recipe was performed both in natural sheep membranes with a diameter of about 2 cm and in artificial membranes with a similar diameter.

UV-light production and treatment

Ultraviolet light was provided by using a Spectrolinker, XL-1500 Series (Spectronics Corporation, Westbury, NY). The unit was factorycalibrated at 5 cm. Energy dosage used for each treatmentwas calculated based on intensities and treatment time used. The set energy dosage wasapplied by setting intensity and time.

RESULTS AND DISCUSSIONS

Sensorial analyses. Eleven examinators were involved in sensorial analyses. Each person pointed exterior texture, section texture, consistence, taste and smell. For each characteristicevaluatorgive points from 0 to 3 for exterior texture; 0 to 5 for interior texture; 0 to 5 for taste and 0 to 4 for smell (odor). Figures 4, 5, 6, 7 present the results obtained after sensorial test for sausages prepared in natural membrane and treated with UV-C radiation.

Figure 4. Samples before sensorial exam.

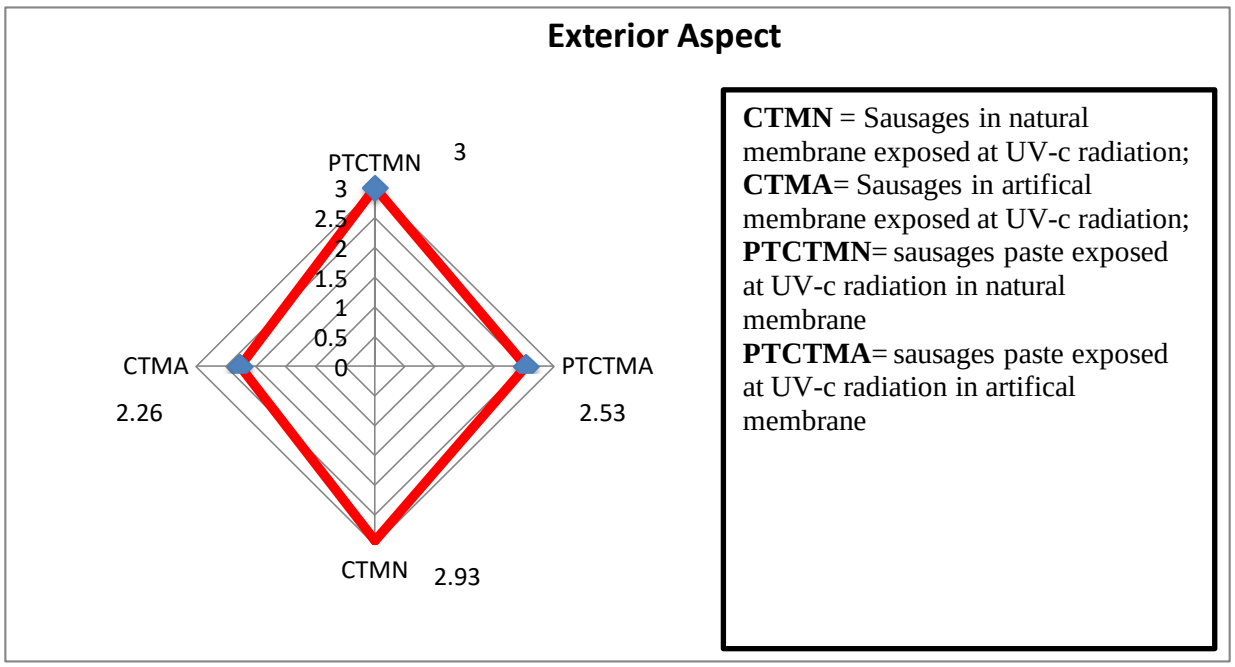

Figure 5. Exterior aspect sensorial analyses
CTMN – sausages UV-C treatment in natural membrane
CTMA - sausages UV-C treatment in artificial membrane
PTCTMN-Paste from sausages UV-C treatment in natural membrane
PTCTMA - Paste from sausages UV-C treatment in artificial membrane

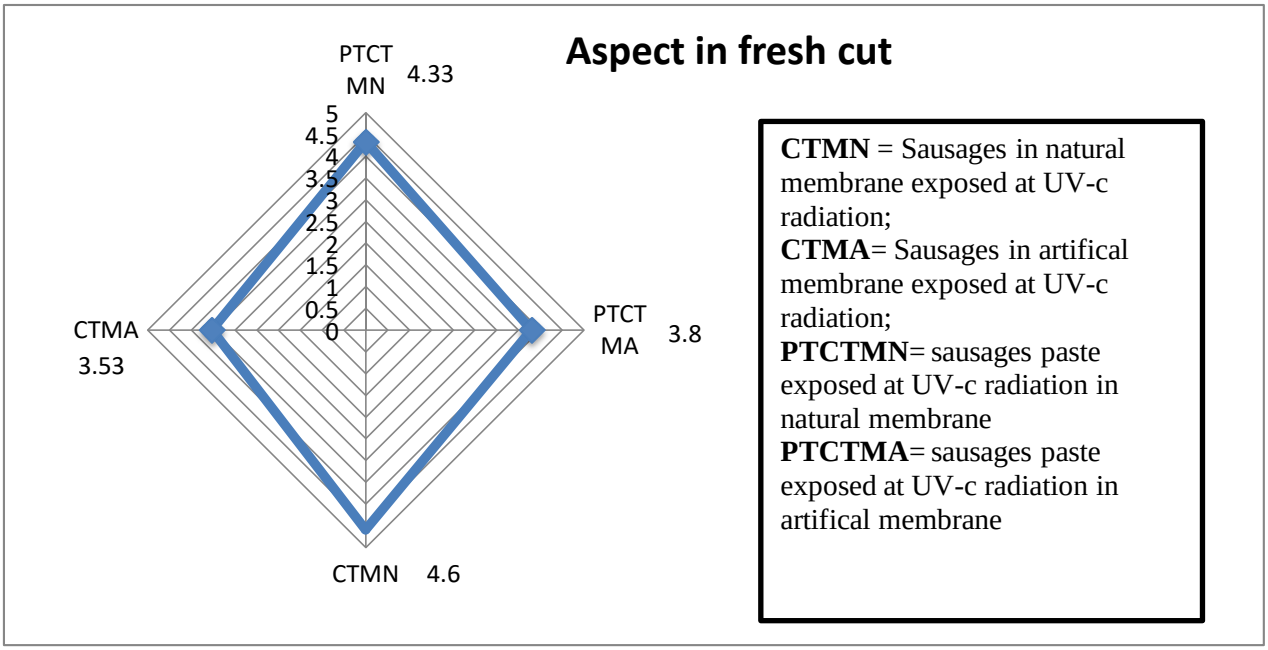

Figure 6. Aspect in fresh cut
CTMN – sausages UV-C treatment in natural membrane
CTMA - sausages UV-C treatment in artificial membrane
PTCTMN-Paste from sausages UV-C treatment in natural membrane
PTCTMA - Paste from sausages UV-C treatment in artificial membrane

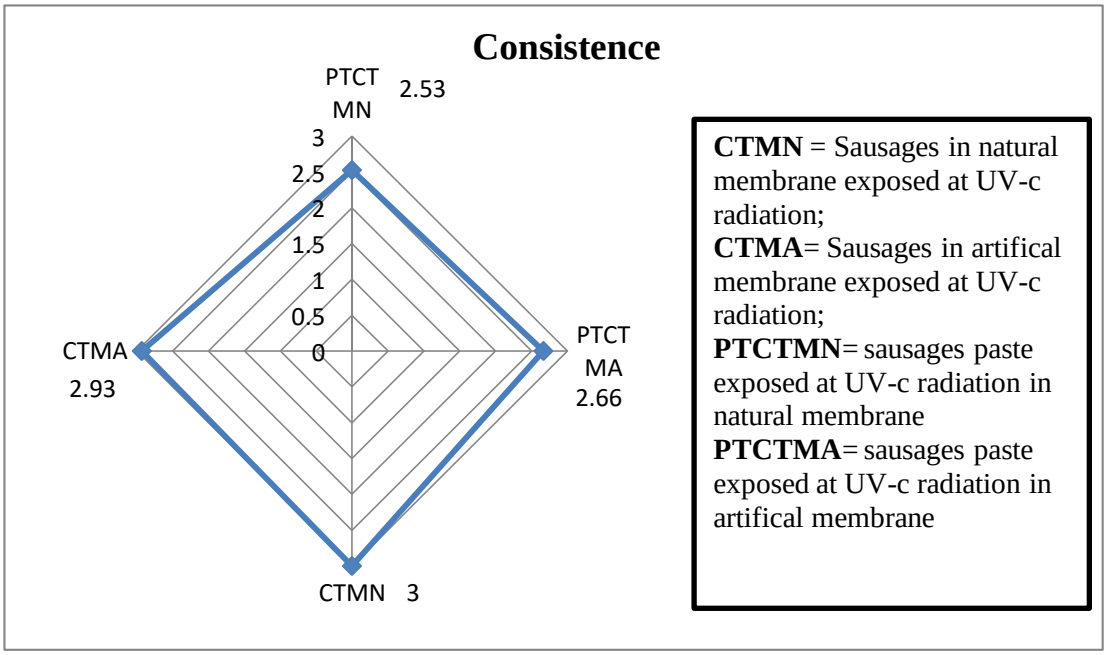

Figure 7. Consistence
CTMN – sausages UV-C treatment in natural membrane
CTMA - sausages UV-C treatment in artificial membrane
PTCTMN-Paste from sausages UV-C treatment in natural membrane
PTCTMA - Paste from sausages UV-C treatment in artificial membrane

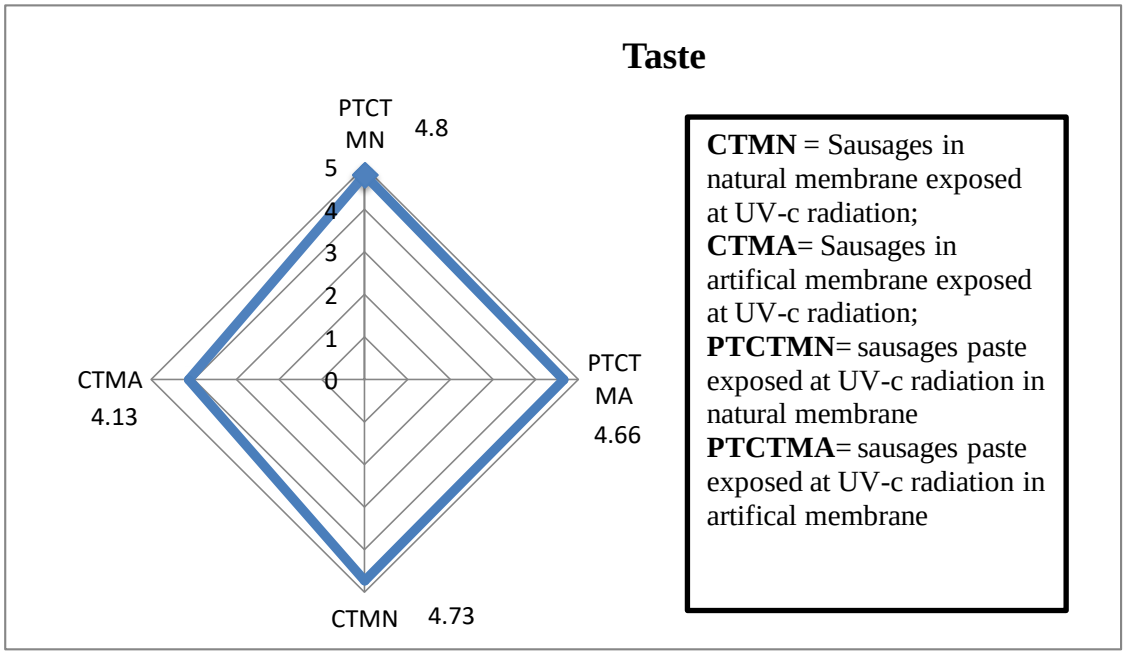

Figure 8. Taste
CTMN – sausages UV-C treatment in natural membrane
CTMA - sausages UV-C treatment in artificial membrane
PTCTMN-Paste from sausages UV-C treatment in natural membrane
PTCTMA - Paste from sausages UV-C treatment in artificial membrane

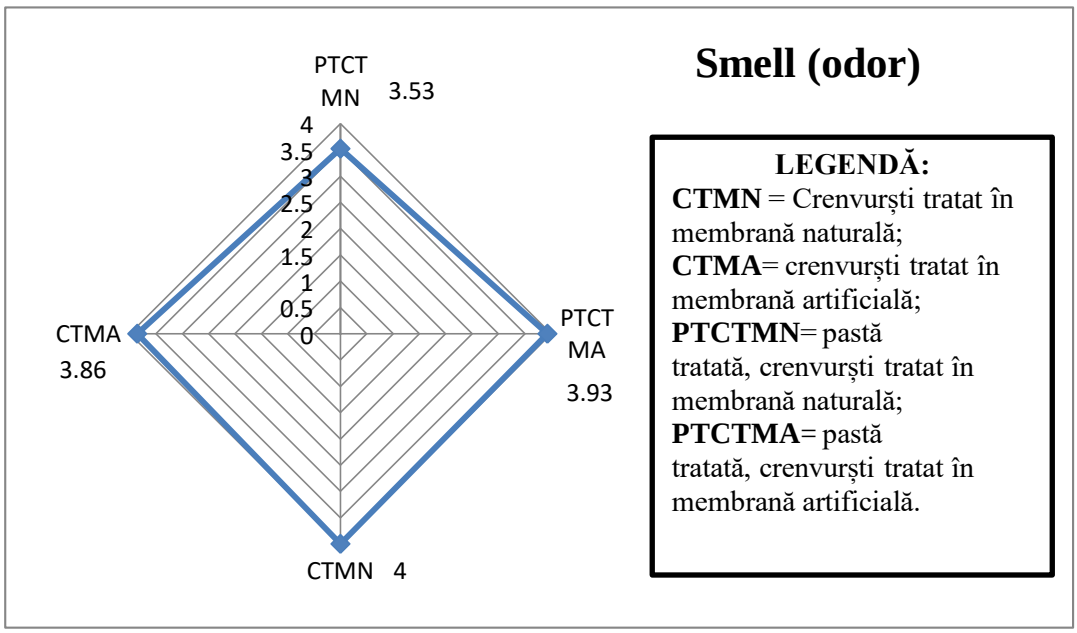

Figure 9. Smell (odor)
CTMN – sausages UV-C treatment in natural membrane
CTMA - sausages UV-C treatment in artificial membrane
PTCTMN-Paste from sausages UV-C treatment in natural membrane
PTCTMA - Paste from sausages UV-C treatment in artificial membrane

In accordance with examinators marks it can conclude that pork sausages with UV-C treatment in natural membrane CTMN obtained high remarks in opinion off all the evaluators. In second position was situated sausages treated with UV-C radiation in artificial membranes. At the end, the evaluators choose sausages past removed from natural and artificial membranes. Marks between samples are not significativedifferent, but on the first position evaluators choose the sausages UV-C treated in natural membranes.
Hydrolysablenitrogen is a freshness index. All the sausages samples where examinate regarding low hydrolysable nitrogen. Results are presented in table 2.

Table 2

Hydrolysable nitrogen

Home-made recipe		
	Natural membrane treatment with UV-c (NH_3, mg/100g)	Artificial membrane treatment with UV-c (NH_3, mg/100g)
CN	27,2	23,8
CT	27,2	23,8
PTCT	20,4	22,1
PTCT 2 MIN	No detectable	18,7

CN – sausages UV-C treatment in natural membrane
CT - sausages UV-C treatment in artificial membrane
Paste from sausages UV-C treatment in natural membrane
Paste from sausages UV-C treatment in artificial membrane

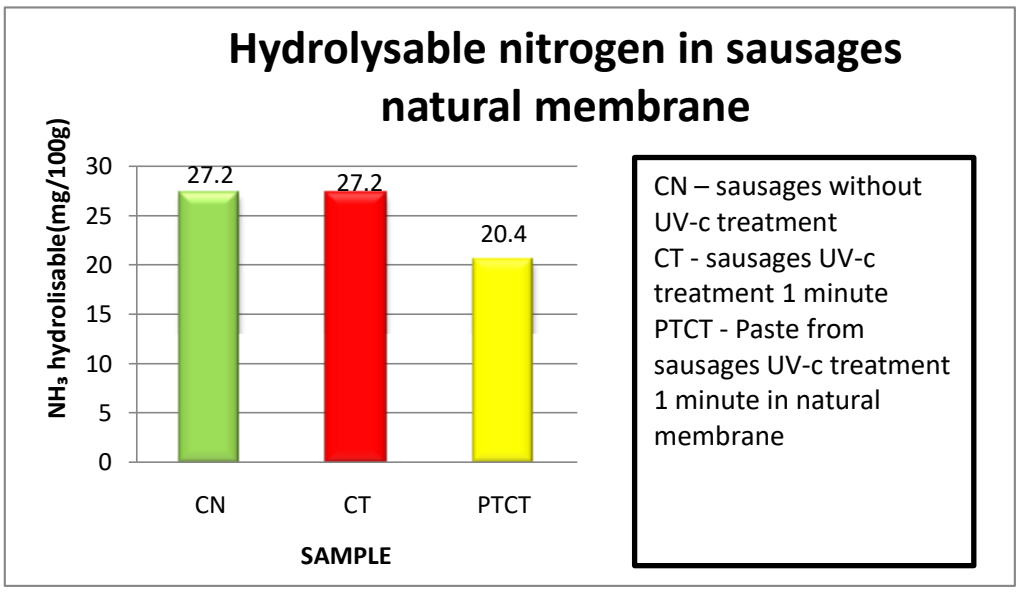

Figure 10 Hydrolysable nitrogen in sausages Home-made recipe

Sausages without UV-C treatment present high concentration in hydrolysable nitrogen. Microorganisms are not destroyed by UV-C and continue activity after sausages made it. A similar concentration in hydrolysable nitrogen record at the sample with 1-minute UV-C treatment. The low content in NH3 is recorded at the sampleswhere the natural membrane was removed, and it used for analyses only sausages paste.

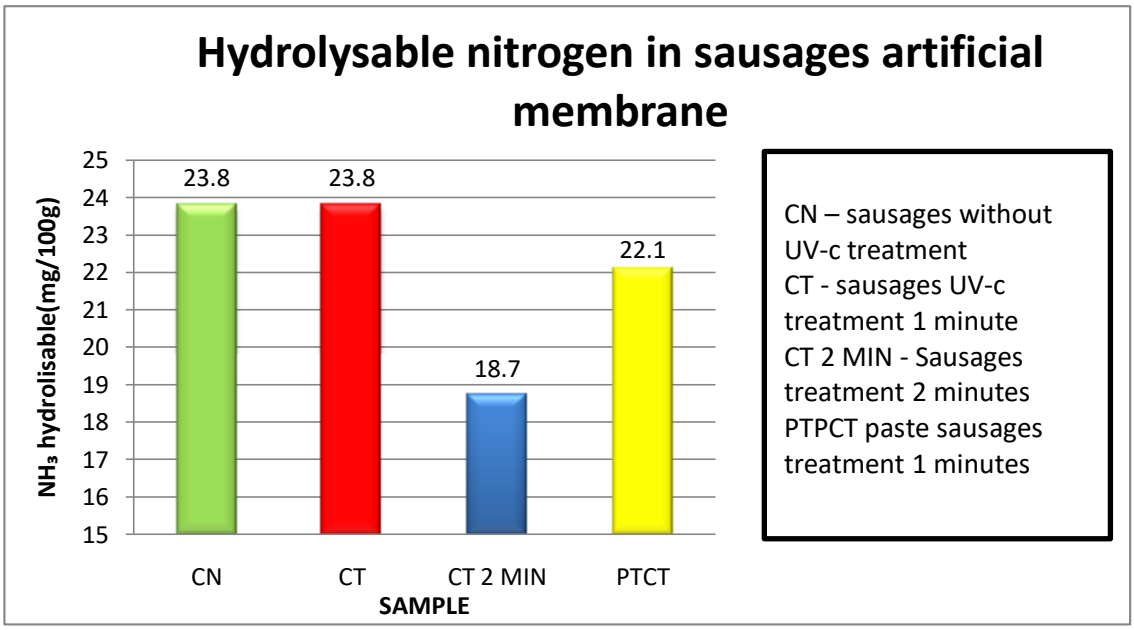

Figure 10 Hydrolysable nitrogen in sausages artificial membrane

Samples treated with UV-C for 1 minute or without UV-C treatment present the same concentration in hydrolysable nitrogen. If the treatment with UV-C increase at 2 minute the results improve significant. Regarding the paste remove from sausages UV-c treatment during 1 minute in artificial membrane the concentration of NH3 increase with 2 mg/100 g product.

CONCLUSIONS

Efficacity of UV-C treatment at the sausages in artificial or natural membranes increase with time exposed. A treatment for 2 minutes is more efficient than a treatment for 1 minutes.

UV-C treatment influence the NH3 (hydrolysable nitrogen) from samples due the effect regarding the total coliform bacteria. Natural and artificial membranes offer a protection barrier for the meat sausages bacteria. On the other hand, paste removed from sausages UV-c treatment in natural membranes present a low concentration in hydrolysable nitrogen due the removed of membranes during the analyses.

UV-C technique can be used to increase the sensorial properties of food where is necessary a thermic treatment. All the examinators which evaluate the sausages in sensorial test prefer the sausages obtained by home-made recipe, packed in natural membranes than the artificial membranes.

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