STUDY ON ORGANOLEPTIC PROPERTIES OF COLLAGEN FILMS AND MEAT PRODUCTS IN COLLAGEN FILMS WITH CO_2 EXTRACTS OF SPICES BY MULTI-SENSOR ANALYSIS

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Abstract – At present, the safety issues regarding food product packaging has assumed great importance. Thus, investigations aimed at analyzing properties of collagen films with natural spice extracts are topical. In this connection, selection of CO_2 extracts of spices having the highest ability to exhibit antimicrobial, antioxidative and aromatizing properties is of profound interest. The comparative analysis of changes in the aroma characteristics of the collagen films having different concentrations of CO_2 extracts of cloves, allspice and nutmeg was performed using the multi-sensory system "VOCmeter". The organoleptic evaluation of smoked-cooked meat products without collagen films and with use of the collagen films with the nutmeg CO_2 extract was also carried out. The obtained results showed that the experimental samples of meat products had more pronounced organoleptic characteristics and possessed stability to the microbiological spoilage during storage.

Key Words – oxidative spoilage, area of "visual fingerprints", carbonade, shelf-life.

I. INTRODUCTION

Nowadays, organoleptic properties such as taste and aroma are of considerable importance for consumer in product selection along with appearance, color, shelf life and manufacturer trade mark.

The aroma of a finished product that emphasizes its individual organoleptic characteristics is formed by used compositions of various natural spices. In food industry, CO_2 extracts are quite widely used instead of dry spices. Their application imparts the necessary aroma to a product; and, thereby, regulates taste and aromatic properties of a food product. As the majority of plant CO_2 extracts has antioxidative and antibacterial properties in addition to their main function of imparting a product necessary organoleptic properties, their use enables prevention of product spoilage and extension of its shelf life [1].

Recently, the incorporation of different components into packaging materials and casings in order to impart them various properties, particularly, the antioxidative, antimicrobial, taste and aromatic, and so forth has become topical.

VNIIMP has carried out the scientific research on the properties of the collagen-based packaging material containing spices CO_2 extracts. Previous investigations showed that collagen films with spices CO_2 extracts had improved organoleptic and physico-chemical indices, and possessed antimicrobial activity [2,3].

The objective instrumental assessment of the aroma of the smoked-cooked meat products produced without collagen films and packed in the modified collagen films was carried out with "VOCmeter" instrument.

One of the main advantages of the "electronic nose" system is the possibility to use it for the complex analysis of all volatile components that form the specific odor and aroma of a product and present it as a characteristic fingerprint.

The aim of the study was to perform a comparative analysis of the smoked-cooked meat products by multisensory method, and establish the extent of changes in the aroma intensity of the finished products during storage.

II. MATERIALS AND METHODS

The subjects of the research were:

- collagen films;
- collagen films containing CO_2 extracts of cloves, allspice and nutmeg in amount of 5%, 10%, 15%;
- samples of smoked-cooked meat products (control – carbonade without a film; experiment 1 – carbonade packaged in the collagen film;

experiment 2 – carbonade packaged in the collagen film with the nutmeg CO_2 extract).

In order to perform investigations, we used "VOCmeter" instrument from AppliedSensor (Germany), which represents a system containing four MOS sensors (metal oxide sensors) and eight QMB sensors (quartz microbalance sensors). The instrument is intended for qualitative and quantitative assessment of gas mixtures [4].

Analysis of the samples of smoked-cooked carbonade using "VOCmeter" instrument was carried out on day 0 (background) and day 10 of storage. To this end, three specimens were taken both from the surface and deep layers of the product.

For specimen acquisition from a surface layer of a sample (not more than 5 mm), the necessary quantity of a product was cut out; 3.0 g were weighed on the laboratory scales with the error not more than 0.2 g and placed into a special glass container (vial), which was then sealed.

For specimen acquisition from a deep layer of a sample, a top layer of a product was removed from a sample surface (no less than 5 mm), and the necessary quantity of a product was cut out from the new surface; 3.0 g were weighed on the laboratory scales with the error not more than 0.2 g and placed into a vial, which was then sealed.

III. RESULTS AND DISCUSSION

During the course of the research on the abilities of each extract to exhibit the aroma intensity depending on concentration, it was shown that irrespective of the concentration the most intensive aroma had the collagen films with the nutmeg CO_2 extract and the least with the allspice CO_2 extract.

An increase in the concentration of each CO_2 extract led to an increase in its odor intensity as evidenced by an increase in the area of the "visual fingerprints" presented in Fig. 1, 2 and 3.

Simultaneously with this, it was established that the losses in aromatic properties rose with an increase in the concentration of CO_2 extracts contained in the collagen films. This was justified by less collagen ability to retain volatiles. Thus, the collagen film with the nutmeg CO_2 extract in amount of 10% was selected for further work.

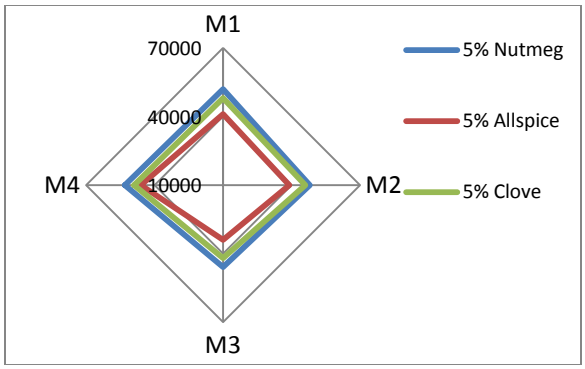

Figure 1. The areas of the aroma "visual fingerprints" of the collagen films with 5% of the different spice extracts

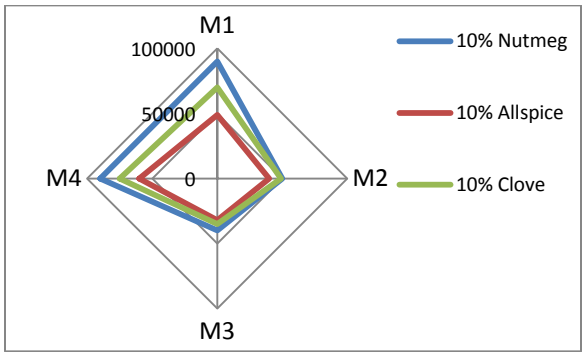

Figure 2. The areas of the aroma "visual fingerprints" of the collagen films with 10% of the different spice extracts

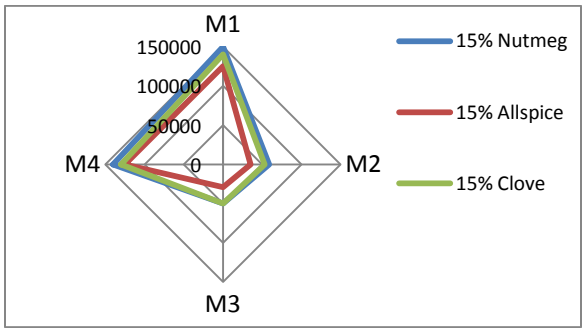

Figure 3. The areas of the aroma "visual fingerprints" of the collagen films with 15% of the different spice extracts

The results of the multisensory analysis of the surface layer of the smoked-cooked meat products presented in Fig. 4 showed that on day 0 the control sample had the smallest area of the "visual fingerprint" in terms of the aroma intensity (S_{vf}=29.58 x 10^7) compared to experimental

sample 1 (S_{vf}=31.39 x 10^7) and experimental sample 2 (S_{vf}=36 x 10^7). However, the values in the experimental samples also had some differences, as the factor affecting the formation of more pronounced aroma in experimental sample 2 was the nutmeg extract.

On the 10th day of the experiment, a rapid increase in the "visual fingerprint" area was observed in the control sample, which indicated that more intensive oxidative processes and microbiological spoilage occurred on the product surface. At the same time, the changes in the "visual fingerprint" area of experimental sample 2 on day 10 was not significant. The obtained results showed that the surface spoilage occurred with less degree in the experimental sample packed in the collagen films with the nutmeg CO_2 extract, which demonstrated the inhibitive effect on the development of undesired microflora on the surface of the finished product.

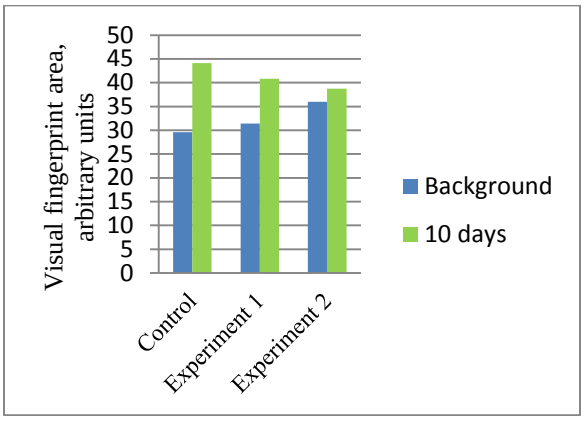

Figure 4. Changes in the area of the aroma "visual fingerprints" in smoked-cooked carbonade during storage (surface layers)

Fig. 5 presents the dynamics of the changes in the aroma intensity in the deep layers of the smoked-cooked meat products, which reflects the process of aromatic substances diffusion into the product.

Analysis of the obtained results indicates that the area of the "visual fingerprints" in the control sample (S_{fv}=41.24 x 10^7) was less compared to experimental samples 1 and 2 (S_{fv}=43.17 x 10^7 and S_{fv}=45.45 x 10^7) due to the presence of the nutmeg CO_2 extract in the collagen film, which enhanced the aroma of the film and penetrated deep into the meat product.

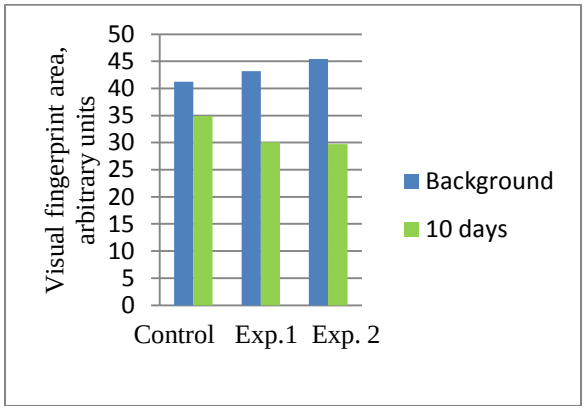

Figure 5. Changes in the area of the aroma visual fingerprints of the smoked-cooked carbonade during storage (deep layers)

On the 10th day, the area of the "visual fingerprints" in the control sample was S_{fv}=34. 94 x 10^7 and was larger than that in the experimental samples, which was associated with the increase in odor intensity due to the occurring processes of fat oxidation and protein destruction. At the same time, this process was delayed in the experimental samples due to the protective film with antimicrobial properties.

IV. CONCLUSION

Based on the results of the multisensory analysis, the nutmeg CO_2 extract with the optimal concentration of 10% was selected for incorporation into the composition of a collagen film. The results of the investigation of the smoked-cooked carbonade in the collagen films with the nutmeg CO_2 extract by multisensory analysis demonstrated that the samples had more pronounced organoleptic characteristics and possessed higher stability to microbiological spoilage during storage.

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