THE STUDY ON THE MYCELIZED FOOD COLORANTS CARMINE AND PAPRIKA FOR SAUSAGE PRODUCTS

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Abstract – Functional properties of the mycelized preparations of the food colorants carmine (E120) and paprika (E160c) were studied, and their effective doses for use in sausage products production were identified. Color indices L, a, b were used for the calculation of the color stability of the stained systems (colorant solutions, protein systems, cooked sausages). The new preparations of the colorants carmine and paprika were superior to the non mycelized forms of the analogous colorants with respect to the overall stability upon exposure to technological factors (light, temperature, storage, environmental pH). Protein systems colored with the mycelized colorants carmine and paprika were stable upon exposure to light and storage (90-96%). The control (without a colorant) and experimental samples of sausages with mycelized carmine dye did not differ in sensory indices. During storage, better color stability was observed in the cooked sausage samples with carmine dye (94.9-96.2%) compared to the control sample (86.4%). Better light stability of color was also observed in the samples with the carmine dye (92.8-96.2%) compared to the control (83.9%). The effective doses were established and the technological recommendations on the use of mycelized food colorants carmine and paprika in the sausage products production were developed.

Key Words – mycelized food additives, cooked sausages, color stability

I. INTRODUCTION

Due to the nanotechnologies, the emergence of the ingredients including the natural food colorants obtained with the use of the technology of micellization at the nano level patented in Germany became possible [1]. Nano particles (food-grade micelles) are the carriers of the active substances and consist of the nucleus and the envelope. The nucleus is formed from one or more active ingredients, the envelope is formed from the system of surfactants that are soluble in water and fat, and are stable to the exposure to temperatures and changes in the environmental pH.

Great demand for mycelized natural food colorants is conditioned by the fact that the substances in the mycelized form acquire new physico-chemical properties and a larger activity not characteristic for their usual forms (crystals, powder, solution etc.). A small concentration of active substances on the background of its increased activity (because of the multiple augmentation in the potential area of interaction) allows to improve the economic and technological indices influencing the cost of a finished product [2].

In this study functional and technological properties of mycelized preparations of the food colorants carmine (E120) and paprika (E160c) were investigated, and their effective doses for the use in sausage products production were identified. The conducted study is timely and topical because the utilization of nanotechnologies in food colorants production allows to increase the share of natural substances being used as food additives and to offer their more active and economically profitable form to the market.

II. MATERIALS AND METHODS

The batches of cooked sausages in quantity of 20 kg were produced under the traditional technology using minced raw meat material, forming, cooking and cooling. The control contained semifat pork, water, sodium chloride, sodium nitrite, sugar and spices. The experimental samples also contained hydrated (1:4) soya protein stained with mycelized colorant carmine instead of pork in quantity of 10% and 40%, respectively.

The study of the color characteristics of the colorant preparations and their stability upon exposure to the technological factors was carried out according to the method of the complex assessment of food colorants developed in GNU

VNIIMP [3]. The quantitative values of color indices L, a, b determined experimentally during the assessment of the color of the stained systems were used for the calculation of the criteria of color stability upon the exposure to the main technological factors characteristic for sausage production (light, temperature, storage duration, environmental pH changes).

The L, a, b indices (where L characterizes the degree of lightness, a is the degree of redness and b is the degree of yellowness) were detected using the spectrocolorimeter "Spectroton".

The stained systems with the mycelized colorants carmine and paprika (colorant solutions, protein systems, cooked sausages) were the subjects of research.

All samples were analyzed in three replicates. We used the Excel Software for data processing.

III. RESULTS AND DISCUSSION

At the first stage of the research, we studied the functional and technological properties of the colorants carmine and paprika, and color stability of their solutions to the exposure to the main technological factors (Table 1) having the paramount importance in production, storage and realization of the sausage products – temperature (80^{o}C), environmental pH changes (in the presence of the food grade phosphates), light (1 hour), storage duration (4 days) – comparing to the common commercial powder forms of the color preparations on the basis of carmine and paprika proved themselves in sausage production.

Table 1 Overall color stability of the new preparations of the colorants carmine and paprika comparing to the preparations of colorants based on carmine and paprika used in sausage production

Preparations of colorants	Color stability to technological factors exposure, %				Overall color stability, %
	light	temperature	storage duration	changes in environmental pH	
Carmine mycelized form	92.00	91.04	91.23	95.07	92.34
Carmine (control)	91.39	83.78	85.79	92.91	89.95
Paprika mycelized form	98.14	97.69	93.18	93.25	95.57
Paprika (control)	98.57	93.13	86.65	91.35	92.07

Carmine had better color stability to the pH change than paprika. The color loss was 4.93% for carmine and 6.75% for paprika.

The colorant paprika was more light- and temperature-stable than carmine. Color losses were 1.86% and 2.31%, respectively, for paprika and 8.0 and 8.96%, respectively, for carmine.

During storage, both colorants had the similar color stability of the solutions: color loss was 8.77% for carmine and 6.82% for paprika.

With respect to the overall color stability upon the exposure to the main technological factors, the new preparations of the colorants carmine and paprika were superior to the used preparations on the basis of carmine and paprika that were chosen as the subjects of the comparison: mycelized carmine – 92.3%, the preparation on the basis of carmine – 89.9%; mycelized paprika – 95.5%, the preparation on the basis of paprika – 92.0%.

The new preparations of carmine and paprika showed color losses upon the exposure to the technological factors less than 10% that characterized them as technologically competitive preparations of food colorants.

At the second stage of the research, the effective doses of the new colorants carmine and paprika were established using the model protein systems (plant proteins hydrated 1:4), and the color stability of the stained protein systems to temperature exposure (80^{o}C) and storage duration (5 days) was determined.

The visual assessment characterized the color of the protein systems with carmine as pink in the range of light pink to dark pink typical of the majority of the traditional groups of sausage products. The protein systems with paprika were characterized by orange hue in the range of lighter – darker with the admixture of light pink color.

The protein systems colored with colorants carmine and paprika were stable to light and storage duration (90-96%).

At the third stage of the research, the model samples of the cooked sausages with a new preparation of the food colorant carmine were produced experimentally in order to optimize the dosage range established on the model protein systems and to verify the functional stability of the colorant established during the analysis of

the solutions. The sausage samples with the colorant were analyzed for the color stability to light exposure (1 hour) and storage duration (5 days). In addition, the sensory characteristics of the cooked sausages samples were tested.

The results of the instrumental assessment of color (Table 2) demonstrated the correspondence of the color between the experimental samples and the control one. The color indices of the control sample produced without the substitution of meat raw material and without colorants were taken as a reference values.

Table 2 Comparative assessment of the color indices of the control and experimental samples of cooked sausages with the preparation of the mycelized colorant carmine

No samples	Hydrated protein, kg/100 kg of minced meat	Carmine, g	Visual assessment	L	a	b
1	0	0	4.9	62.76	9.49	10.34
2	10	30	4.9	62.93	8.81	11.10
3	40	60	4.9	64.05	8.38	11.75

The color differences of the experimental sample with 10% of the raw meat material substitution and the colorant carmine (the minimal dose 30 g) were 4.91% and that of the sample with 40% of the meat raw material substitution and the colorant carmine (the maximum dose 60 g) were 8.11% comparing to the control sample. Visual color differences between the samples in comparison were not established.

In regard to the sensory characteristics, the control and the experimental samples of the cooked sausages with the colorant carmine did not have differences except some discrepancy between the scores (0.1-0.2) in the assessment of the consistence due to the use of the hydrated plant protein. The uniform color was seen on the cut surface of the sausage link, which can be explained by good solubility of the colorant.

During storage, better color stability (94.9-96.2%) was observed in the experimental samples with the colorant carmine. The color stability of the control sample was 86.4%. Better color stability to light exposure (92.8%-96.2%) was observed in the experimental samples of cooked sausages with the colorant carmine. Color stability of the control sample was 83.9%.

IV. CONCLUSION

According to the results of the analysis of the solutions, protein systems and cooked sausages, the recommended effective dose range of the colorant carmine preparations was 30-65 g per 100 kg of cutting raw meat material. The color carmine imparted light pink to pink red color to the staining systems that corresponded to the color of the most traditional sausage products, provided color stability during the production cycle, storage period and realization of finished products upon exposure to the technological factors: acidity regulators, temperature, light, storage duration.

The recommended effective range of the doses of the colorant paprika was 15-30 g per 100 kg of cutting meat raw material. The colorant paprika imparted light-yellow to yellow-orange color to the coloring systems that corresponded to the color of the minced meat of the individual sausage products with non-traditional color such as pâté which color on the cut surface was characterized as yellow-brown.

On the basis of the results of the research, the technological recommendations on the use of the new mycelized forms of preparations of food colorants carmine and paprika in the sausage products production were developed.

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