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EFFECT OF "VITMEAT-C" PREPARATION ON COLOUR CHANGE AND STABILITY OF "BOLOGNA" TYPE SAUSAGE

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ABSTRACT

Nowadays, according to expectations of consumer, meat products should be attractive from sensoric point of view, stable and safe. For consumers buying now more products in retail shops, colour is an important criterion by which they evaluate and choose meat products. Due to opinion of consumer, colour reflects proper composition of product, in particularly relation of meat to other compounds, freshness of raw materials and proper conditions of storage. Unexpected colour is associated with low quality of product [7].

All expectations related to better quality and the extend of stability are well fulfill by sodium lactate used in proper amount [1, 11]. This substance is a product of natural lactic fermentation and its use doesn't be controversial. In majority of countries the sodium lactate is used in amounts resulted from rules of the *Good Manufacturing Practice* (GMP) to achieve the assumed technological effect [6, 10].

Ascorbic acid applied to obtain an optimal and stable colour of cured meat products is like a sodium lactate, full accepted additive, however, if it is applied in improper amounts may cause undesirable changes of this property [3, 12].

Results presented in this study indicate possibilities to improve colour of "bologna" type sausage manufactured by the use of sodium lactate and more amount of ascorbic acid.

Key words: sodium lactate, ascorbic acid, quality improvement, meat products

MATERIALS AND METHODS

The objective of this study was checking the possibility of application of the selected blends contained sodium lactate and ascorbic acid for improvement of colour and stability of "bologna" type sausage.

Experimental "bologna" type sausage produced under commercial conditions in meat processing plant was the subject of the study. Sodium lactate and "Vitmeat-C" preparation commercially made as a mixture of sodium lactate and ascorbic acid were used among technological additives. The control sausage (0 sample) was produced without these additives.

While experimental sausage 1 contained 2% of sodium lactate in relation to main raw materials, sausage 2 contained 2% of "Vitmeat-C" preparation.

Comminuted meat formula was placed in polyamide casings (φ = 73 mm) and after production procedure all sausage samples were stored under chilling conditions (2-4°C). Control tests were done 2, 6, 10, 13 and 17 days after production. One time, 2 days after production, sensory evaluation of total quality of experimental sausages has been done using 5-point scoring method. During storage of sausages, changes of total aerobic mesophilic bacteria count was determined according to the Polish Standard No A-82055-6.

Colour attributes of meat product were evaluated using the SPECTRO-PEN apparatus (Dr Lange Co, Germany) due to the procedure given in the manual. The SPECTRO- PEN apparatus represents a spectrophotometer measuring degree of reflected light in the range between 400 and 700 nm, each 20 nm, with 45°/0° sphere geometry of measurement and adjustment using white muster sample. Results were expressed as values of colour attributes L*, a* and b*. Marked differences were found by calculation of obtained results to the synthetic parameters, it means

$$C^* = \left[(a^*)^2 + (b^*)^2\right]^{0.5},\quad \Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{0.5},\ \Delta H = [(\Delta E^*)^2 - (\Delta L^*)^2 - (\Delta C^*)^2]^{0.5}$$ [4].

Colour changes of meat products were sensory evaluated by panel of experts using graphical method (maximum score equal to 10 points). Character of colour (typicality) and its acceptability were evaluated separately. Brightness of colour was also evaluated in the range of 0 (to bright) and 10 (to dark) point scores.

The evaluation was carried out immediately after cutting sausage sample and 1 hour later.

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RESULTS AND DISCUSSION

Based on data collected during the sensory evaluation of cross section colour, binding degree of slice, smell, taste and salinity was found, that all examined sausages demonstrate good sensory quality directly after production. Rate of changes related to the lost of freshness during storage of examined sausages results first of all from amount and type of microorganisms remaining after heat treatment. The main factors influenced on amount and their development in meat formula are formula composition, conditions of production and storage of final products [5, 10].

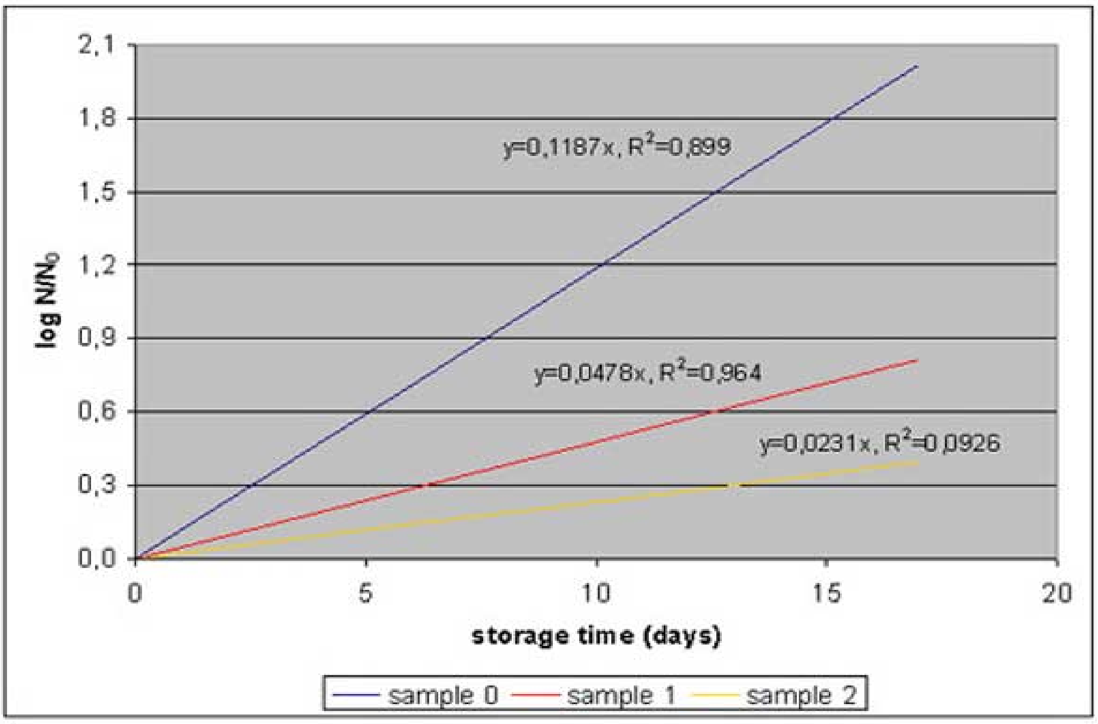
The stability of examined sausages were evaluated on the base of changes of aerobic mesophilic bacteria count (Table 1). Results are expressed as a logarithm of N and N_0 values where N means number of bacteria determined 2 days after sausage production and N_0 means initial bacteria number.

Table 1. Changes of bacteria number expressed as log N/N_0

Days of storage	Sample		
	0	1	2
2	0	0	0
6	0.3413	0.311	0.074
10	1.4326	0.510	0.266
13	1.7105	0.570	0.321
17	1.9050	0.836	0.364

Data collected in Table 1 were used to calculate the correlation degree between change of bacteria number determined after certain time of storage (depended variable y) and time of storage (independed variable x). Figure 1 illustrates results of these calculations.

Fig. 1. Changes of total aerobic mesophilic bacteria count expressed as logN/N_0



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The highest dynamic of bacteria grow was found for control sample. In sausages contained sodium lactate addition, independently of ascorbic acid level in sample, the rate of bacteria development was similar and significantly lower in comparison to the reference sample. So, the addition (2%) of sodium lactate preparation significantly inhibited the dynamic of microorganisms development.

Results of instrumental evaluation of colour of sausages are shown in Tables 2, 3 and 4. Under conditions of this study, changes of "a" value (red colour part) and "b" value (yellow colour part) were statistically not significant, independently of sausage type. Changes of brightness (L*) are illustrated on Figures 2 and 3. Sausage samples contained "Vitmeat-C" preparation and reference samples were no different in term of brightness, but they were significantly brighter in comparison to sausage samples contained sodium lactate only. More detailed analysis of colour changes is possible after calculation of obtained results to the synthetic colour parameters like C* value (psychometric colour saturation) (Table 2), ΔH value (colour hue differences) (Table 3) and ΔE (colour total differences) (Table 4) of examined sausages related to reference sample.

Table 2. Psychometric colour saturation C*

Time of measurement	Sample	Storage time (days)				
		2	6	10	13	17
Immediately after cutting	0	16.33	15.79	15.79	15.83	16.22
	1	16.50	15.70	16.18	15.73	15.41
	2	15.91	15.07	15.41	15.33	15.22
1 hour ater light exposure	0	17.93	17.55	17.37	17.53	17.31
	1	17.52	17.06	17.88	17.79	17.00
	2	17.11	17.08	17.45	16.29	16.25

Table 3. DH value for examined sausages related to reference sample

Time of measurement	Sample	Storage time (days)				
		2	6	10	13	17
Immediately after cutting	1	0.95	0.64	0.95	1.04	1.20
	2	0.72	0.00	0.65	0.75	0.37
1 hour after light exposure	1	1.06	0.66	1.07	2.43	1.79
	2	0.83	0.11	0.58	0.48	3.14

Table 4. DE value for examined sausages related to reference sample

Time of measurement	Sample	Storage time (days)				
		2	6	10	13	17
Immediately after cutting	1	2.31	2.35	3.61	3.29	2.96
	2	0.98	1.40	1.43	1.04	1.91
1 hour after light exposure	1	3.51	2.42	4.15	3.14	3.89
	2	1.39	0.58	2.07	1.56	2.07

Fig. 2. L* - value determined directly after cutting of sausage

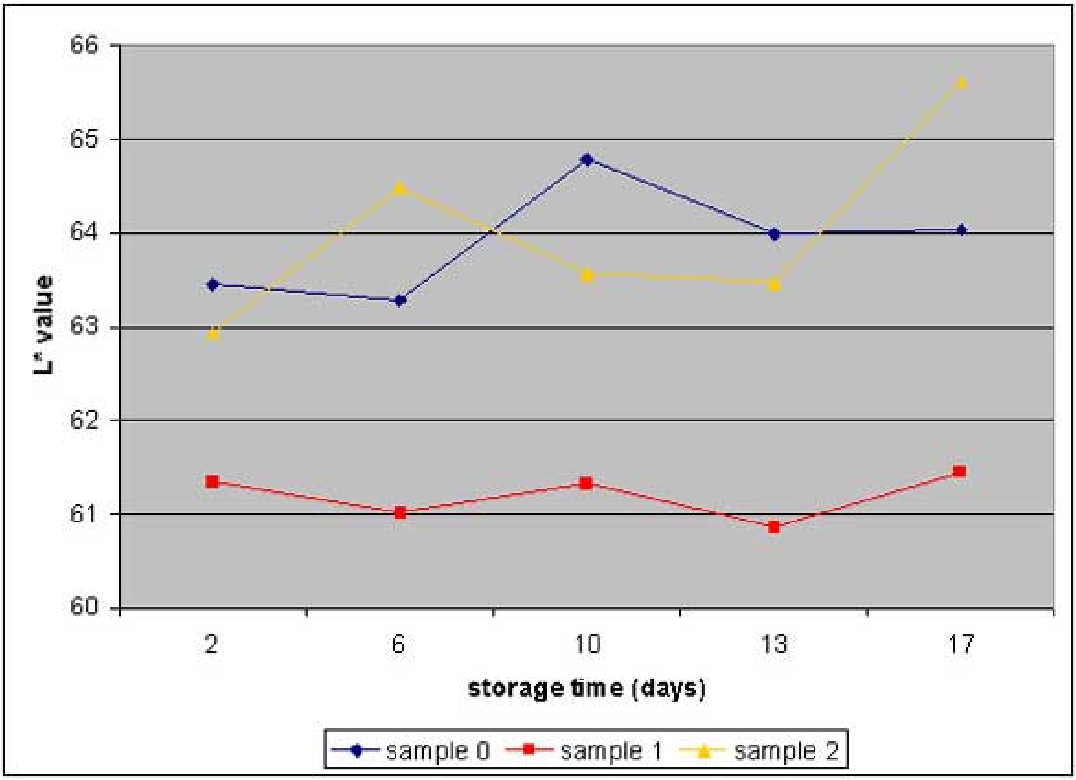
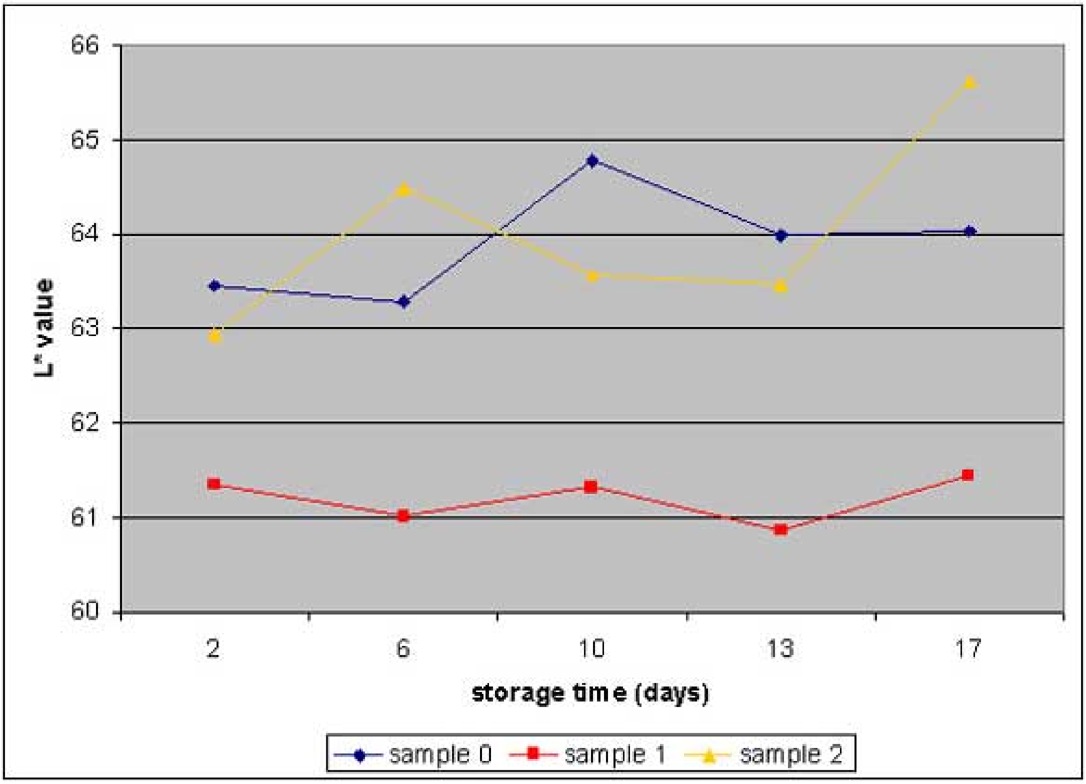


Fig. 3. L* - value determined directly 1 hour after light exposure



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Psychometric colour saturation of experimental sausages was affected by all of examined factors it means type of sausage, storage time and time of exposure to light. Colour hue differences (ΔH) for sausage 1 and sausage 2 in comparison to reference sample were not statistically significant, it means, colour hue didn't changed under study conditions. Results of calculation of colour total differences (ΔE) between examined sample and reference sample indicated statistically significant influence both of sausage type as well as storage time. Time of exposure to light had no influence on this parameter.

In respect to colour character (colour typicality) each variant of sausage manufactured with addition of "Vitmeat–C" preparation was evaluated sensory statistically higher in comparison to the control sausage. To the beginning of storage time these differences were small and not significant, but follow the storage they increased and after 17 days were statistically significant.

After 1 hour exposure to the daily light, the color of sausage was evaluated as less typical. Initially, the mean difference was equal to 2.6 points, but later, follow the storage, this difference decreased. Also in this case the highest scores were observed for sausages contained "Vitmeat-C" preparation and stored 17 days. Figures 4 and 5 illustrate all relationships described above.

Fig. 4. Change of colour acceptance (typicality) determined directly after cutting of sausage (max score =10 points)

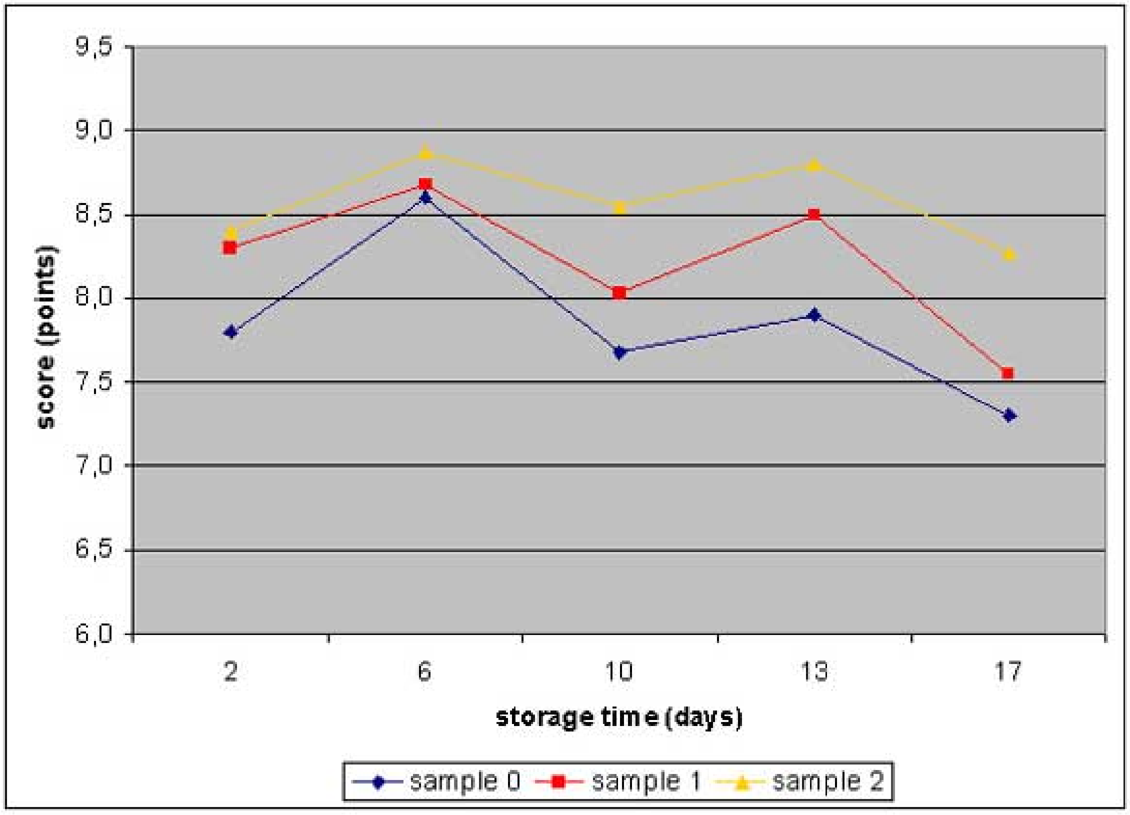

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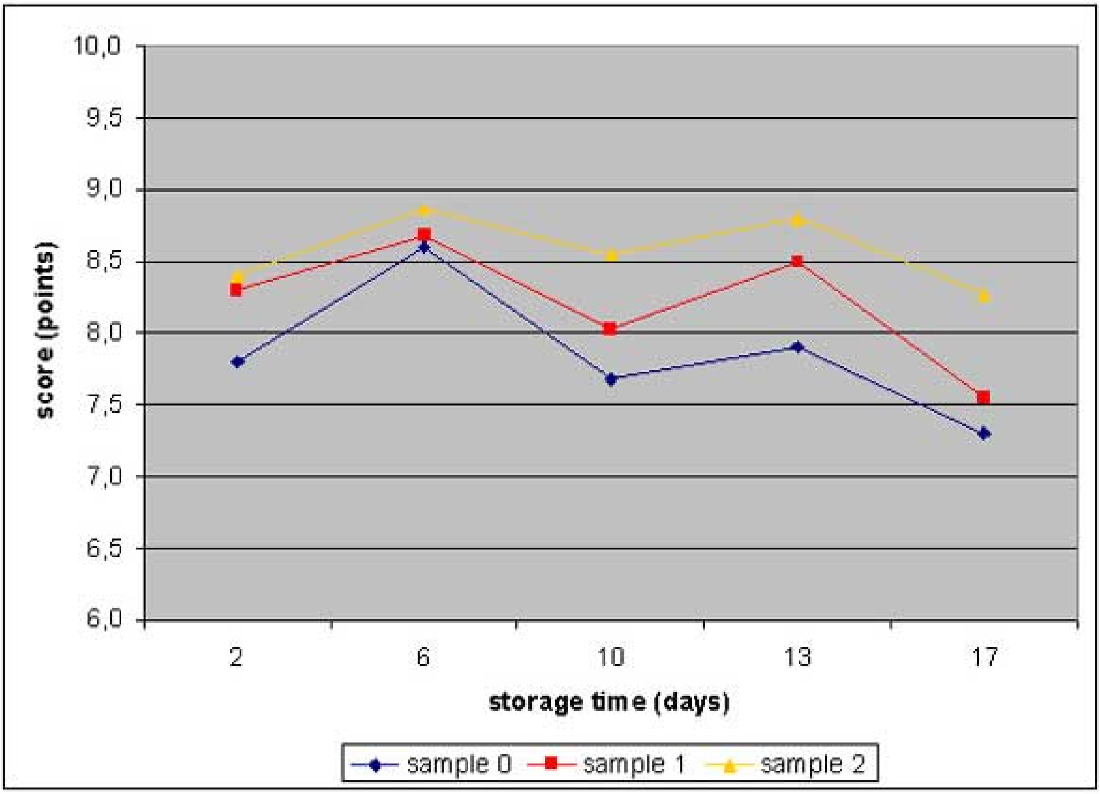
Fig. 5. Change of colour acceptance (typicality) determined directly 1 hour after light exposure (max score =10 points)



To take into consideration the possibility to change the colour of sausages by the use of "Vitmeat–C" addition it was necessary to check acceptability of this change by consumer. Results of evaluation of colour acceptability presented on figures 6 and 7 indicate similar observations as these obtained by the evaluation of colour typicality of examined sausages. The highest acceptability demonstrated colour of sausages contained "Vitmeat–C" preparation both evaluated immediately after cutting as well as after 1 hour exposition to the daily light. Especially important is a fact, that the addition of this preparation allows to improve high significantly the colour of meat product after its exposure to daily light. In comparison to other sausages this difference of acceptability remained on the same level at least 10 days.

Results of the sensory evaluation of sausage brightness are presented on Figures 8 and 9. Statistically significant differences between evaluated sausages were observed during whole time of storage.

As the results indicate, one hour after cutting significant different colour was observed in the case of control sample only. One hour exposure to daily light has increased colour brightness in the case of reference sample only.

Results of sensoric evaluation indicate higher differentiation of obtained data in comparison to results of instrumental evaluation.

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Fig. 6. Change of colour acceptance determined directly after cutting of sausage (max score =10 points)

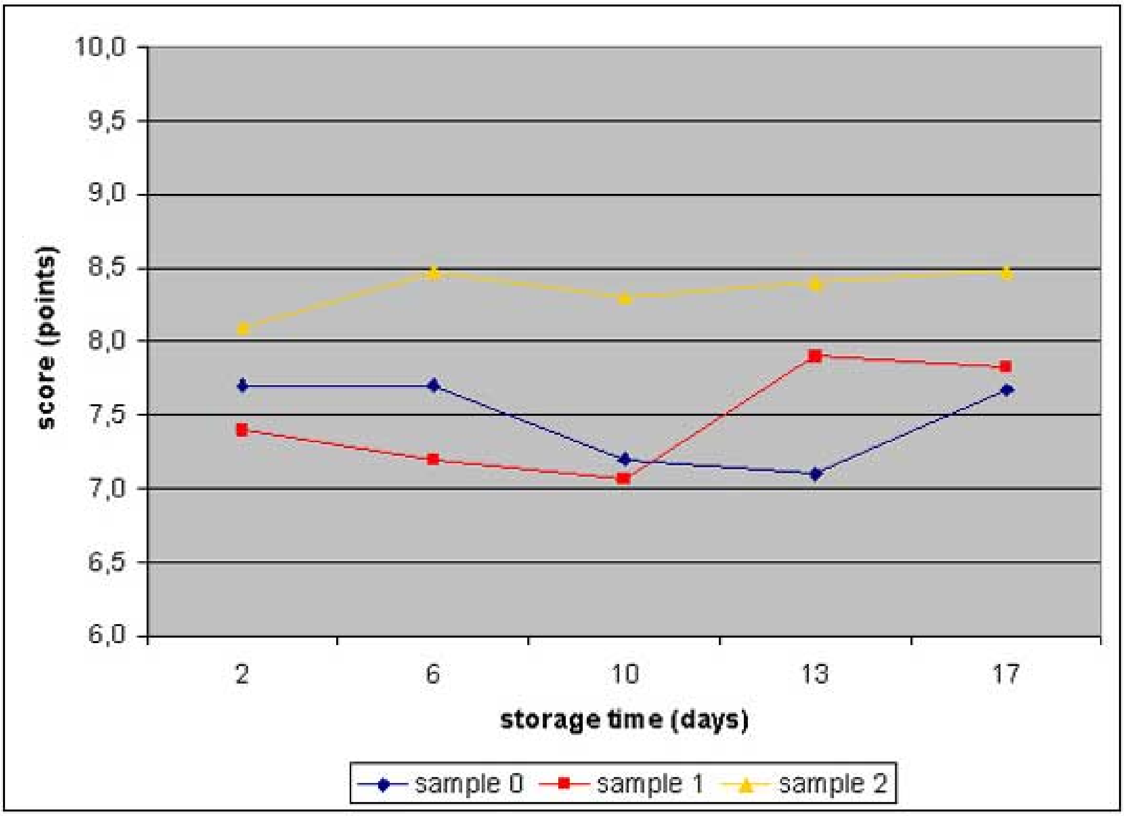

Fig. 7. Change of colour acceptance determined directly 1 hour after light exposure (max score = 10 points)

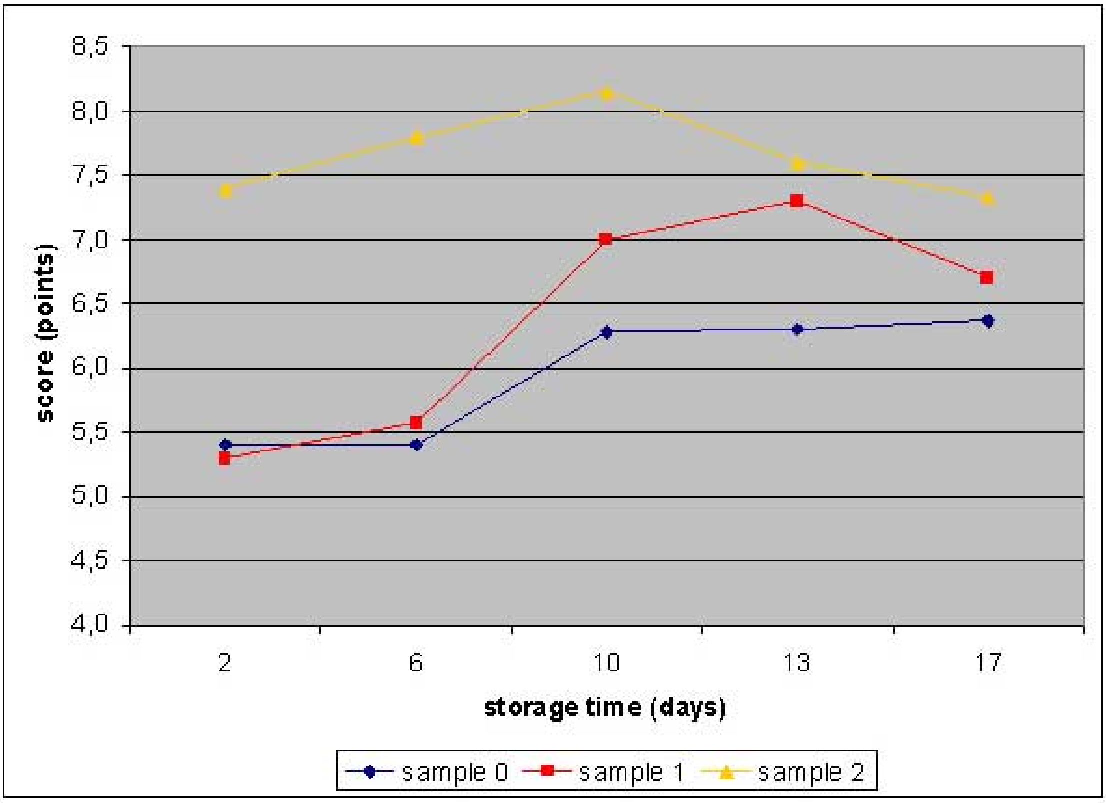

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Fig. 8. Sensory evaluation of colour brightness determined directly after cutting of sausage (to bright=0 point, to dark=10 point)

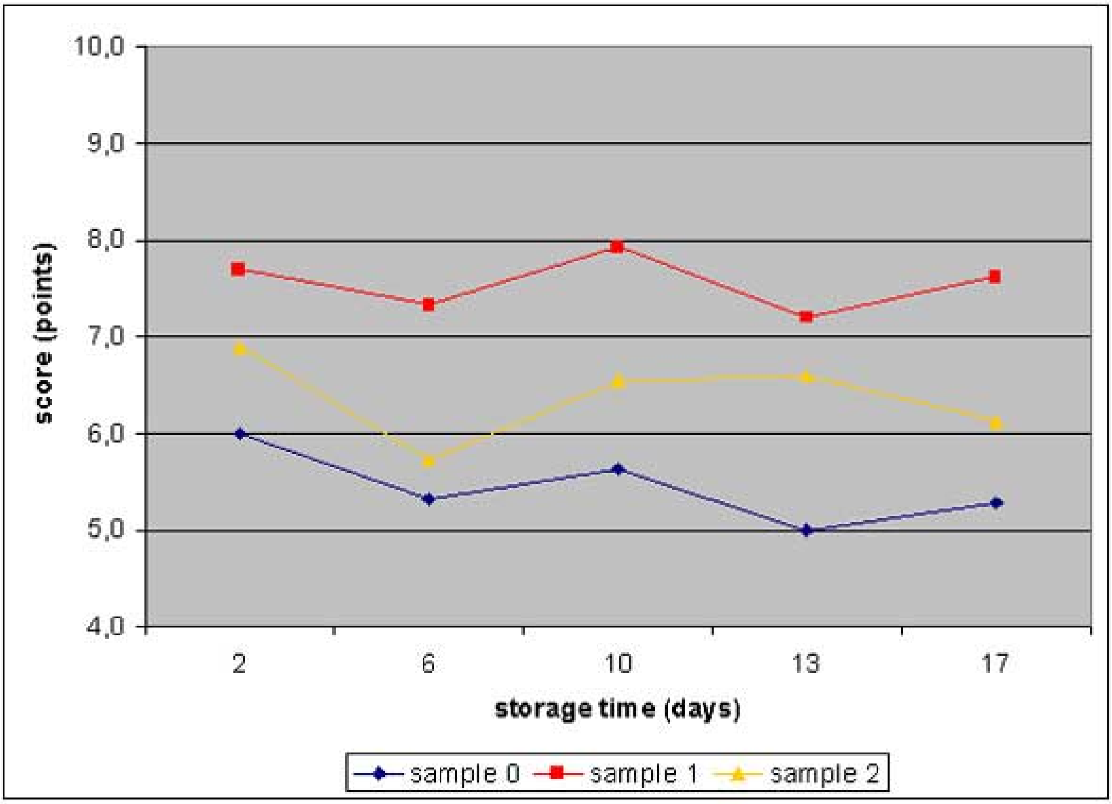
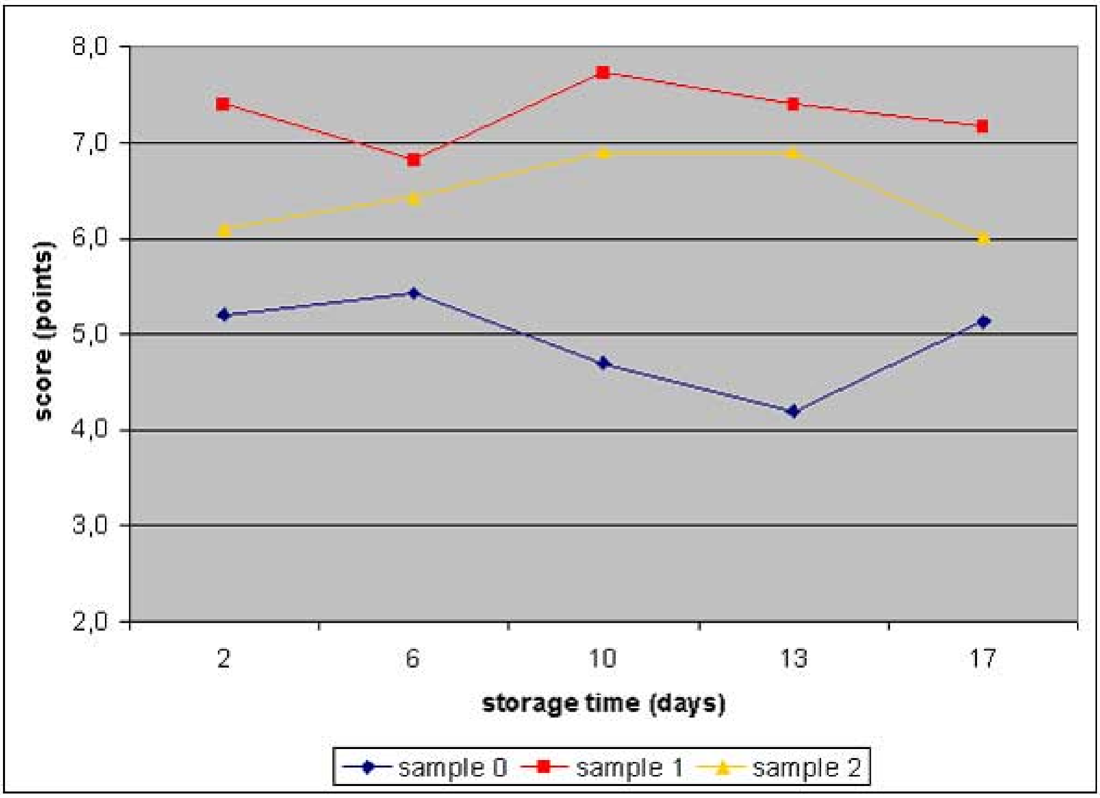


Fig. 9. Sensory evaluation of colour brightness determined directly 1 hour after light exposure (to bright=0 point, to dark=10 point)



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CONCLUSIONS

1. The quality of all sausages examined 2 days after production was evaluated as good.
2. The presence of 2% “Vitmeat–C” preparation in sausage formula inhibited the development of aerobic mesophilic bacteria.
3. The type of sample, storage time and exposure time significantly affected on psychometric saturation of colour of meat products expressed as C* - value.
4. Under conditions of this study changes of colour hue of experimental sausages in comparison to control sausage were not observed.
5. The colour of “bologna” type sausage contained “Vitmeat–C” preparation was evaluated as most typical and acceptable both immediately after cutting as well as after 1 hour exposure to the daily light.
6. In respect to colour acceptability in first 10 days of storage sausage contained additional amount of ascorbic acid was evaluated significantly higher by evaluation 1 hour after cutting.

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