FACTORS INFLUENCING COLOR STABILITY OF CURED COOKED MEAT PRODUCTS

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SUMMARY: The effect of meat quality parameters of technology, frozen storage of raw materials and some additives has been studied in experimental batches of Bologna-type sausage. In order to detect discoloration caused by light and oxygen sliced samples were compared after different exposure times. Samples were evaluated by tristimuli measurement, by visual color judgement and by spectrophotometry of extracted muscle pigments. In case of normal and DFD raw material the product showed better reddening if time elapse before cooking was longer, heat treatment more intensive. Frozen storage of raw material influenced reddening and color stability negatively. Further reddening has been detected during cold storage of the product. Ascorbic acid increased reddening, dextrose and glutamate had negative effect. Although light and oxygen induced discoloration was not slower in presence of factors promoting reddening, yet products with higher initial nitroso-pigment concentration stay longer acceptable in terms of color.

INTRODUCTION: Nitroso-hem pigment of cured meat products is sensitive to light and oxygen, that cause fading, brownish or greyish discoloration of sliced products /Erdman and Watts, 1957; Tarlagdis, 1962; Fox, 1966; Barton, 1967; Acton et al., 1986; Yen et al., 1988/. Processes responsible for discoloration take probably two steps. In the first step the nitroso group dissociates from pigment molecule induced by light and presence of oxygen /Tarlagdis, 1962/, followed by oxidation of nitroso-group /Tarlagdis,1962; Fox, 1966/. Light serves as energy source for oxidation. Some authors suggest that pirrol structure of hem may also be oxidized /Erdman and Watts, 1957; Tarlagdis,1962/.

Aim of our investigations was to study the factors influencing color stability of slices of cooked meat products induced by light, such as quality of raw material /normal, PSE, DFD meat, fresh and frozen pork/, technological parameters /time elapse before cooking, intensity of heat treatment/,additives /ascorbic acid, dextrose, MSG and blends thereof/.

MATERIALS AND METHODS: Bologna type sausage was produced of p.m.72 hours chilled /Exp.I. and III./ and 3 months frozen stored /Exp.II./ normal, PSE and DFD pork /M.semimembranosus/ and stuffed in 40 mm casing impermeable for water vapour. Experimental design is shown in table 1. Heat penetration

pattern is shown on fig. 1. In experiment III. meat product was prepared of normal pork, the sausage was cooked an internal temperature of 72°C after 2 hrs time elapse at ambient temperature. In this experiment different additives were applied /1: control, 2: ascorbic acid, 3: Tari Colpur 4o S (Giulini GmbH, FRG), 4: blend of ascorbic acid + dextrose + MSG, 5: dextrose, 6: MSG/. Samples were analysed immediately after cooking and after cold storage of 1 week /~5°/. Residual nitrite /Griess-Ilosvay/ and pH was measured. Slices of 1o mm thickness were used for examination of color stability, color measurements and visual color judgement, and slices of 1 mm for determination of pigment content. Slices im Petri-dishes were illuminated in day-light + 6 pcs of fluorescent light /4o W/ in 2 m distance. Samples were evaluated by tristimuli measurement /MOMCOLOR-D/, with reflectance method. Color of slices exposed to light was measured on 3 slices and 3 spots each after light exposures of o, 1, 2 and 4 hrs. On the basis of the results color stimuli were calculated in CIELAB system. The panel of 5 members carried out the ranking test /Kahen, et al., 1973/. Pigment content was determined according to Gantner /1959/6o/.

Table 1. - Experimental designe I.meat post mortem 72 h. /and II. meat frozen stored 3 months/

Sample	Meat quality I. and II.	Time elapse before cooking /h/	Heat treatment, 4o min at temperature /C°/
N 11	normal	2	72
N 21	normal	4	72
N 31	normal	24	72
N 12	normal	2	82
N 22	normal	4	82
N 32	normal	24	82
P 11	PSE	2	72
P 21	PSE	4	72
P 31	PSE	24	72
P 12	PSE	2	82
P 22	PSE	4	82
P 32	PSE	24	82
D 11	DFD	2	72
D 21	DFD	4	72
D 31	DFD	24	72
D 12	DFD	2	82
D 22	DFD	4	82
D 32	DFD	24	82

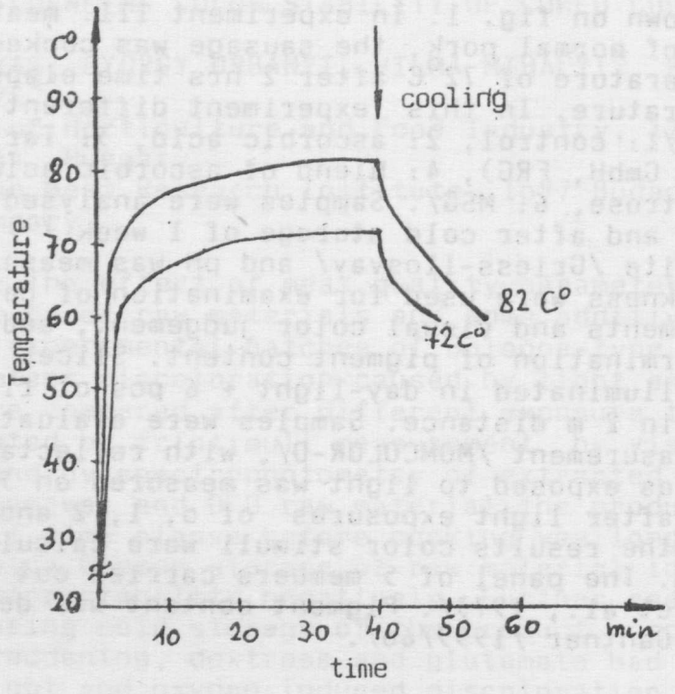


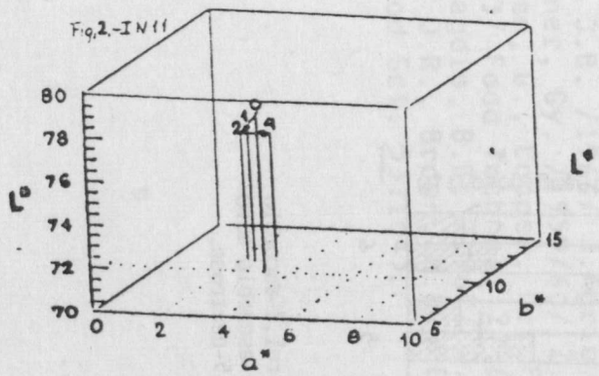
Fig.1.-Heat penetration patterns

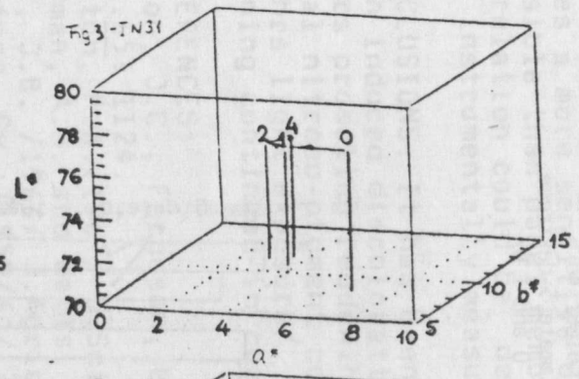
RESULTS AND DISCUSSION: Results of tristimuli measurement are shown on figures 2-1o. Changes in nitroso - and total pigment centent of samples prepared with different additives are shown on fig. 11.

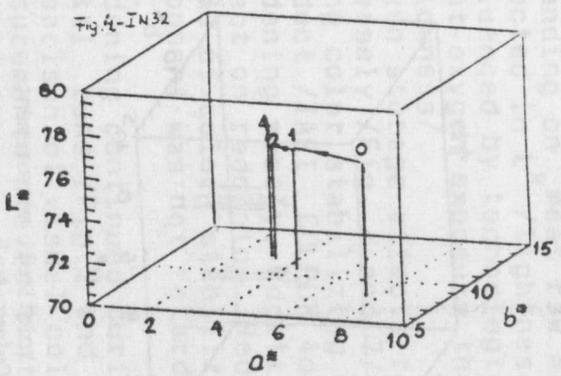
Basic conclusions are as follows:

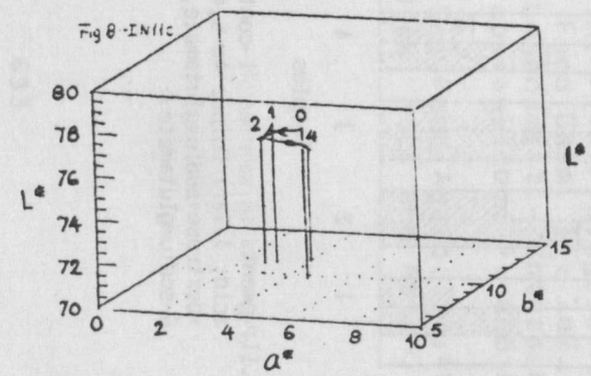
- Increase of time elapse before cooking /from 2-4 to 24 hrs/ is advantageous in terms of reddening if normal or DFD meat is used /Fig.2 and 3/.
- Higher temperature or more intensive heat reatment /4o mins at 82°C instead of 4o mins at 72°C/ also promoted reddening but longer time elapse before cooking proved to be more efficient /Fig.3 and 4/.
- DFD meat gave the most intensive red colored product, PSE gave the least intensive red color /Fig.3, 5 and 6/. Reddening of the product prepared of PSE meat was affected much less by time elapse before cooking and intensity of heat treatment than products prepared of normal or DFD meat.

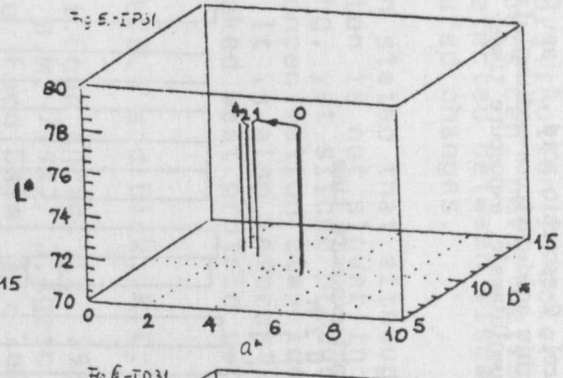
Figures 2.-8.- Values of tristimuli measurement

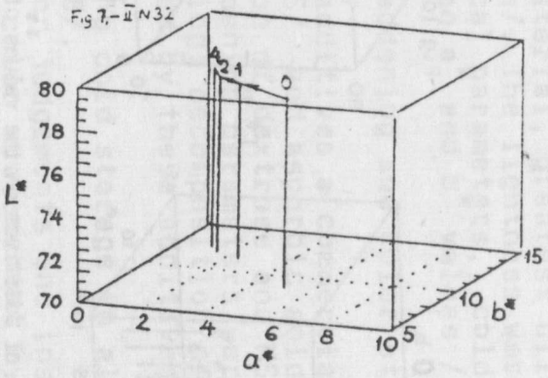


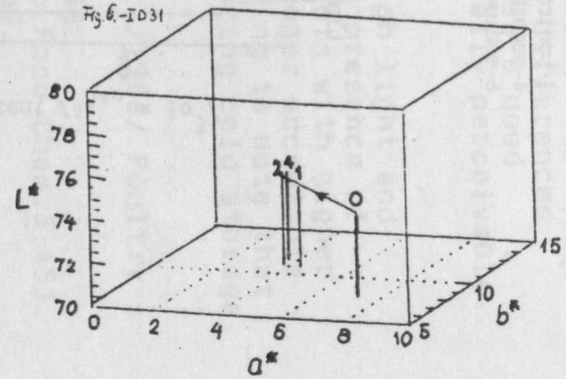




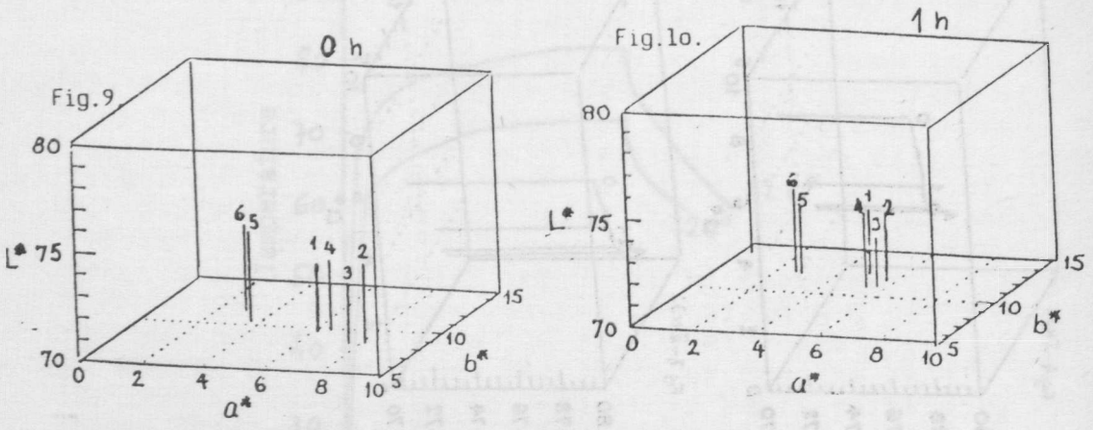








c: product, cold storage 1 week
0,1,2,4-hours of light exposure times



Figures 9.-1o. Effect of additives on the values of tristimuli measurement /1-control, 2-ascorbic acid, 3-Tari Colpur 4o S, 4-ascorbic acid+dextrose+sodiumglutamate,5-dextrose, 6-sodiumglutamate, exposoure times: 0 and 1 h/

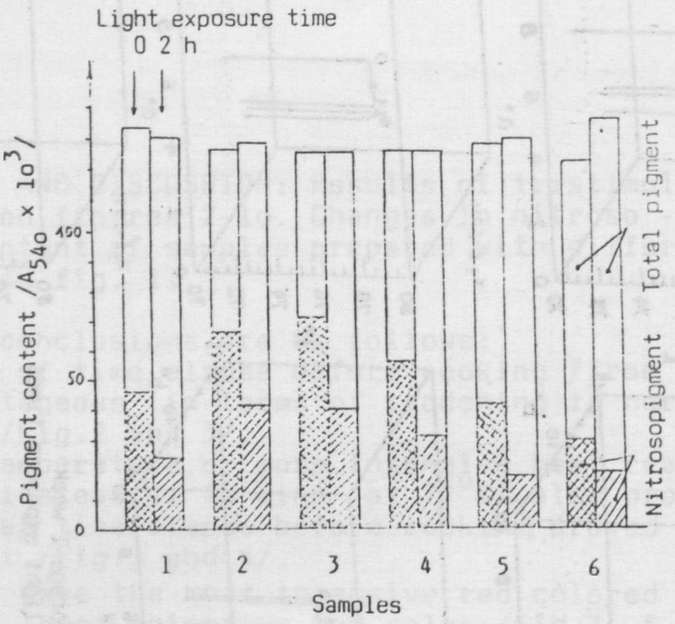


Fig.11. Pigments in samples /1-control,2-ascorbic acid, 3-Tari Colpur 4o S,4-ascorbic acid +dextrose+sodiumglutamate,5-dextrose, 6-sodiumglutamate/

- Depending on meat raw material, greatest differences were detected in L^* /lightness/. The lightness were far less influenced by technological parameters, cold storage, light-oxygen exposure than a^* and b^* values /redness and yellowness/.
- Frozen storage affects reddening and color stability adversely /Fig. 4 and 7/.
- Among color stabilizing additives a commercially available product /TARI COLPUR 4oS/ and ascorbic acid promoted reddening mostly. Addition of dextrose and MSG had an adverse effect on reddening. Reddening parameters were ineffective in terms of color stabilizing: decomposition of red color stimuli component was not retarded by these additives /Fig.9, 1o and 11/.
- Reddening continued during cold storage in all three experimental runs /Fig.2 and 8/.
- Comparison of visual color judgements and instrumental color measurements proved that color measurement by MOMCOLOR makes a more sensitive distinction in color differences possible than panel members can, nevertheless a good correlation could be detected between visually perceivable and instrumentally measured changes.

CONCLUSIONS: It has been stated that although light and oxygen induced discoloration is not slower in presence of factors promoting reddening, yet sliced products with higher initial nitroso-pigment concentration stay longer acceptable /1-2 hrs light exposure/. It is also interesting to note that reddening continued in cooked meat protein during cold storage.

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