Effect of natural antioxidants extracted from spices on quality of dry sausages

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Abstract

Oxidation of haem pigments during storage causes colour changes of dry sausages. Lipid peroxidation causes deterioration of quality and can accelerate the oxidation of haem pigments. Antioxidants extracted from spices can reduce the rate of both, the oxidation of haem pigments oxidation and the lipid peroxidation. These processes in dry cooked sausages were studied. To slowdown the peroxidation natural antioxidants obtained by extraction from rosemary (different concentration and fractions) were added. The colour was evaluated by using VIA; muscle tissue areas were thresholded and their colour was measured. Lipid oxidation was evaluated measuring thiobarbituric and peroxide value and by amount of oxidative products using liquid chromatography (RP-HPLC). During the storage, TBA value gradually increased, reached a maximum and then it decreased. The analysis by HPLC shows similar results. Colour changes (redness a* decrease) during exposition of dry sausages cuts to air and light is influenced by concentration of rosemary oleoresin, mostly by its light fraction. These rosemary antioxidants influenced also lipid oxidation; at higher concentration of oleoresin the carry-through effect is supposed.

Introduction

The oxidation of haem pigments and lipids cause the appearance deterioration and colour changes at dried/cooked sausages. During exposition of sausages cuts to light and oxygen these reactions are accelerated. The use of natural antioxidants from spices (e.g. rosemary, salvia, oregano) can be a suitable and natural way to reduce extends of such oxidations [Suhaj 2006].

Rosemary extracts contains specific phenolic compounds, e.g. rosmarinic acid, carnosol, caffeic acid etc. which are able to stabilize free radicals and break the oxidation chain. Effectiveness of spice extracts is often higher to synthetic antioxidants in dependence of medium which they should affect in (water, oil...) [Yanishlieva et al. 2006]. The rosemary extracts, containing phenolic compounds, are shown as efficient antioxidants for dry fermented sausages [Dragojev et al. 2007]. These antioxidants suppress the lipolytic processes during production of fermented sausages [Dragojev et al. 2006].

The complicated structure of roughly grained dry sausages and different kinetics of colour changes in different sausages layers makes it difficult to measure colour using classical reflectance spectrophotometry. Video image analysis can help to select individual meat particles and to measure separately its colour, i.e. to evaluate only muscle particles. [Pipek et al. 2004].

Experimental

The colour changes and lipid oxidation in cooked/dry sausages during storage were studied as influenced by rosemary extracts addition. Besides, the colour changes were measured during exposition of the sausage cuts to lights and air.

Materials

Dry/cooked sausages (standard production) were prepared with addition of different fraction of rosemary extract: light fraction, heavy fraction and complete extract (see Table I). After production and necessary drying (under a_w<0.93) the whole sausages were stored under room temperature and in definite intervals they were analysed for degree of lipid oxidation and colour changes. For evaluating of colour stability during exposition to light and air, the sausages were cut and the slices exposed to ambient air oxygen in dark or under light of two fluorescent tubes.

Symbol	Antioxidant	g.kg-1
R1	Standard rosemary oleoresin	0,6
R2		0,4
R3		0,3
R4		0,2
R5		0,1
R6	Heavy fraction	0,3
R7	Light fraction	0,3
C	Control	-

Methods

Colour evaluation using VIA. The surface of the exposed slices was scanned using scanner HP Scanjet 5470c and the images were evaluated using VIA software NIS-Elements 2.20 (Laboratory Imaging Prague). After thresholding of muscle particles their colour was measured and expressed as lightness L*,

redness a*, yellowness b*, mean red (R), mean green (G) and mean blue (B); the ratio of red r = R/(R+G+B) was calculated.

Lipid oxidation was evaluated by TBA test and by HPLC in reverse phase. Thiobarbituric number (TBA) was determined spectrophotometricaly at 538 nm after distillation of sample with vapour and reaction of distillate with 2-thiobarbituric acid in hot water bath. Oxidation product content in lipids part was determined in petrol ether extract (after Soxhlet) by HPLC in reverse phase with spectrophotometric detection (210.8 nm).

Results and discussion

The colour of sausages changed during storage, as due to exposition of sausage cuts to air and light. Video image analysis proved to be a suitable method to evaluate colour in complicated heterogeneous structure of dry cooked sausages. The selection (thresholding) of muscle particles enabled to study in detail their colour. The storage time of whole intact sausages has little effect on colour, mostly due to water evaporation and haem pigment concentration, which resulted in a darker colour (decrease of lightness L*). The addition of rosemary extract has minimal influence on this darkening. In the opposite lipid oxidation changed during storage (see below).

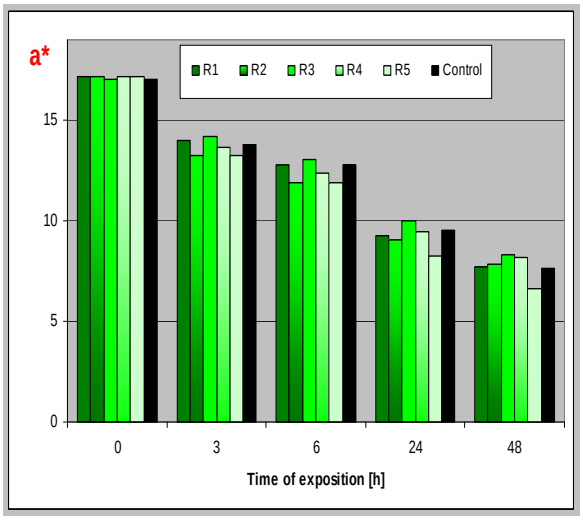

Figure 1. Effect different concentrations of rosemary extract on dry sausage colour during exposition to air and light

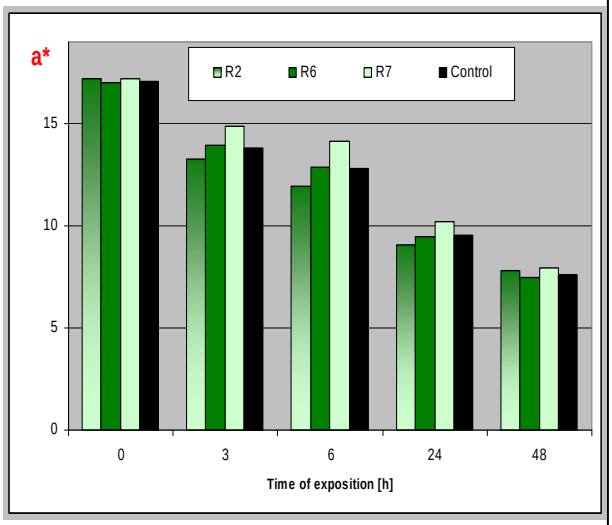

Figure 2. Effect different fractions of rosemary extract on dry sausage colour during exposition to air and light.

Most apparent is the decrease of redness a* during first 48 hours after cutting. The rosemary addition influenced the decrease of redness the most effective being the concentration 0,2-0,3 g/kg (see Fig.1), in comparison to different fractions, the most effective in suppressing the redness decrease being the light fraction (see Fig.2). In the opposite no effect was observed at the samples with the heavy fraction of oleoresin. Practically the same results were found at rate of red colour r.

The lipid oxidation was evaluated after TBA test and HPLC. Both methods provided similar results. During first two weeks the concentration of oxidation products (1,3-propandial and other) increased, especially at the samples with high concentration of rosemary oleoresin (see Fig.3), probably due to carry-through effect (overdosage of antioxidants causes transformation of theirs antioxidant properties to prooxidant). This increase was higher at the standard oleoresin and heavy fraction (see Fig. 4). In the opposite, the oxidation of control samples was retarded and was more apparent during second and third week. The rapid increase at the samples, where rosemary antioxidants were added, was followed by decrease under initial values. It can be supposed due to the recombination of oxidation products with other compounds of sausages. These changes have to be studied in detail.

Conclusions

Colour changes (redness a* decrease) during exposition of dry sausages cuts to air and light is influenced by the concentration of rosemary oleoresin, mostly by its light fraction. These rosemary antioxidants influenced also lipid oxidation; at higher concentration of oleoresin the carry-through effect is supposed.

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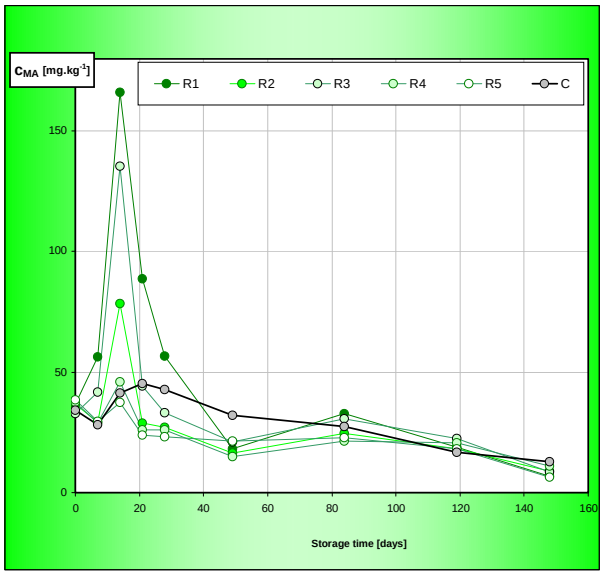

Figure 3. Effect different concentrations of rosemary extract on lipid oxidation (TBA) in dry sausage during storage.

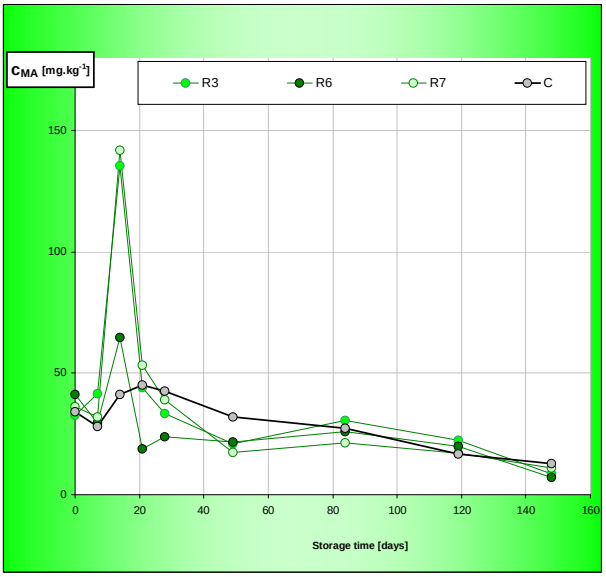

Figure 4. Effect different fractions of rosemary extract on lipid oxidation (TBA) in dry sausages during storage.

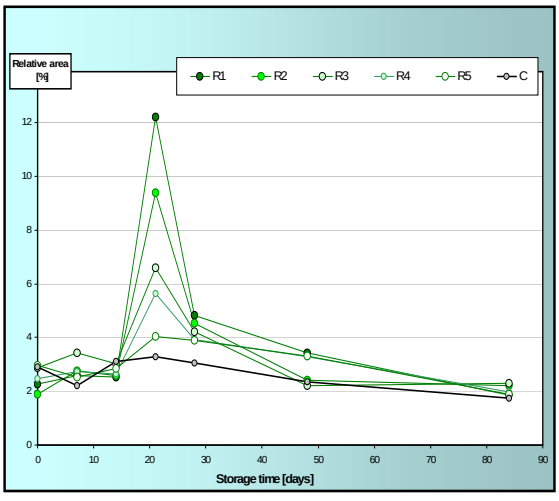

Figure 5. Effect of different concentrations of rosemary extract on lipid oxidation (HPLC) in dry sausage during storage.

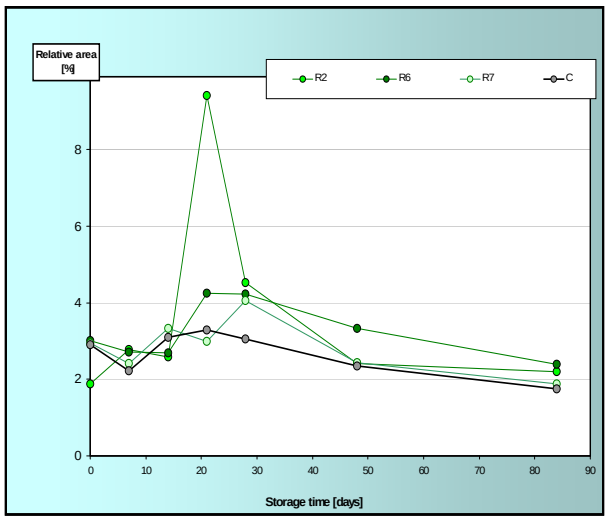

Figure 6. Effect different fractions of rosemary extract on lipid oxidation (HPLC) in dry sausages during storage.