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THE EFFECT OF CARBONATE PREPARATIONS ON THE RHEOLOGICAL PROPERTIES OF MEAT BATTER AND ON SAUSAGE QUALITY

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ABSTRACT

The effect of three different carbonate preparations BTC, OPREN and QTR on the rheologic properties and quality of meat batter and comminuted sausages was studied. Meat batters and the manufactured comminuted sausages were used as experimental material. Carbonate preparations were added to the batters according to the instructions of the producers. Sausage batters were analysed 4 to 5 hrs and the sausages 24 hrs after their production. Carbonate preparations added during meat chopping operation were found to increase pH value and decrease thermal drip in the batter whereas sausage texture and sensory quality were not worsened in comparison with the control sausage. Carbonate additives increased considerably the yield of finished products. The experimental findings demonstrated that the examined carbonate preparations may be used in the commercial production of comminuted sausages.

Key words: functional additives, carbonate preparations, comminuted sausages

INTRODUCTION

Carbonates have been widely used in the food industry. They can also be found among additives used in meat chopping operations since they increase hydrogen ion concentration (pH) in meat above the isoelectric point of muscle proteins and, thus, make their water-holding capacity higher (Hammer, 1993; Rutkowski *et al*., 1993). During meat batter production, however, a strong alkalization has to be avoided since it can cause fat saponification. To prevent that reaction an additive of ascorbic acid is required. The elevation of pH value by 0.5 markedly improves water holding capacity of meat batter. The appearance and properties of the chopped meat with added carbonates is similar to that with added phosphates. The ascorbic acid may not be added during chopping because the batter will not reach the desired quality. For that reason the particles (crystals) of the ascorbic acid must be covered with a thin layer of fat having high melting point, thus fat will melt during sausage cooking and in this way the acid will be released (Rock and Vosgen, 1993; Vosgen, 1993). The neutralization of carbonate follows and the excess of ascorbic acid reduces the nitrites too. That reaction results in faster and more effective meat curing process and in good colour fixation. According to the opinion of manufacturers of the functional additives used in meat chopping, the sausages produced with added carbonates did not differ in taste, odour, texture and colour from the controls. On the other hand, sausages with added carbonates demonstrated dense structure, a lack of fat or gel seepage, smoth surface on the cross-section and higher yield of the finished product (Roch and Vosgen, 1993). The use of carbonates made the reduction of phosphates content in the product possible (Dolata, 1995).

The objective of this study was the comparative assessment of the effect of three carbonate preparations: BTC of Moguntia Comp. (Germany), QTR of Novichem Comp. (Poland) and OPREN an experimental preparation, on the rheologic properties and quality of meat batter and comminuted sausages.

MATERIALS AND METHODS

Meat batter and a model comminuted sausage produced from: porcine meat of Grade III (46%); small pieces of lard (20.5%); water (29%) and salt with curing agents (2.0%) were used as control samples. The specified above carbonate preparations were added to the particular experimental groups in the following quantities, BTC: 1,7%, OPREN: 0.075%; QTR: 0.5% of the meat-and-fat weight. Those quantities were recommended by the manufactures of all preparations.

The sausages were produced on semi-commercial scale. Meat and fat were separately ground in a meat grinder, type W-82, using punched-plate screen with holes of 3 mm diameter. The ground meat was wet-cured with curing mixture used in the quantity of 2% of meat weight and thereafter stored under refrigeration at 4-6°C for 24h. The ground lard was kept under the same conditions. The raw materials were comminuted in a laboratory bowl chopper and seasonings, ice and a carbonate preparation were added to each batter. Chopping operation lasted for 8 min. and batter temperature was below 12°C. Polyamide sausage casings of 22 mm diameter were stuffed with the particular kinds of batter, using hydraulic stuffer of Mainca Comp. Smoking and cooking procedure of sausages was conducted in ATMOS equipment and followed by chilling in water and refrigerated storage at 4-6°C for 24 hrs.

In the meat batters the pH value, free water content, thermal drip and viscosity were determined on the day of production.

The concentration of hydrogen ions was measured using pH-meter type N-123.

Free water content was determined by blotting paper technique, developed by Volowinska and Kelman (1961).

Thermal drip was determined according to Kijowski and Niewiarowicz (1978) by measurement of water and liquid fat released during sausage heating.
Apparent viscosity was measured in the rotation viscosimeter Rheotest 2 type RV using cutting velocity D = $1s^{-1}$(Dolata, 1992).
Water content was determined by drying to constant weight and fat content by Soxtlett method (Budslawski, 1992).
Sausages were examined after 24h of refrigerated storage. Texture was determined in INSTRON 1140 universal testing instrument. TPA test was used and samples of $2.2x10^{-2}$ m diameter and $2.0x10^{-2}$m height were squeezed twice to reach 50% of their initial height (Bourne, 1966, 1978), whereas the head movement velocity during TPA test amounted to $5x10^{-2}$m/min. The prepared diagram of the general profile of texture was used to determine elasticity (mm) and cohesion of samples. The cutting test of samples of $2.2x10^{-2}$m diameter was carried out with Warner-Bratzler knife of 0.5 m/min cutting rate and the maximum cutting force (N) and cutting work (J) were measured (Voisey and Hansen, 1967). INSTRON 1140 instrument was connected through the interface with a computer to prepare an examination programme, to record the results on a disc and to carry out statistical analysis of the experimental findings.
Sensory analysis of sausages quality was performed using five-score scale (Barylko-Pikielna, 1975). The following quality characteristics were evaluated sausage appearance on the surface, colour on cross-section consistency texture and flavour. The sensory panel consisteded of five persons each time.

RESULTS

The results of experiments were subjected to the bifactor analysis of variance and the data are presented in Figures 1-8.
The analytical results of sausage batter revealed an appreciable increase of pH value by the used carbonate preparations in comparison with the control sample. The highest pH value was found in the batter with added OPREN preparation (Fig.1). No statistically significant differences with regard to free water content were noticed between control batter and the batters with added particular carbonate preparations (Fig.2).

Figure 1. pH

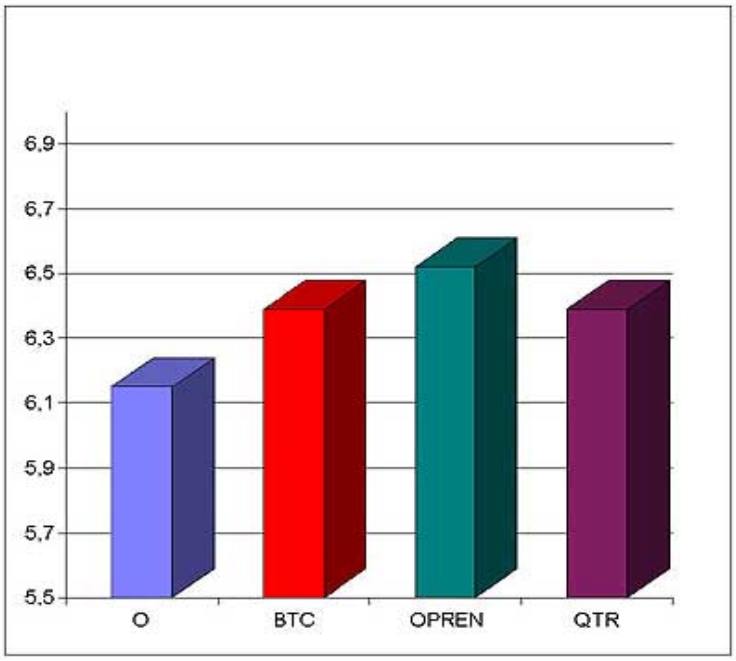
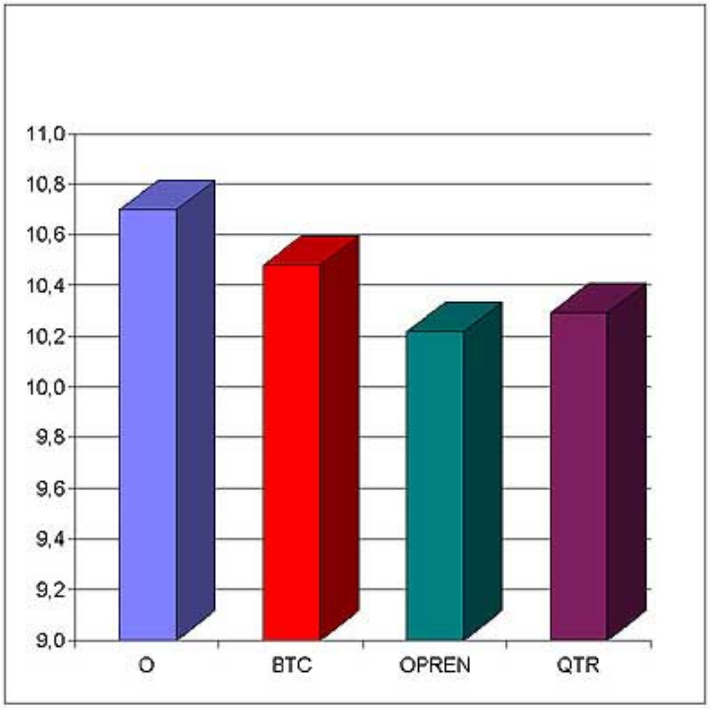


Figure 2. Free water



On the other hand, highly significant differences were observed in the thermal drip between the control sausage batter and all sausage batters containing carbonate preparations. The highest value of thermal drip was found in the control sample, however, no statistically significant differences were noticed between sausage batters containing OPREN or QTR preparations (Fig.3). No statistically significant difference was noticed in the apparent viscosity between the control sample and the experimental sausage batters (except the batter with added BTC). Statistically significant difference, however, was found in viscosity between sausage batters with BTC or QTR preparations added (Fig.4).

Figure 3. Thermal drip [ml/100]

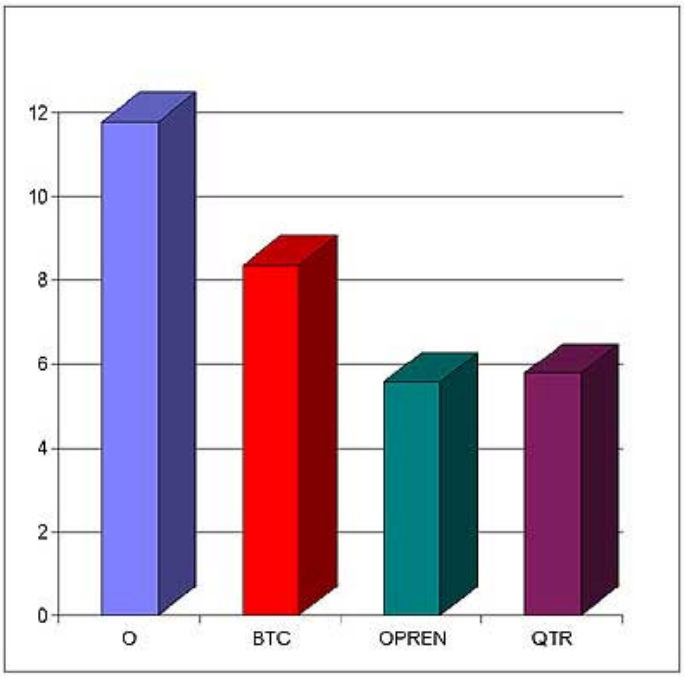
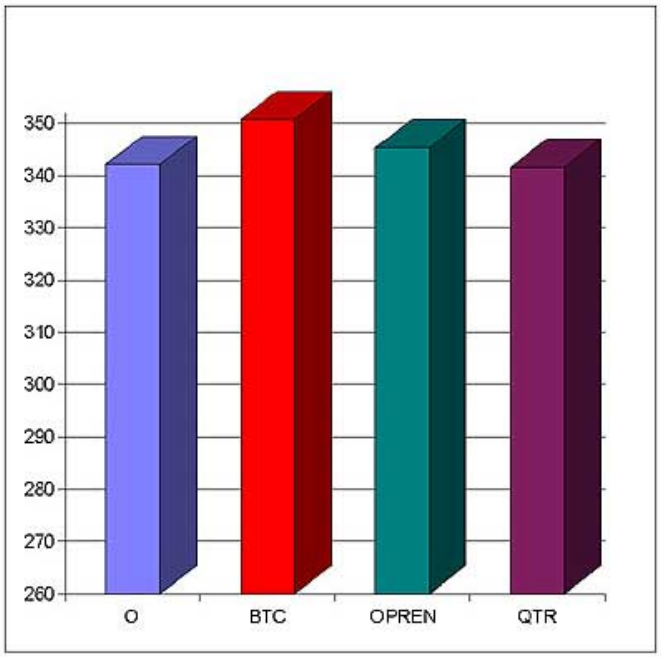


Figure 4. Viscosity [Pa*s]



The samples of the control sausage examined for texture demonstrated higher values of cutting force, elasticity and cohesion in comparison with the sausage batters with added carbonate additives. On the other hand, statistically significant differences between the control and the experimental sausages occured only with regard to the cutting force (Fig.5). In the case of cohesion (Fig.6) and elasticity (Fig.7), despite the lower absolute values, no statistically significant differences were noticed in comparison with the control sample.

Figure 5. Shear force [N]

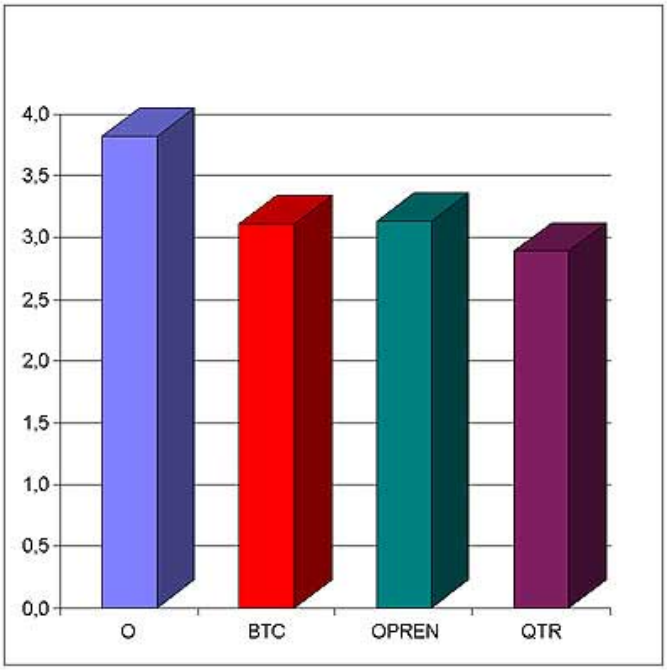


Figure 6. Cohesivenees

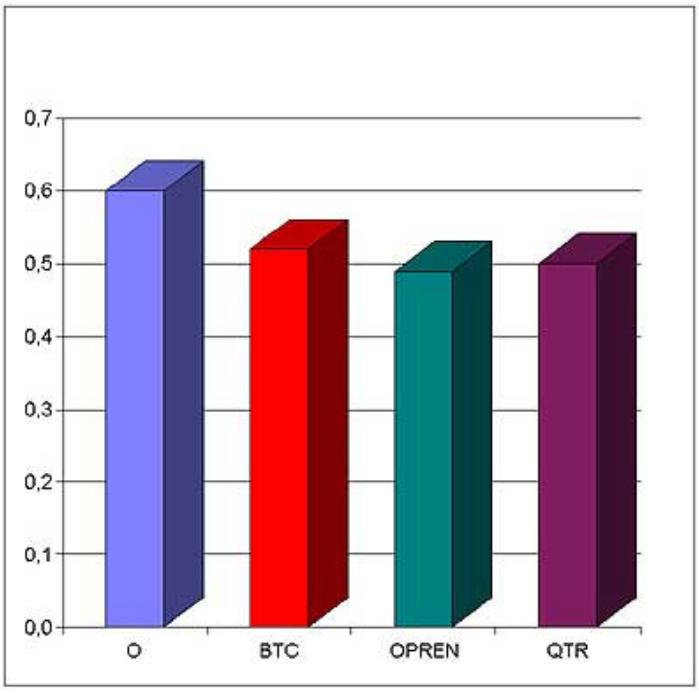
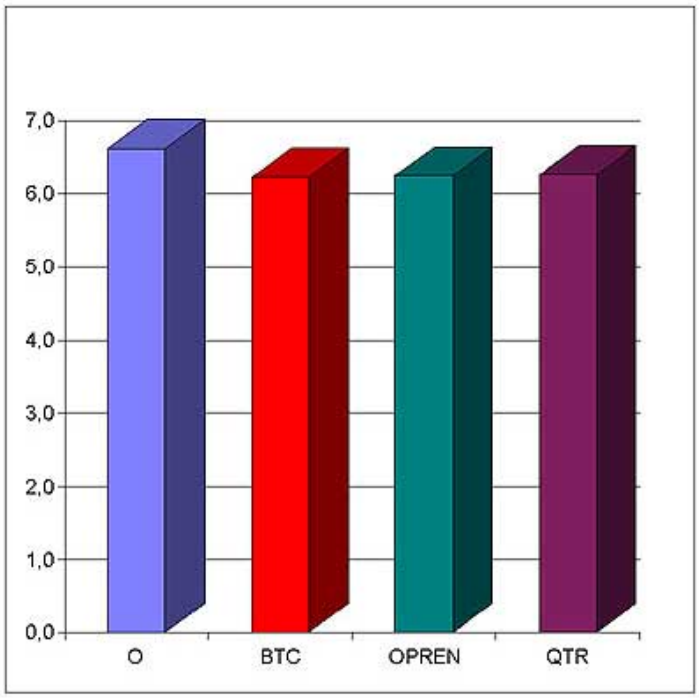


Figure 7. Elasticity [mm]



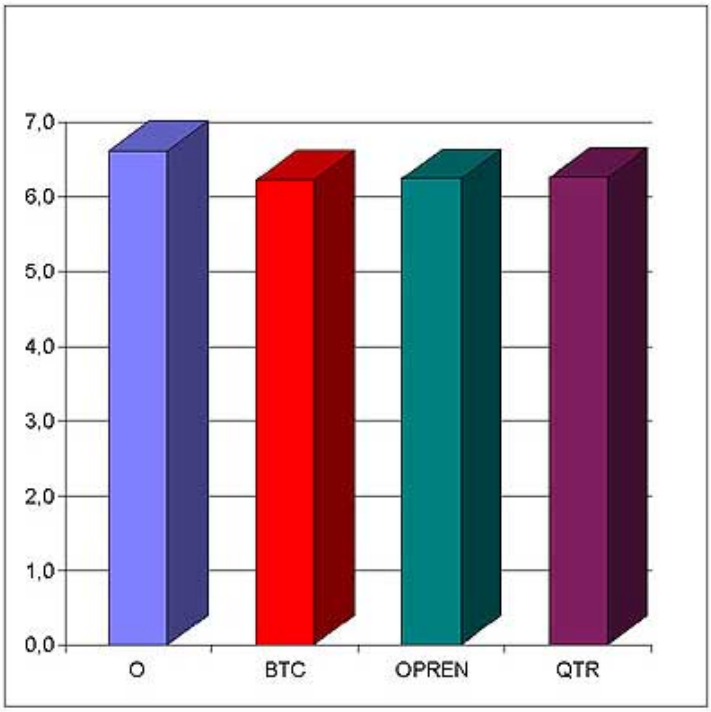
The results of sensory analysis (Tab.1) demonstrate that sausages with added carbonate preparations obtained total quality scores at similar level (BTC: 4.28; PREN: 4.17; QTR: 4.25) and showed no statistically significant difference when compared with the control sausage (4.3). The sausage with added QTR preparation obtained the highest sensory scores for surface appearance. Sausages having batters with added BTC and OPREN were also scored higher than the control sausage (4.23). The results of sensory evaluation of sausage juiciness were at a similar level.

Table 1. Mean values of selected sensory analisis parameters (5 point estimation)

Parameter	Unit	Option				LSD
		Control	BTC	OPREN	QTR	=0.05
Appearance external	point	4.23	4.33	4.40	4.43	0.30
Cuffed serrface colour	point	4.37	4.20	4.03	4.27	0.18
Consistency	point	4.40	4.20	3.90	4.15	0.21
Juiciness	point	4.23	4.33	4.27	4.24	0.29
Flavour	point	4.30	4.32	4.23	4.17	0.27
General evaluation	point	4.30	4.28	4.17	4.25	0.25

Carbonate preparations used in the production of comminuted sausages increased significantly the finished product yield. The data in Figure 8 show that in all experimental groups the product yield was found higher than that in the control group where the yield amounted to 114.2%.

Figure 8. Production yield [%]



CONCLUSIONS

1. Carbonate preparations added to the batter increased the pH value and reduced the thermal drip significantly.
2. Texture assessment of all sausages revealed no statistically significant differences except the cutting force.
3. Sausages produced with added carbonated preparations and evaluated by a sensory panel demonstrated no significant differences in the sensory attributes in comparison with the control sausage.
4. Finished product yield was found higher in the sausages with added carbonate preparations than in the control sausage.

5. The experimental results indicate that the examined carbonate preparations may be used in the commercial production of comminuted sausages.

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