INTRODUCTION

Oxidation processes of meat constituents and meat products occurring during their storage affect a change in colour through oxidation of myoglobin and oxidative changes of lipids [Morrissey et al., 1998]. Meat products are enriched with compounds exhibiting antioxidative activity in order to increase oxidative stability as well as to obtain products with an enhanced activity of antioxidants [Ahn & Nam, 2004]. An interesting cereal applicable in meat products may be oat, since it contains a rich complex of antioxidants both hydrophobic and hydrophilic in character [Bratt et al., 2003; Mattila et al., 2005; Marténez-Tomé et al., 2004]. They include, among others, phenolic acids, avenaromides, flavonoids, tocopherols, and inositol phosphates.

The study was aimed at evaluating the effect of roasted oat addition on the oxidative stability of comminuted meat products during their 30-day storage. A hypothesis was advanced that natural compounds with antioxidant activity present in oat are likely to inhibit oxidation processes in meat products.

MATERIAL AND METHODS

The experimental material were model comminuted meat products with the following basic recipe formulation: 25% of cured beef, 25% of cured pork, 20% of minced pork fat and 30% of water/ice. The following products were prepared: control products (PK), a product with 0.05% addition of sodium ascorbate (PA), and products supplemented with naked oat grain at a dose of 2% (PO2) and at a dose of 5% (PO5). The naked oat used in the study was previously roasted in an oven to a temperature of 100°C and ground to powder. Meat and trimming fat, after comminution in a grinder through a plate with mesh size diameter of 3 mm, were chopped in a laboratory apparatus Robot-Cupe (model R3V.V.) at 1500 rpm by adding to the chopper’s bowl first meat followed by water/ice and fat, and finally roasted oat. The final temperature of the batter obtained in the chopping process did not exceed 14°C. The batter was then transferred into glass jars (50 mm in diameter and 80 mm in height), next the jars were pasteurized in water until internal temperature of the sample has reached 70°C. Than, the products were chilled with cold water, stored under chill conditions for 24 h and subjected to analyses.

Measurement of acidity. Measurements of pH were carried out with a CPC–501 digital measuring instrument (ELMETRON) and a combined electrode type ERH–111 [PN–ISO 2917:2001].

Measurement of redox potential. The redox potential was determined according to the method of Nam & Ahn [2003] using a combined electrode type ERPt-13 and a digital measuring instrument CPC–501 (ELMETRON).

Measurement of colour parameters. Measurements of colour parameters were performed with the reflection method using a spherical colorimeter (X-Rite), using illuminant D65 and 10° observer angle. White reference standard (L*=95.87, a*= -0.49, b*=2.39) was used as a reference. Results were expressed in the CIE L*a*b* system. The total change of samples colour over 30-day storage was computed using the following formula: ∆E = √(ΔL*² + (Δa*)² + (Δb*)²) [Kłossowska & Tyszkiewicz, 2000].

Lipid oxidation determinations. The lipid oxidation was determined by assaying values of TBA number according to the method of Pikul et al. [1989]. Intensity of colour produced in the reaction of malondialdehyde with 2-thiobarbituric acid was measured with a digital spectrophotometer at a wavelength of 532 nm [Kłossowska & Tyszkiewicz, 2000].
bituric acid was measured by means of a Nicole Evolution
300 spectrophotometer (Thermo Elektron Corporation) at a
wave length of 532 nm. The value of TBA was expressed in mg
of malondialdehyde per 1 kg of meat product.

**Mathematical and statistical analysis of results.** De-
terminations of the parameters analysed were carried out in
3 replications. The experiment was carried in two replications.
The results obtained were analysed statistically. Significance
of differences between the mean values was determined at a
significance level of $\alpha \geq 0.05$ with the Tukey’s t-test.

**RESULTS AND DISCUSSION**

The results obtained demonstrated a significant ($\alpha \geq 0.05$)
effect of roasted oat supplement on values of the examined
parameters of meat products during their storage. The pH
values of meat products with the addition of oat (PO2 and
PO5) were significantly higher after 1 and 15 days than the
pH values noted for the control product (PK) and the prod-
uct with sodium ascorbate (PA), (Figure 1). After 30 days
since production, the pH value of products supplemented
with oat and sodium ascorbate was observed to decrease,
whereas that of the control product – to increase. Acidity is
a key parameter determining the quality of meat products,
among others their colour. Investigations by Livingston &
Brown [1981] demonstrated that a drop in meat pH results
in an increased content of metmyoglobin in meat, which af-
fected colour deterioration.

Values of the redox potential (Figure 2) were decreasing
for all experimental variants along with the time of storage
proceeding. The lowest values of the oxidation-reduction po-
tential, changing negligibly within the 30-day storage period,
were reported for the product with 0.05% addition of sodium
ascorbate (PA). The addition of oat affected a reduction in the
redox potential of comminuted meat products (samples PO2
and PO5). The potential’s values were observed to decrease by
c. 40 units after 15 and 30 days of storage in the case of the
sodium ascorbate-supplemented product as compared to the
control one. In addition it was observed that the greater the
oat supplement, the lower the value of redox potential. Ahn
& Nam [2004] demonstrated that beef supplemented with
0.1% of ascorbic acid was characterised with a lower value of
the redox potential than the control sample. In addition they
observed that a low level of oxidation-reduction potential af-
fected the maintenance of heme pigments in a reduced form,
which resulted in smaller changes in the colour of meat.

Results of measurements of TBA in the experimental meat
products (Figure 3) demonstrated that changes proceeding in
fat of the control product were substantially higher as com-
pared to those observed for the products supplemented with
oat and sodium ascorbate. It may point to a protective ef-
fact of oat components on metabolism of fat of comminuted
meat products during their chill storage. After 30 days since
production, the lowest value of the fat oxidation index, ac-
counting for 1.1 mg/kg, was reported for the product with 5%
addition of roasted oat (PO5). It may be assumed, then, that
antioxidants delivered with oat prevent deterioration process-
es of fat. Thus, it seems advisable to incorporate whole oat
grains into meat products since the content of compounds
with antioxidative activity is higher in those parts of a ker-
nel which are separated in the milling process [Decker et al.,
2002]. A research by Sánchez-Escalante et al. [2001] demon-
strated that the application of ascorbic acid proved ineffective
in preventing lipid oxidation in meat products.
Oxidation stability of meat products

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Oceniano wpływ dodatku rozdrobnionego oswa poddanego prażeniu w temperaturze 100°C na stabilność oksydacyjną drobno rozdrobnionych wyrobów mięsnych podczas ich chłodniczego przechowywania. Wykazano, że wartości potencjału oksydoredukcyjnego wyrobów z udziałem oswa były niższe podczas 30-dniowego okresu przechowywania w porównaniu do wartości uzyskanej dla wyrobu kontrolnego. Wyrobę wzbogaconą w dodatek roślinny charakteryzowały się ponadto wyższą stabilnością barwy w porównaniu do wyrobu kontrolnego. Uzyskane wartości wskaźnika TBA doświadczalnych wyrobów mięsnych sugerują, że zastosowany preparat oswa działa ochronnie na tłuszcz, hamując jego wzbogacone w dodatek roślinny charakterystyka. W porównaniu do wyrobów kontrolnych obserwowano również niższe wartości potencjału oksydoredukcyjnego w okresie przechowywania.

REFERENCES


STABILNOSĆ OKSYDACYJNA DROBNO ROZDROBNIONYCH WYROBÓW MIĘSNYCH Z UDZIAŁEM OWSA

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