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Characterization of the properties of cereal cookies with reduced ochratoxin content

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INTRODUCTION & AIM

Cereals are recognized to be the most important agricultural products in the world, both as human foods and as the main constituent of animal feed. In order to meet the requirements of a growing world population, global production and yield of cereals has been increased for the last 50 years. Major types of cereal grains include maize, rice, wheat, barley, millet and oats. However, analysis of nutritional, chemical, and physical properties of oat grains, with emphasis on β-glucans, has led to its appreciation in human nutrition, mainly due to its health-promoting properties, including cholesterol-lowering, blood glucose-stabilizing, anti-cancer, and anti-inflammatory effects. Worldwide significance and extensive use of cereal grains and their products makes cereals preservation and decontamination one of the most crucial food safety issues. Therefore, cereals microflora and its toxic metabolites are being more important not only to the scientific community, but also food processing industries, which is mainly due to the need to fullfill higher quality standards and legal regulations that have been imposed on food companies. Mycotoxins are low molecular weight fungal secondary metabolites that pose a threat as toxic contaminants of food products, thereby necessitating their effective monitoring and control. Reports regarding the presence of mycotoxins in agri-food products constitute the third group of the most frequently transmitted notifications in RASFF. Fungal toxins, such as ochratoxins (OTAs), are responsible for reducing the quality of cereal grains. The content of OTAs in grain is influenced by various factors, including the type of grain, climatic conditions, harvesting and storage conditions, and technological processes. Contamination with OTAs has the potential to cause significant economic losses and serious health consequences.

Considering the aforementioned, the main goal of the project was to reduce the ochratoxin content by using an innovative technological operation and to determine the influence of this process modification on the properties of generated cereal cookies.

MATERIALS & METHODS

The project involved a technological investment that involves implementing its own new technology and starting production of significantly improved **two types of cereal cookies**: **oatmeal cookies (OC) and oatmeal cookies with a crunch (OCC).** The applied technological modification consisted of conditioning the flour in the presence of sodium bicarbonate before the actual extrusion process.

The following analyses were performed:

- **Determination of ochratoxin A content**

The immunoenzyme assay of ochratoxin A (test ELISA) was performed. The measurements were carried out using a Stat-Fax 4700 Microwell Reader.

- **Color measurement**

The color was measured using a 3Color colorimeter. The intensity of the color was determined by its three elements: L *, a *, b *.

- **Analysis of texture**

Texture of cookies was measured by using a texture analyzer TX-700 for comparison of brittleness.

- **Extraction process of lipd fraction**

Extraction process was conducted using Soxtec 8000 apparatus with petroleum ether as a solvent.

- **Determination of lipid oxidation products by means of acid and peroxide values**

According to the procedures described in PN-EN ISO 660:2010 and PN EN ISO 3960:2012, the determinations of acid and peroxide values were performed, respectively. The measurements were carried out by the use of a titrator TitraLab AT100.

RESULTS & DISCUSSION

Table 1. Physicochemical properties of tested oatmeal cookies. Data denoted with the same lowercase letter are not significantly different (α = 0.05 with Tukey's post hoc test). OC - oatmeal cookies, OCC - oatmeal cookies with a crunch

Type of sample	L *	a *	b *	Ochratoxin A content [µg/kg]
OC	68.82	5.37	26.62	0.338 ± 0.072 [a]
OCC	48.65	12.01	13.69	0.364 ± 0.051 [a]

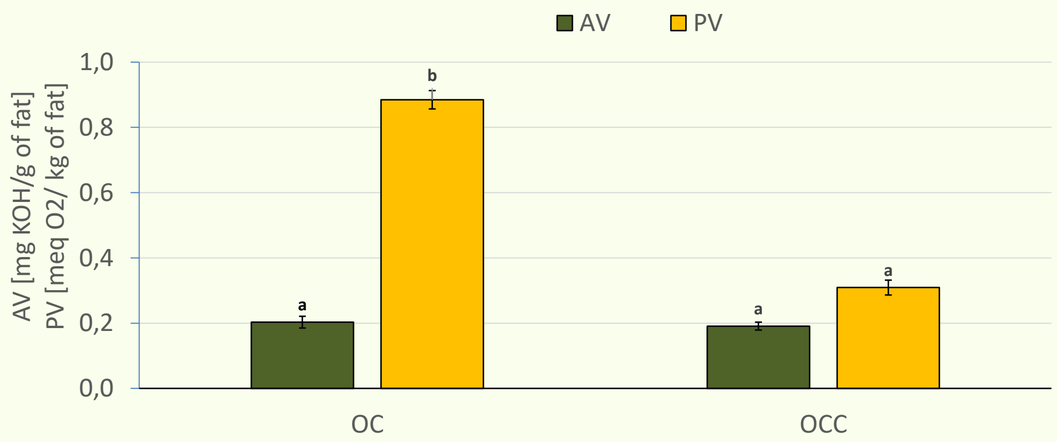

Figure 1. Acid (AV) and peroxide value (PV) of tested oatmeal cookies. Data denoted with the same lowercase letter are not significantly different (α = 0.05 with Tukey's post hoc test). OC - oatmeal cookies, OCC - oatmeal cookies with a crunch

The modified technology made it possible to obtain cookies with a ten-fold lower ochratoxin content than in the raw material, as confirmed by the obtained results of ELISA test. The brightness of the cookies (L*) was about 50-70, and the subsequent chromatic coordinates a and b were from about 5 to 12 and from about 14 to 27, respectively. Analysis of the texture of the obtained cookies showed that oat cookies were characterized by high brittleness. The lipid fraction isolated from the tested cereal cookies was characterized by its satisfactory hydrolytic and oxidative stability, as evidenced by low levels of acid and peroxide values.

CONCLUSIONS

- The main assumptions of the project have been fulfilled.
- The exploitation of the innovative technological operation influenced physicochemical as well as sensory properties of generated cereal cookies.
- The effect of the project implementation is the introduction of process and product innovation to the local market.

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