

pt. „Wielopiersścieniowe węglowodory aromatyczne jako rzeczywiste zagrożenie występujące w środkach spożywczych.”

Polycyclic aromatic hydrocarbons (PAHs), compounds with proven mutagenic and carcinogenic properties, are commonly found in the environment as a consequence of the industrial development and technology that increase the human exposure to these pollutants. The literature review and information provided by the RASFF system show that an overall contamination of foodstuffs with the PAHs sold and available on the Polish market is at least in some cases significantly different as compared to that determined in the food products available in other European countries. These differences result from the use of different methods in food processing, related among others, to regional traditions or consumer preferences as well as to the specificity of the Poland food market.

The aim of this study was to determine whether a presence of the PAHs in foodstuffs sold in selected regions of southern Poland could represent a potential health risk for the consumers. The benzo(a)pyrene (BaP) and sum of four PAHs ( $\Sigma 4\text{WWA}$ ) (benzo(a)pyrene, benz(a)anthracene (BaA), benzo(b)fluoranthene (BbFA) and chrysene (CHR)) contents were determined in refined and unrefined vegetable oils, smoked meat, fish and poultry products, teas and infusions, and in a variety of cereal products. Above mentioned groups of products have been selected based on assumption of the European Food Safety Authority (EFSA) that considers these types of products as the main contributors of PAHs into human diet. Małopolska and Podkarpacie are regions where the production of smoked meat-products is very popular. According to the local tradition, meat-products are subjected to hot “brown” smoking. Other foods tested are products generally available in these areas. The paper discusses the issues related to the formation of the PAHs and their properties, and describes the changes in legislation in force. The determination of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene contents in various groups of foodstuffs by validated test methods was carried out, and then the results were compared with the maximum levels given in the current EU regulations (Commission Regulations (EU) No 835/2011; (EU) No 1327/2014, (EU) 2015/1125, and (EU) 2015/1933).

In order to determine the PAHs in vegetable fats, smoked meat and fish products and cereal products, saponification, extraction and purification using a column filled with aluminum oxide processes were carried out. For chromatographic analyses of tea samples, the QuEChERS technique was used. Quantitative and qualitative determination of the PAHs was performed using liquid chromatography with fluorimetric detection (HPLC-FLD).

In the case of vegetable oils, smoked meat and poultry products, the levels of the PAHs tested did not exceed the maximum levels set in the EU regulations in force, except for one sample of traditionally smoked sausage. Traditionally smoked products were characterized by statistically significantly higher levels of contamination with PAHs in comparison with products smoked by industrial methods and with the addition of smoke flavorings. The highest BaP and  $\Sigma 4\text{WWA}$  contents (4.83  $\mu\text{g}/\text{kg}$  and 73.01  $\mu\text{g}/\text{kg}$ , respectively) were found in canned smoked sprat in oil. The  $\Sigma 4\text{WWA}$  value exceeded the maximum levels (EU 2015/1125). Very high variation in PAH content in dried commercial teas was found; however, the transfer of  $\Sigma 4\text{WWA}$  from tea leaves to tea infusion was determined at 0.48% for black teas and from 1.55 to 1.72% for red, white and green teas.

In all test samples of cereal products both BaP and  $\Sigma$ 4WWA contents did not exceed 1  $\mu\text{g}/\text{kg}$ , i.e. the amount constituting the maximum levels for benzo(a)pyrene and sum of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene in products intended for infants and young children, according to the requirements of Commission Regulation (EU) 2015/1125.

The levels of consumer exposure to the PAHs taken in a form of food were also estimated in this study. For this purpose, possible scenarios of consumption and contamination of selected food products were taken into account. Furthermore, the actual risk represented by the presence of the PAHs in foodstuffs was assessed based on the calculation of the Margin of Exposure (MOE). The latter is a tool used for the risk assessment to determine the health risks due to the presence of potentially toxic (genotoxic and carcinogenic) compounds in foodstuffs.

In the case of average exposure level of selected groups of consumers, no significant health risk resulting from the consumption of food products within all analyzed groups was found, since the Margin of Exposure was calculated to be more than 25,000. In the case of a high level exposure of selected groups of consumers, a high health risk for adult consumers and children consuming smoked sausages was identified. A significant health risk for children aged 4-9 was found in the case of frequent or high consumption of smoked sausages that show an average level of contamination with the PAHs. In other cases, an increased health risk (MOE values in a range of 10,000 - 25,000) was determined for the following categories: (i) high/frequent consumption of smoked sausages by adults and (ii) average and high consumption of smoked sausages by children, (iii) high consumption of other smoked meat by children.

In the medium and high consumption of cereal products by children aged 4-9 (taking into account so-called the worst-case scenario), it can be concluded that there is an increased risk for children's health associated with intake of BaP. In other cases considered here, the consumption of cereal products, including baby food, does not represent a health risk neither for adult consumers or children.

The intake of the PAHs in a form of food depends on the amount of consumed food products and can be of a high health risk for consumers. This, however, depends on the type of product consumed as well as on processing method used by manufacturer. Action should be taken to reduce the levels of BaP, BaA, BbFA and CHR in food. This applies to producers/manufacturers (selection of appropriate raw materials and optimization of technological processes) and includes educational activities promoting a well-balanced diet.

*Aliya Zedova*