

EFFECT OF NUMBER OF SMOKING CYCLES ON THE LEVEL OF PAH CONTAMINATION IN KABANOS SAUSAGE

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Introduction

Polycyclic aromatic hydrocarbons (PAH) are common environmental and food contaminants. PAH levels in food and factors affecting the levels of PAH contamination have been investigated for many years. These studies gave insights into the carcinogenic properties of PAH and served as a basis for making a list of PAH compounds that should be identified in foodstuffs. The first list, developed by the Environmental Protection Agency (EPA), included 16 PAH, of which only half showed carcinogenic properties. Recently, the European Food Safety Authority (EFSA) has developed a new list of 15 carcinogenic PAH. The Commission Regulation (EC) No 208/2005 set maximum levels for benzo(a)pyrene contamination in some foodstuffs, establishing that the maximum level of benzo(a)pyrene contamination in smoked meat products should not exceed 5 µg/kg (Wenzl et al. 2006; Simon et al. 2006). This regulation is particularly important in Poland, where almost half of the meat is consumed in the form of meat products (Borys 2005). Cured meats, mainly smoked cured meats account for a considerable proportion of meat products made in Poland. It is known that the smoking process contaminates smoked products with PAH compounds that form during thermal degradation of wood (Borys 2004). The amount of PAH formed during wood degradation determines PAH levels in the smoke, and therefore the amount of PAH that penetrate the product being smoked. It is known that the amount of PAH produced depends mainly on wood degradation temperature. Modern smoke generators are able to control temperature, exposure to oxygen and the amount of wood (wood chips) that reaches the degradation area. The amount of PAH penetrating a smoked product is also determined by smoking temperature, smoke density, humidity in the smoke chamber, smoke flow rate, the degree to which a smoked product area is dried, degree of surface development, and composition of the smoked product (Borys 1997). The level of smoked product contamination with PAH is affected by many factors and it is difficult or impossible to predict the level of PAH contamination during the smoking process.

Aim

The aim of the present study was to determine the effect of the number of smoking cycles (from 1 to 6 times) on the level of PAH contamination in kabanos sausage.

Methods and results

Kabanos sausages, characterized by considerable degree of surface development (approx. 0.3 m²/kg), were used to investigate the level of PAH contamination. Skewered sausages were dried for 30 min at 45°C and smoked for 30 min in a smoking chamber using a closed smoke circulation system. After smoking, sausages were scalded until the internal core temperature reached 72°C. The smoking process was repeated for 5 consecutive days to obtain sausages smoked from once to 6 times. After smoking, sausages were dried to reach the final yield of 60%. PAH levels were determined by grinding a 100 g sample of the sausage. The extraction of PAH from sausages was carried out using methanol-chloroform solvent mixture. The PAH extract was purified on a Plgel column 600x7,8mm. PAH levels were determined using HPLC-FLD on a Hypersil Green PAH column 250x3mm. The results of PAH determination are given on Fig. 1.

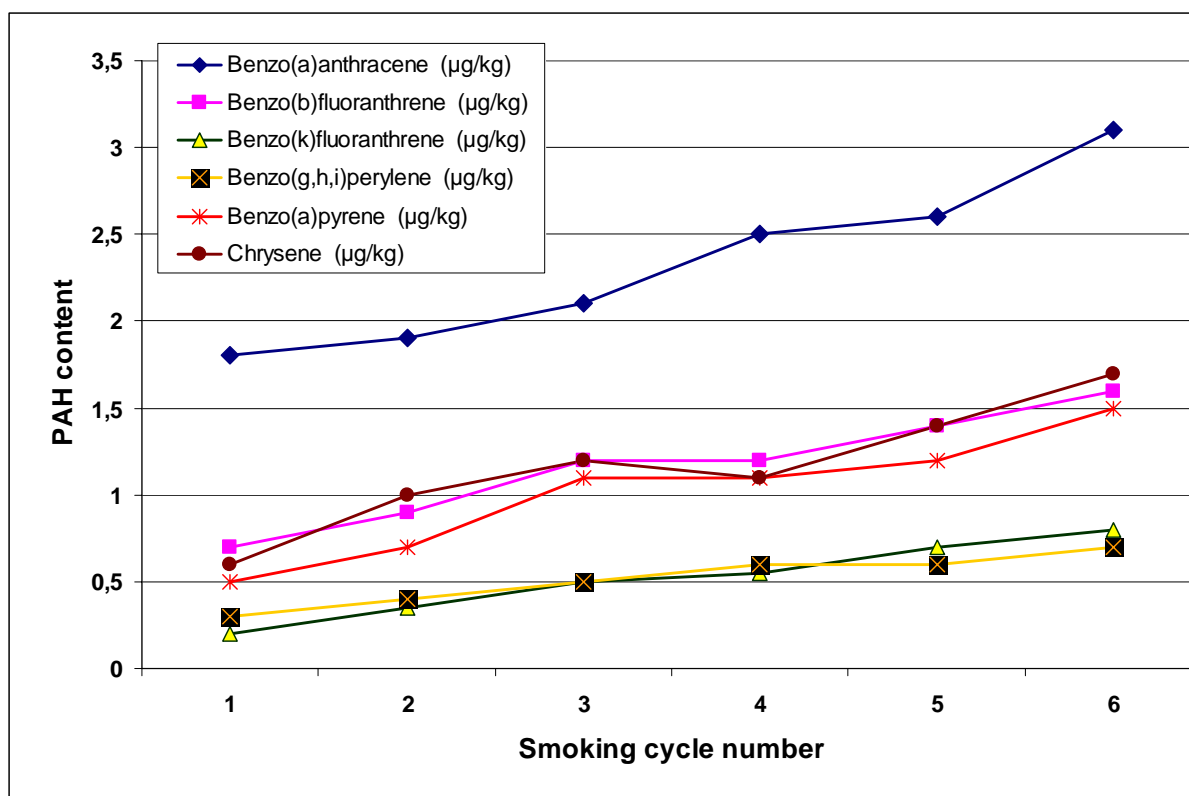


Fig. 1 The level of PAH contamination of kabanos sausage in relation to number of smoking cycles.

Summary

The following PAH compounds were found in all the sausage samples analysed: benzo(a)anthracene, benzo(b)fluoranthrene, benzo(k)fluoranthrene, chrysene, benzo(g,h,i)perylene, and benzo(a)pyrene. The level of these PAH increases with the number of smoking cycles. The highest contamination levels were found for benzo(a)anthracene (3.15 µg/kg), followed by chrysene (1.7 µg/kg) and benzo(b)fluoranthrene (1.6 µg/kg). The level of benzo(a)pyrene contamination ranged from 0.56 µg/kg for sausages smoked once to 1.56 µg/kg for sausages smoked 6 times. The level of benzo(a)pyrene determined in the sausages is considerably lower than that permitted by the Regulation No 208/2005 (maximum of 5 µg/kg).

The presented study showed that by using GMP for controlling wood degradation temperature in the smoke generator and exposure of oxygen to the degradation area, it is highly unlikely to exceed the permissible PAH contamination levels in smoked meat products, as measured by the level of benzo(a)pyrene.

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