EMERGING CONTAMINANTS IN PM10 OF RESIDENTIAL AREA IN KRAKOW

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INTRODUCTION

Emerging contaminants (ECs) are a group of chemicals that show the adverse impact on ecosystems and human health but their concentration has been not regulated in environmental legislation yet, as their presence has been not well-known so far. They might have a synthetic origin or might be derived from natural sources. There are several types of known existing ECs such as antibiotics, pesticides, pharmaceuticals, effluents, certain naturally occurring contaminants and more recently nanomaterials. The identification and the knowledge about the origination, fate and processes of transport and transformation of ECs are still sparse. However, these issues are of high importance due to the strong toxicological impact of ECs [1]. Polycyclic aromatic hydrocarbons (PAHs), however alreasdy included in legislation (Directive 2008/50EC) are a class of organic compounds that consists of two or more aromatic rings in their structure. PAHs are a group of ubiquitous and widespread semi-volatile hydrocarbons. Some of them are classified by International Agency for Research on Cancer (IARC) as probable or possible carcinogenic and mutagenic, like benzo[a]pyrene or dibenzo[a,h]anthracene. PAHs are mainly formed during natural and anthropogenic combustion processes of fuels like wood, coal, peat, oil, fossil fuels, waste, crop/agricultural waste, animal dung and biomass. In the atmosphere PAHs occur in both, gas and particulate-bound phase [2]. Phenols are characterized as volatile organic compounds that are released to the ambient air during the manufacturing processes of many phenolic resins and organic solvents. The biggest amount of phenols are emitted to the atmosphere from petroleum refineries, petrochemical, steel mills, coke oven plants, coal gas, synthetic resins, pharmaceuticals, paints, plywood industries and mine discharge [3].

The goal of the study was to determinate the concentration of benzo(a)pyrene and alkylphenols, as representatives for PAHs and phenols respectively, in PM10 fraction of aerosols collected in the residential area in Krakow.

EXPERIMENT

Samples were collected during the short (21-day) sampling period in January and February 2016. PM10 samples were collected on 47 mm quartz fibre filters (Pallflex). The mass of particulate matter per filter was gravimetrically measured as 3.96 mg on average. Averagely, 55 m^3 of ambient air was aspirated by the particulate matter impactor. PM10 samples were analysed for the presence of BaP, bisphenol-A and phenol with an application of the gas chromatography equipped with mass spectrometer. The analytical method was similar to that one presented in previous works [4].

RESULTS AND DISCUSSION

The average concentration of PM10 during the sampling period was equal to 73.2 $\mu g \cdot m^{-3}$ and ranged between 17.7 and 201 $\mu g \cdot m^{-3}$. In 15 days out of 21-day sampling period the concentration of

PM10 was higher than the limit value for PM10 according to 2008/50EC. The presence of benzo[a]pyrene, bisphenol-A, phenol was confirmed in all analysed samples.

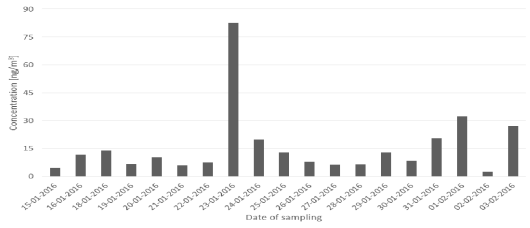

Fig. 1 The concentration of benzo[a]pyrene in analysed samples

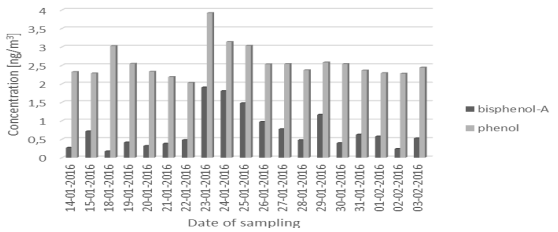

Fig. 2 The concentration of bisphenol-A and phenol in analysed samples

It showed that the average concentration of benzo[a]pyrene was estimated at 15.83 ng·m^{-3} and 2.56 ng·m^{-3} respectively for phenol while average concentration of bisphenol-A was estimated at 0.69 ng·m^{-3} . The concentrations measured for benzo[a]pyrene were in the range of 2.46 ng·m^{-3} to 82.5 ng·m^{-3} and 2.03 ng·m^{-3} to 3.91 ng·m^{-3}, respectively for phenol. The concentrations measured for bisphenol-A were in the range of 0.15 ng·m^{-3} to 1.9 ng·m^{-3}. The mass of benzo[a]pyrene contributes to the 0.025 % of PM10 mass, while phenol and bisphenol-A to 0.005 % and 0.005%, respectively. The highest level of BPA was observed in PM10 aerosols from Chennai and Mumbai, India. In Chennai, the concentration range was 200 - 17.4 pg·m^{-3} (average 4550 pg·m^{-3}) [5]. One of the significant emission sources of od atmospheric BPA could be the open burning of domestic plastic wastes [6].

CONCLUSION

The relation between emitted ECs and the source still needs to be identified. That is why the samples of PM 10 were collected in the residential area of Krakow, which is mainly affected by air pollution originating from combustion processes like biomass or coal combustion. Recognition of the sources of emission of ECs is extremely important, therefore in the following part of the study authors will focus on the ECs emission from combustion processes for the production of heat.

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