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$PM_{2.5}$ PAHs in large urban agglomerations in Bulgaria

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Abstract. Clean air is a basic human need and a key prerequisite for the life quality. In series of directives, the EU is gradually imposing increasingly stringent requirements for ambient air quality, expressed in norms for maximum permissible atmospheric pollutants concentrations. However, in large urban agglomerations, poor air quality continues to have a negative impact on people's health as one of the main concerns are the high particulate matter (PM) concentrations, especially those with an aerodynamic diameter bellow 2.5 microns ($PM_{2.5}$).

The elucidation of the PM impact on human health, PM sources of pollution and respective policies to improve air quality lies in their composition study. In this regards, the specifics of the large cities, i.e. types and quantities of pollutants, geographical location and local meteorological conditions, may have a strong influence on the composition of PM and in particular PM associated polycyclic aromatic hydrocarbons (PAHs). The aim of the current study is to determine the concentration of PAHs in airborne $PM_{2.5}$ collected in two large cities in Bulgaria, i.e. Sofia, as a capital with a population of millions, located in a valley and Burgas - a large industrial center, located on the Black Sea coast. Additionally, the correlation of $PM_{2.5}$ associated PAHs concentrations with meteorological parameters is addressed as well. In both cities, the location of the sampling stations is far from local sources of emissions, which aims to provide information on background concentration levels. Four $PM_{2.5}$ sampling per week in a period of a month, i.e. October 2020, were conducted in parallel at both stations in according to the standard EN 12341: 2014 and according to Directive 2008/50/EC. The subsequent analysis of $PM_{2.5}$ associated PAHs was performed by a gas chromatograph coupled with a triple quadrupole mass spectrometer (GC–MS/MS) in the selected reaction monitoring (SRM) mode. The obtained results reveal that for the studied period $PM_{2.5}$ associated PAHs concentrations in Sofia are higher than those in Burgas. The averaged concentrations of $[BaP]_{eq}$ for the studied period is 0.49 ng m^{-3} for Sofia and 0.04 ng m^{-3} for Burgas. However the averaged concentrations of $[BaP]_{eq}$ do not exceed the annual limit value of 1 ng m^{-3} set for *BaP*. The linear regression analysis demonstrated significant correlation of total PAHs concentrations with PM2.5 for Sofia and with some meteorological parameters. PAHs bound to PM2.5 originate from pollution sources which are rather pyrogenic.

Keywords: Urban Air Quality, $PM_{2.5}$, PAHs in $PM_{2.5}$.