Determination of Absorption Ångström Exponent Values for Black Carbon source apportionment Aethalometer Model in Urban Background Environment

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One of the most abundant light-absorbing components of atmospheric aerosols emerging from fossil fuel combustion and biomass burning in urban areas is black carbon (BC) which is strongly associated with air pollution and climate change. Its significance as the second highest anthropogenic contributor for global warming after CO_2 was acknowledged in a special report *Global Warming of 1.5 ºC* by IPCC [1]. Therefore, it is crucial to identify the specific sources of carbonaceous aerosol pollution in each region and develop mitigation strategies to control their radiative effects on the climate. Carbonaceous aerosol particles originating from various sources exhibit different chemical composition and consequently different physical properties. Aethalometer model for BC source apportionment is based on the dependence of aerosol absorption on the wavelength of light which is defined as source specific absorption Ångström exponent (AAE) and describes the wavelength variation in aerosol absorption.

In our study an Aerosol Chemical Speciation Monitor (ACSM) and a 7-wavelength Aethalometer were deployed in Vilnius (urban background site) in October (2014) and May - June (2017). The aim of the study was to perform a systematic source apportionment for BC by examining dynamics of mass concentration and optical properties alteration during heating and non-heating seasons. In order to separate sources of BC, the most suitable values of AAE (absorption Angstrom exponent) were selected for BC_{tr} (originated from traffic emissions) and BC_{wb} (originated from biomass burning): 0.9 and 2.2, respectively. The BC_{tr} absorption increased more than 50 % in the period 2014 – 2017 which suggests that there was a significant increase in BC_{tr} mass concentration due to a rise in diesel vehicles number in the city. Organic aerosol (OA) source apportionment analysis was performed by applying positive matrix factorization (PMF) which revealed five main sources during cold season in 2014: primary OA (POA), local OA (LOA), two different biomass burning OA (BBOA-1 and BBOA-2) and oxygenated OA (OOA). Meanwhile in spring 2017 five main sources included two different oxygenated OA (more and less oxygenated OA (LVOOA and SVOOA, respectively)) and local hydrocarbon-like OA (LOA). Our results show significant alteration of aerosol optical properties over the course of the day related to traffic rush hours and residential heating during both heating and non-heating seasons. The results of this study provide most suitable combination of AAE values for BC source apportionment and additional insights into air quality in urban environment.

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