

Source apportionment of atmospheric carbonaceous aerosols collected in Krakow, based on concentrations of organic/elemental carbon (OC/EC) and carbohydrates

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Keywords: particulate matter, source apportionment, combustion, OC/EC, carbohydrates

Air pollution is nowadays a growing problem of global significance, mainly due to adverse health effects such as cancer, asthma, allergies or cardiovascular diseases. Especially large urban centres are heavily affected by deterioration of air quality. Atmospheric aerosol particles consist of both organic and inorganic compounds as well as materials of biogenic origin. Airborne particulate matter (PM) is emitted by numerous sources, most of them related to anthropogenic activities such as coal or biomass combustion in heat generation processes, gasoline and diesel combustion in car engines, and uncontrolled burning of solid wastes.

The study was focusing on determination of chemical composition of atmospheric aerosols collected in Krakow, Poland, from 23th Jan. 2018 to 12nd Sep. 2018 in order to obtain information on their sources. Altogether 294 samples were collected on quartz fibre filters. They represent PM₁₀ and PM₁ fractions collected with 24 h resolution. The analytical work comprised thermo-optical carbon analysis (Sunset OC/EC Lab Analyser), determination of 14 carbohydrates by means of High-Performance Anion-Exchange chromatography with Pulsed Amperometric Detection (ICS 3000, Dionex).

The highest mean concentration among carbohydrates was detected for Levoglucosan (0.21 µg/m³) which is well-known marker of biomass burning. Existence of numerous sources of carbonaceous aerosols in the city atmosphere (e.g. combustion, traffic) is reflected in highly variable OC/EC ratios. The mean OC/EC ratio for PM₁₀ fraction was equal 5.6 (range 2.2-17.3) to be compared with 5.1 (range 1.6-13.3) for PM₁ fraction. Furthermore, the concentration of the inorganic anions and cations (Br⁻, NO₃⁻, NO₂⁻, F⁻, SO₄²⁻, PO₄³⁻, Cl⁻, Li⁺, Na⁺, NH₄⁺, Mg²⁺, K⁺, Ca²⁺) were determined with isocratic ion chromatography on an ICS-1100 instrument (Thermo Scientific). Parallel to filter sampling on-line characterization with ACSM (Aerosol Chemical Speciation Monitor) and aethalometer was performed.

Acknowledgement

This article is based upon work from COST Action COLOSSAL supported by COST (European Cooperation in Science and Technology).

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