

Abstract

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Increased aerosol concentrations can result in changes in hydrological cycles, reduced biodiversity, or adverse effects on human health. One of the most important properties that affects individual phenomena is the elemental composition of aerosols. For the purpose of determining the elemental composition of aerosols, the PIXE method, which uses an external beam that allows for in-air analysis of samples, was optimised in the CENTA facility. Atmospheric aerosol samples were collected in Bratislava by pumping air through quartz filters, on which particles of all sizes were captured. A cascade impactor was also used for the sampling, to separate particles into size fractions. At the CENTA facility, 12 elements were identified in aerosol samples, but the concentration was not determined for all of them. Of the nine elements with a determined concentration, sulphur had the highest levels in all samples, except for one. During the period when the wind blew Saharan dust over the territory of Bratislava, the concentrations of the elements Ti, Fe, and especially Ca reached significantly higher values than their average. Changes in element concentrations were also observed in other periods. For example, elements such as S, K, and Cl were characterised by increased concentrations during the heating season. For aerosols separated into size fractions, it was typical that elements with similar properties to S had the same representation in each category, while elements such as Ca or Fe had a higher level among larger particles. Elemental analysis of aerosol samples was also carried out at ATOMKI, leading to the identification of nine additional low-concentration elements. The results obtained can be used to assess air quality, monitor pollution, and identify sources of pollution.

Key words: External beam, PIXE, atmospheric aerosols, elemental composition, cascade impactor