Determination of dicarboxylic acids in atmospheric aerosols using continuous Aerosol Counterflow Two-Jets Unit

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Atmospheric aerosols are responsible for a number of deleterious effects on human and environment. Detailed study of chemical composition of atmospheric aerosols is important for both their role in various environmental issues and correlation with adverse health effects.

Atmospheric aerosols are composed of many organic compounds that originate from various primary sources or are formed secondary in the atmosphere from the oxidation of gas-phase precursors. Dicarboxylic acids (DCAs) are group of compounds of both primary (traffic or biogenic emissions) and secondary (photochemical oxidation / decomposition) origin. DCAs in atmospheric aerosol have received much recent attention because of their capabilities to form CCN and affect thus the global radiation balance and eventually the global climate (Hsieh et al., 2007).

Measurement of chemical composition of aerosols is presently mostly performed by sampling of aerosols at filter-packs or impactors with subsequent off-line analysis. Alternatively, on-line aerosol collectors based on a condensation of steam on particles are used (Simon and Dasgupta, 1995; Khlystov et al., 1995; Weber et al., 2001). Another approach is applied in aerosol collector called Aerosol Counter-flow Two Jets Unit (ACTJU), where a deionized water at room temperature instead of steam is employed for the continuous sampling of atmospheric aerosol particles (Mikuška and Večeřa, 2005). The original version of ACTJU collector under optimum conditions collects quantitatively aerosol particles down to 0.3 μm in diameter while the collection efficiency of smaller particles decreases. A combination of original version of ACTJU collector with a water-based condensation growth tube (GT) located upstream of the ACTJU sampler (Mikuška et al., 2015) allows quantitative sampling of aerosol particles down to a few nm in diameter. The collector effluent is permanently sucked out from the ACTJU for subsequent on-line analysis of particulate water-soluble species.

A method for the detection of dicarboxylic acids in collector effluent was developed. The method is based on the preconcentration of acids on a preconcentration column. DCAs were eluted using a KOH solution and analysed using ion chromatography (ICS 2100, Dionex). Chromatogram of DCAs separation is shown in Fig. 1.

The combination of the GT/ACTJU was applied to the determination of dicarboxylic acids in urban aerosols in Brno. Atmospheric aerosols were continuously sampled using the GT/ACTJU into deionized water, collected acids were on-line preconcentrated and then detected by means of ion chromatography. A sampling of aerosol particles on parallel filter was used as a reference method.

The method was verified using a laboratory generated standard aerosol of DCAs. The experimental results will be demonstrated.

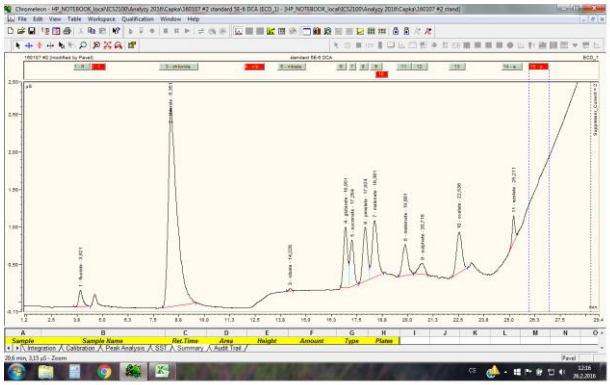

Figure 1. Separation of dicarboxylic acids using ion chromatography.

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