



Total carbon isotopic values at background and urban sites in Lithuania during summer 2008

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Stable carbon isotopes have been successfully used in source apportionment studies of atmospheric aerosols where two or more sources have a distinct isotopic composition. It has been shown that areal and temporal isotopic variabilities of aerosol samples are related to the diversity of the sources (Cahier, 1989), but there is a lack of studies of size segregated aerosol carbon isotope values (Garbaras et al., 2009).

The sample collections were performed at the Air pollution research station in Preila during 17 - 22 September, 2008, at the Rūgšteliškis background station during 10 – 18 July, 2008, and Vilnius city center during 03 – 06 June, 2008. The Preila station is located in western Lithuania on the coast of the Baltic Sea, on the Curonian Spit. The Curonian Spit is a narrow sandy peninsula (0.4-4.0 km width), which separates the Baltic Sea from the fresh water Curonian Lagoon. The Rūgtelikis background station is located in the eastern part of Lithuania, in a forested area. Sampling in Vilnius was performed in the city centre where traffic is intensive.

The samples were collected with a Micro-orifice Uniform Deposit Impactor (MOUDI) model 110 which has D50 cut-off diameters: 18, 10, 5.6, 3.2, 1.8, 1.0, 0.56, 0.32, 0.18, 0.10 and 0.056 μm . Aluminum foil was used as the impaction surface. Total carbon isotope values ($\delta^{13}\text{C}$) were measured at each stage using the elemental analyzer (*FlashEA 1112*) connected to the stable isotope ratio mass spectrometer (*ThermoFinnigan Delta Plus Advantage*) (Garbaras et al., 2008). Simultaneously the carbon amount at each stage was measured using the elemental analyzer with a thermal conductivity detector.

In the accumulation mode the total carbon mass concentration was the highest in the size range of 0.32 – 0.56 μm (about 0.37 $\mu\text{g}/\text{m}^3$) at the Preila and Rūgtelikis stations, while in Vilnius the total carbon mass concentration was the highest in the size range of 0.10 – 0.18 μm (26.4 $\mu\text{g}/\text{m}^3$). In the coarse mode the total carbon mass concentration was the highest in the range of 3.2 – 5.6 μm (0.14 $\mu\text{g}/\text{m}^3$) at the Preila and Rūgtelikis stations and 10.8 $\mu\text{g}/\text{m}^3$ at the Vilnius station in the range of 3.2 – 5.6 μm .

The total carbon concentrations were about 100 times higher in Vilnius than in Preila and Rūgtelikis. Despite this, $\delta^{13}\text{C}$ values in the accumulation mode were about -27 ‰ in Preila and Rūgtelikis and about -29 ‰ in Vilnius. Distinct isotopic patterns in this mode imply that aerosol particles differ in Preila and Rūgtelikis compared with those in Vilnius. In Vilnius city local transport emissions are the main source of aerosol particles in the accumulation mode (peak total carbon concentration in the size range of 0.10 – 0.18 μm supports that).

Less negative carbon isotopic values in the coarse mode (-22.4 ‰ in Preila, -23.2 ‰ in Rūgtelikis and -23.8 ‰ in Vilnius) imply, that these local aerosol particles can be mixed with carbonate material, coming from resuspended dust or soil erosion because local vegetation has more negative values than those observed.

Using the stable carbon isotope analysis it is possible to distinguish origin of the aerosol particles in accumulation and coarse modes.

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