Metinė anglies turinčių aerozolio dalelių kaita vertinant per izotopinės sudėties prizmę

Yearly variation of carbonaceous aerosols through isotopic composition view

Agnė Mašalaitė[1], Inga Garbariene[1], Andrius Garbaras[1], Justina Šapolaitė[1], Žilvinas Ežerinskis[1], Laurynas Bučinskas[1], Ulrike Dusek[2] and Vidmantas Remeikis[1]

[1]State Research Institute Center for Physical Sciences and Technology, Department of Nuclear Research, Savanorių pr. 231, 02300 Vilnius, Lithuania
[2]Centre for Isotope Research (CIO), Energy and Sustainability Research Institute Groningen (ESRIG), University of Groningen, Groningen, 9747AG, the Netherlands
agne.masalaite@ftmc.lt

Atmospheric aerosol particles play an important role in many environmental processes, influencing climate change processes and human health. The stable carbon isotope (^{13}C) and ^{14}C have the potential to give insights into the sources and processing of organic aerosol. However, the use for source apportionment has been somewhat limited, because the ^{13}C source signatures vary and show some overlap. The ^{14}C analysis is a powerful tool for distinguishing between fossil and non-fossil (contemporary) carbonaceous aerosol sources. The impacts of urban and coastal aerosols are diverse and far-reaching. Variation in the local pollution sources during the seasons changes drastically, and all the studies are highly desirable to provide a complete picture of air pollution for a given area. This study explores a dataset of year-round collected aerosol particles (PM_1) at urban and coastal areas. This is the first study, where annual variation of isotopic composition ($\delta^{13}C$) and fraction of contemporary carbon (f_c) revealed the main pollution sources and manifests their utility in aerosol research. The additional data leads to a comprehensive analysis of aerosol particles and a description of the seasonal variation.

72 filters from the urban site and 103 from the coastal site were measured to receive the seasonal variations at both sites. The stable carbon isotope ratio values of total carbon were determined using an elemental analyzer "Flash EA 1112" coupled to an isotope ratio mass spectrometer "Thermo Finnigan Delta Plus Advantage" (EA-IRMS) via a ConFlo III interface. The $^{14}C/^{12}C$ ratio (radiocarbon) of samples with sufficient carbon content (68 filters) was analyzed using a single stage accelerator mass spectrometer (SSAMS) "NEC".

The time series of the monthly averaged $\delta^{13}C_{TC}$ values of aerosol particles from urban and coastal sites exhibited a pronounced seasonal cycle (Fig. 1). Distinct seasonal variations were observed in $\delta^{13}C_{TC}$, with enrichment in winter and depletion in spring indicating a shift among emission sources in urban site. The situation is slightly different in coastal site. The variation of isotopic composition for individual filters was within 3 ‰ difference between the minimum and maximum value at coastal site but variation between averaged values of the month was only by 1.6 ‰.

We demonstrate with an extensive source study that in Lithuania and likely other Eastern European regions, the seasonal variability of TC with high winter maxima, revealed the strong influence of residential heating with wood and pollutants from long-range air mass flow from southern countries (coal combustion). Air mass back trajectory analysis revealed that South and Southeaster continental air masses are more loaded with higher levels of TC than northerly air masses.

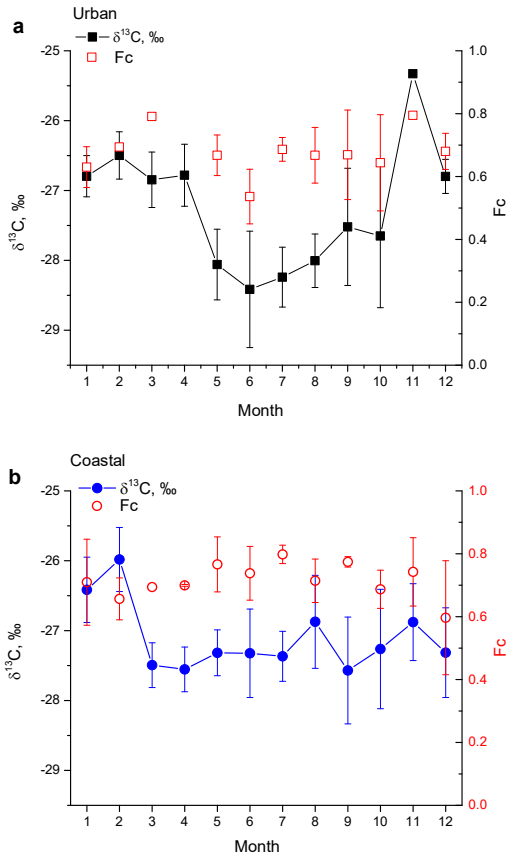

Figure 1. Yearly variation of stable carbon isotopic composition and f_c at urban (a) and coastal (b) sites.

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