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Use of stable carbon and nitrogen isotope ratios in size segregated aerosol particles for the O/I penetration evaluation

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Stable carbon and nitrogen isotope ratio are successfully used in the atmospheric aerosol particle source identification [1, 2], transformation, pollution [3] research.
The main purpose of this study was to evaluate the penetration of atmospheric aerosol particles from outdoor to indoor using stable carbon and nitrogen isotope ratios.
Six houses in Kaunas (Lithuania) were investigated during February and March 2013. Electrical low pressure impactor was used to measure in real time concentration and size distribution of outdoor aerosol particles. ELPI+ includes 15 channels covering the size range from 0.017 to 10.0 μm. The 25 mm diameter aluminium foils were used to collect aerosol particles. Gravimetric analysis of samples was made using microbalance. In parallel, indoor aerosol samples were collected with a micro-orifice uniform deposition impactor (MOUDI model 110), where the aerosol particles were separated with the nominal D50 cut-off sizes of 0.056, 0.1, 0.18,0.32,0.56, 1.0, 1.8, 3.2, 5.6, 10, 18 μm for impactor stages 1-11, respectively. The impactor was run at a flow rate of 30 L/min. Air quality meters were used to record meteorological conditions (temperature, relative humidity) during the investigated period.
All aerosol samples were analyzed for total carbon (TC) and total nitrogen (TN) contents and their isotopic compositions using elemental analyzer (EA) connected to the stable isotope ratio mass spectrometer (IRMS).
TC concentration in indoors ranged from 1.5 to 247.5 μg/m3. During the sampling period outdoors TN levels ranged from 0.1 to 10.9 μg/m3. The obtained outdoor δ13C(PM2.5) values varied from -24.21 to -26.3‰ while the δ15N values varied from 2.4 to 11.1 ‰ (average 7.2$\pm$2.5 ‰. Indoors carbonaceous aerosol particles were depleted in 13C compared to outdoors in all sampling sites. This depletion in δ13C varied from 0.1 to 3.2 ‰Ẇe think that this depletion occurs due ongoing chemical reactions (oxidation) when aerosol particles penetrates from outside to inside. Observed isotope ratio depletion indicates that information about aerosol sources can be lost if measurements are performed only inside house. Using carbon and nitrogen isotope ratios data set, we were able to identify and distinguish main aerosol sources (traffic, heating activities) and penetration of aerosol particles from outdoor to indoor.

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