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Excess of Polonium-210 activity in the surface urban atmosphere

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The concentrations of 210Pb, 210Bi and 210Po were measured from February 2010 to May 2010 and from May 2011 to April 2012. The seasonal change of 210Po/210Pb and 210Bi/210Pb activity ratios indicate on independent fluctuations of tropospheric 210Pb and its decay products, particularly 210Po. A simple calculation method for the estimation of the excess of 210Po, in relation to its activity formed from 210Pb, during the residence time of the urban aerosols in Lodz city, Central Poland is proposed. Most of 210Po in urban air is not a decay product of 222Rn but is result of input of artificial origins. The highest levels of 210Po were observed in winter period. It suggests that the substantial source of 210Po in this region is an anthropogenic emission from domestic and power plant combustion of coal, rather than other usually suggested sources such as soil resuspension, or stratospheric air intrusion.

The comparison of date with 210Po/ 210Pb ratios allows to determinate the excess of the unsupported 210Po activity in the aerosol samples. Additional influx of unsupported ΔAPo, can be calculated.
The main aim of this work was to check the seasonal fluctuations of the Δ210Po activity on the base of aerosol residence time determinations in the urban area.
The activity concentration fluctuation during the period of whole year: from 3 548 to 133.5 μBq/m3, from 1 025.8 to 54.6 μBq/m3 and from 136.9 to 9.44 μBq/m3 for 210Pb, 210Bi and 210Po, respectively. In all cases the highest concentration was measured in a winter period. The results of activity ratio were divided for 4 seasons spring (March-May), summer (June-August), autumn (September-November) and winter (December-February).

In urban air 210Po coming from additional source is adsorbed on the surface of particles. Specific activity strongly dependents on the aerodynamic diameter of the solid particles of aerosol. Generally, fine particulate matter carries more 210Po than the coarser fractions.
Anthropogenic source of Polonium is strongly connected with not only heating (power plant and domestic coal burning) typical for winter season but also with electricity generation and technical activity during the whole year.Polonium as more volatile element than Pb or Bi can be emitted with flue gases.
In high temperatutre processes average about 50% of the total activity of 210Po is discharged in gaseous form or ultra-fine particles to the atmosphere.

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