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ORIGINAL PAPER

Mercury associated with size-fractionated urban particulate matter: three years of sampling in Prague, Czech Republic‡

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An analysis of suspended particulate matter, with an emphasis on the Hg chemical forms, is presented. Dust samples originating from an area highly affected by traffic pollution in the city of Prague (Czech Republic) were sampled over a period of three years from air-conditioner filters and fractioned by size. The samples were morphologically characterised by scanning electron microscopy. The main method used for the analysis of constituent mercury compounds was sequential extraction by leaching solutions in combination with thermal desorption. The total mercury content ranged from 0.37 mg kg^{-1} to 0.82 mg kg^{-1}. It emerged that the mercury was distributed in a wide spectrum of forms, and various trends in the distribution of these forms among the different size classes were observed. The fraction leached by nitric acid (consisting of elemental and complex-bound mercury) was the main constituent of total mercury. The highest content of this fraction was observed in the finest particle size class. The heterogeneity of morphology of the material increased with the size fraction.

Keywords: mercury, sequential extraction, thermal desorption

Introduction

Mercury is ubiquitous in the atmosphere. Its background concentration of 1.5–1.7 ng m^{-3} (Lindberg et al., 2007) is virtually constant across the entire northern hemisphere (Pandey et al., 2011; Wängberg et al., 2001). The average level of mercury in the atmosphere is now two to five times higher than in pre-industrial times and the deposition rate has increased by up to three times (Mason et al., 1994; Pirrone & Mason, 2009). At present, the mercury emissions from anthropogenic sources are considered to be comparable to the estimated emissions from natural sources. As a result of human activities, approximately 2,200 tons of mercury were released in 2000, while emissions in 2005 were estimated to be approximately 1,930 tons. The burning of fossil fuels was the major source, accounting for approximately 45 % of anthropogenic emissions, while the second largest source was artisanal/small-scale gold-mining with a contribution of approximately 18 % (Pacyna et al., 2006, 2010). Since mercury is regarded as an important pollutant, much attention is directed towards research into its chemistry in the environment.

Increasing mercury levels in ambient air result in a higher risk to humans from exposure to this highly toxic metal. In organisms, mercury tends to bind to sulphur-containing groups of enzymes, amino acids, and cellular membranes, which results in an inactivation or alteration of their biological functions. Mercury acts neurodegeneratively and may cause chronic diseases including Alzheimer's or Parkinson's diseases. Even at low concentrations, mercury can cause problems with motor activity and affects the renal, cardio-

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