

XAFS Study of Iron in Atmospheric Aerosols of Vehicle Emission

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Iron compound is one of the main components in atmospheric aerosols, particularly in the inhaled particles. The concentration of iron in air may be an index of air pollution. The inhaled particles, with an aerodynamic diameter $< 10\mu\text{m}$ (PM_{10}), can reach the underside of respiratory tract where they are phagocytized by alveolar macrophages (AM). So the study of concentration, chemical speciation and structure of iron may give us a great deal information on air pollution. Most suspended particles contain elemental iron and iron oxides (from vehicle emissions, power plants, eruptions, meteor showers, smelteries, etc.), and other forms of iron compounds are mostly the result of chemical reactions of iron oxides with acids in air. Thus, the study of iron-containing atmospheric aerosols of vehicle exhaust emission is important.

The PM_{10} samples of vehicle emissions collected at different position of a tunnel were studied by the mean of ICP-MS and XAFS spectroscopy. And the results of ICP-MS indicated that the contents of the Fe and Pb elements are $30.1\pm 0.3\%$ and $40.5\pm 0.1\%$ as well as $939.4\pm 20.6\text{ppm}$ and $308.1\pm 1.8\text{ppm}$ for PM_{10} (outside) and the PM_{10} (middle), respectively. We also obtained the near-neighbour parameters of Fe ions by analysis of Fe K-edge fluorescence EXAFS spectra for the three tunnel samples. On the basic of the fitting results, the coordination number of the first Fe-O shell is about 3 with a coordination distance (with O) in the range of $2.012\sim 2.021\text{\AA}$. Combined with the XANES analysis, Fe in the PM_{10} samples was mainly present in the form of Fe_2O_3 .