ENVIRONMENTAL SCIENCE

Environmental science involves various research fields. The topics selected in this section mostly relate to health hazards and environmental destruction. Actual environmental samples are often very dilute, small in quantity, or spatially or chemically inhomogeneous, so analyses using high-brilliance synchrotron radiation (SR) X-rays are indispensable to study such samples. Moreover, new techniques are being developed that further enhance the study of environmental samples.

In the first topic, Hokura *et al.* show the 2-dimensional cellular distribution of cadmium in hyperaccumulating plant tissues by high-energy μ-X-ray fluorescence imaging. This is a powerful technique that can be used to obtain information on the distribution and chemical state of heavy elements. Hokura *et al.* showed that the distribution of cadmium positively correlates with that of zinc.

The second topic concerns the treatment of soil contaminated by organic arsenic compounds. Harada *et al*. have determined the effectiveness of heat treatment as a step in the detoxification of soil contaminated with organic arsenic compounds. They successfully revealed the heat treatment changes chemical state of arsenic compounds from the organic state to the inorganic pentavalent state using XANES analysis.

The third topic concerns the removal of NO_x emissions from diesel engines in vehicles. Shimizu studied the dynamical structure changes of high performance Ag/Al_2O_3 catalysts during de-NO_x catalysis by *in situ* Quick XAFS analysis and discovered the reductive aggregation and oxidative redispersion of Ag species, which are crucial steps in efficient catalysis.

Mitsunobu *et al.* developed a new method combining a column reactor with a time-resolved Quick XAFS technique. This method is a very simple and a direct tool to determine chemical state and local structure during a chemical reaction at solid-water interfaces. They applied it to the oxidation of As(III) induced by amorphous manganese oxide (δ-MnO_2), natural strong oxidizer, which is an important reaction for toxicology and geochemistry, and directly measured the rate constant of As(III) oxidation.

The last topic concerns the detection of asbestos used in conventional building materials, which is now a most pressing health hazard. Recently, the legal standard for the regulation of asbestos was reduced from 1.0 to 0.1 wt%, which exceeds the detection limits of conventional laboratory analysis methods. Kato *et al*. developed an SR X-ray powder diffraction method using surface diffractometry optimized for the detection of crystalline asbestos, and achieved a detection limit of up to 0.02 mg (0.02 wt%) of asbestos.

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