

Spacial distribution and speciation of heavy metals in surface sediments from the Yangtze Estuary in China

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The Yangtze estuary is one of the world's largest estuaries. After the recent two decades of prosperous economy and booming industrial development, a tremendous amount of natural and anthropogenic heavy metals are carried by the Yangtze River and settled in the estuary. The objective of this paper is to compare the contents, speciation and source of heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb and Zn) in surface water and sediments from the nearshore, river channel and coastal areas in the Yangtze estuary. The concentrations of all heavy metals in surface water were lower than I Class of Surface water quality Standards of China. The concentrations of all heavy metals except Ni in the sediments of the nearshore areas were higher than those of the river channel and coastal zones. In the nearshore areas, the concentrations of most heavy metals, except Hg, in the sediments of the southern branch were higher than those of the northern branch because of the import of pollutants from the urban and industrial activities around. Compared with the threshold effect level (TEL), Cr and Ni were the most heavily contaminated in all samples, followed by As. The speciation analysis suggested

that Cd, Pb and Zn in all sediments showed higher bioavailability than the other heavy metals, and thus posed ecological risk. Significant correlations were observed among Cr, Cu, Ni and Zn ($r > 0.77$) in the nearshore areas, Ni, Cu, Zn and Pb ($r > 0.85$) in the river channel and Ni, Cu, Cr, Pb and Zn ($r > 0.75$) in the coastal zones. Discharge of urban and industrial sewage, shipping pollution and the properties of the sediments dominate the heavy metal distribution in the Yangtze estuary. The results obtained here could provide foundation for the future remediation as well as the protection of water quality of the Yangtze estuary.

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