

HEAVY METALS IN SUSPENDED SEDIMENTS IN RIVERS FLOWING THROUGH MEGACITIES IN SOUTHEAST ASIA

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Abstract

Heavy metals in suspended sediments (SS) were investigated in the lower Chao Phraya River, Thailand, and Marikina-Pasig River basin, Philippines, both in the rainy and dry seasons. In addition, we assessed the relative pollution level of SS by determining enrichment factor of particulate metals. The particulate fractions accounted mostly for 60-100% of total concentrations of Cr, Mn, Ni, Cu, Zn, and Pb in both dry and rainy seasons. The comparison of metal contents of the sampled SS and upper continental crust (UCC) implied some anthropogenic inputs of Cr, Ni, Cu, and Zn as well as the dilution process for those metals in the rainy season in Chao Phraya River. Enrichment factor in both rivers also indicated anthropogenic effects on metal content in SS, reflecting the distinctive seasonal process in Chao Phraya River and the spatial variation within Marikina-Pasig River basin. Overall, the results revealed the importance of the particulate phase of heavy metals in both target rivers to understand the transport and reactivity of heavy metals.

Keywords: Chao Phraya River, Enrichment Factor, Heavy Metals, Marikina-Pasig River, Suspended Sediments

Introduction

In Southeast Asia, heavy metals are being accumulated in urban rivers, estuaries, and adjacent coastal zones (Prudente et al., 1994; Uruse et al., 2006; Thongra-ar et al., 2008; Zhu et al., 2010) as one of the consequences of the recent rapid urbanization and industrialization. Bioavailability and toxicity of heavy metal depend on its concentration as well as chemical speciation. For example, zinc and copper are essential for the growth of organisms, while its accumulation in aquatic organisms results in the inhibition of a number of processes involved in metabolic pathways (e.g., Spencer and Nichols, 1983; Di Toro et al., 2001). Thus, heavy metals can negatively affect aquatic organisms and ecosystems, depending on their concentration and chemical speciation, which highlights the importance of proper monitoring and management of heavy metals in aquatic systems.

Several large rivers in Southeast Asia are also characterized by a massive load of suspended sediments (SS) (Meybeck et al., 2003). Such high sediment load is largely the result of natural processes (e.g., erosion and transport) in their catchments and often makes water quality control complex in terms of water supply as well as ecological management. Consequently, the deterioration of aquatic ecosystems is closely related to SS in highly turbid rivers because SS serves as the carrier of a number of pollutants including heavy metals, causing secondary and tertiary pollutions in adjacent water bodies (Uruse et al., 2006; Zhu et al., 2010), and SS can be also potential food sources for aquatic fauna.

