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Enrichment and Flux of Heavy Metals along the Coastal Sediments of Pakistan

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Abstract : Heavy metal contamination in the marine environment is a global issue, and in past decades, this problem has intensified due to an increase in urbanization and industrialization, especially in developing countries. Marine sediments act as a preliminary indicator of heavy metal contamination in the coastal and estuarine environment, which has adverse effects on biota as well as in the marine system. The aim of the current study was to evaluate the contamination status, enrichment, and flux of heavy metals in two monitoring years from coastal sediments of Pakistan. A total of 74 sediment samples were collected from seven coastal areas of Pakistan in two monitoring years, 2001-03 (MY-I) and 2011-13 (MY-II). The geochemical properties (grain size analysis, organic contents and eight heavy metals, i.e. Fe, Zn, Cu, Cr, Ni, Co, Pb, and Cd) of all sediment samples were analyzed. A significant increase in Fe, Ni and Cr concentrations detected between the years, whereas no significant differences were exhibited in Cu, Zn, Co, Pb and Cd concentrations. The extremely high enrichment (>50) of Cu, Zn, Pb and Cd were scrutinized in both monitoring years. The annual deposition flux of heavy metals ranged from 0.63 to 66.44 and 0.78 to 68.27 tons per year in MY-I and MY-II, respectively, with the lowest flux evaluated for Cd and highest for Zn in both monitoring years. A significant increase ($p < 0.05$) was observed in the burial flux of Cr and Ni during the last decade in coastal sediments. The use of geo-indicators is helpful to assess the contamination analysis for management and conservation of the marine environment.

Keywords : coastal contamination, enrichment factor, geo-indicator, heavy metal flux
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