A systematic and meta-analysis review of heavy metals pollution, toxicity potential, ecological and biological risk in surface sediments of Mahshahr and Imam Khomeini port estuaries (Coastal areas of Khuzestan province)

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Abstract

Coastal areas including the estuaries of Persian Gulf are sensitive and fragile areas of aquatic ecosystems in Iran that are severely affected by pollution from urbanization, industrialization, and maritime activity. Despite numerous studies on the status of pollution, especially heavy metals in these areas, comprehensive and systematic studies on this subject have not been conducted. Therefore, the present study was conducted in order to comprehensively assessment and systematically analyze of heavy metal pollution (Cu, Hg, Ni, Pb, Cd, Co) in coastal sediments of these areas by searching for studies performed between 2008 and 2020 through databases. Numerous indicators were also used to describe the objective and comprehensive description of heavy metal pollution and risks in coastal sediments. Several results were obtained from this study: (1) Among the metals studied, Cd, Hg and Ni were the most worrying metals in sediments of these areas; (2) In terms of pollution load index (PLI) and potential ecological risk (PER), Musa estuary was the most polluted station and was under the considerable ecological risk category, and other stations were under the uncontaminated category and low ecological risk; (3) From the ecological risk of an individual element perspectives (Er_r^i), all metals except Cd and Hg were in the low risk class, and the highest percentage of metals contribution in potential ecological risk (PER) was related to Cd and Hg; (4) In terms of sum toxic units (ΣTU) with the exception of Musa and Darvish estuaries, other areas were under the non-toxic category and the highest percentage of metals contribution in total toxicity was related to Ni and Hg; (5) According to the biological risk assessment index (mPELQ), with the exception of Doragh estuary (9% probability of toxic), other stations were in the range of 21% to 49% probability of biological toxicity. Based on the results, from the heavy metal pollution prevention and control perspective, toxicity and risks caused by them, it is necessary to prevent the transfer of heavy metals, especially Cd, Ni and Hg in coastal sediments of the Persian Gulf because of dominant human activities around of estuaries. Also, due to the higher level of indicators in the stations of Imam Khomeini port, Darvish estuary, Ghanam and especially Musa estuary, pollution resource analysis should be done to control the entry of pollutants and develop more effective management strategies in these areas.

Keywords: Heavy metals, Sediments, Potential ecological risk index, Biological risk index, Toxic units index, Persian Gulf.