Heavy Metal Threat Assessment By Geochemical and Statistical Tools for the Red Sea Surface Sediments, Egypt

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Twenty seven samples of recent bottom sediments were collected from three sites (Ras Gharib, Safaga, and Quseir) along the Red Sea coast of Egypt. The collected samples were subjected to a total digestion and analyzed by Inductively Coupled Plasma- Emission spectrometer (ICP-ES) for major and heavy metals including (Al, Fe, P, Mn, Cr, Zn, Ni, Pb, B, As, Co, Hg, Cu, and Cd). Concentration data were processed using correlation analysis, principal component analysis (PCA), and hierarchical cluster analysis. Multivariate statistical analysis classified heavy metals in the study area into different groups. Statistically, significant spatial variations were observed among all sediment variables. Correlation analysis and PCA show that the metal content of sediments was mainly regulated by the organic matter, Fe oxy-hydroxides contents, and grains size. Pollution intensity of the Red Sea coast was measured using the enrichment factor (CF), geo-accumulation index (Igeo), and the pollution load index (PLI). Severe and moderately severe enrichment of Cd, As, Pb, Hg, B, P and Zn in the Quseir harbour with minor enrichment of Cu and Co were observed, which reflects the intensity of the anthropogenic inputs discharged into this system. The results of both pollution load and geo-accumulation indices reveal that Quseir is the most polluted area, followed by Safaga while Ras Gharib is the least contaminated area. A comparison with sediment quality guideline quotient was also made here, indicating that there may be some ecotoxicological risk to benthic organisms in these sediments.
Key words: Heavy metals; bottom sediments; statistics; Pollution load index; Red Sea; Egypt