

Mapping of heavy metal, zinc, copper and iron contamination in surface sediments of Shadegan wildlife refuge using different methods of interpolation and GIS

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Abstract

The present study aimed to fractionation and determination of the most appropriate metals interpolation method such as zinc, copper and iron in surface sediments in range of Shadegan wildlife refuge was done for locating the polluted areas. Study and checking the total concentration and bioavailability of these elements in surface sediments and achieving the correct spatial distribution of pollutants based on the total concentration and their origin was carried out by sampling of 160 stations in three parts (northern, central and southern) of refuge from 0-5 cm of the surface layer of sediment due to the marshland of some areas of the wetland and the lack of access to these areas in May and November of 2014. The total concentrations of metals were analyzed in surface sediments by direct aqua regia method and their values were evaluated in sediment geochemical phases using 4-step sequential extraction method, while interpolation and modeling of spatial variations of metal concentrations in sediments through ordinary Kriging methods, radial basis function (spline) and inverse distance weighting (IDW) were drawn in Arc GIS and their accuracy compared by using error correction criteria RMSE and MAE and most useful method was selected. Maps of the distribution of concentrations of zinc and copper were prepared by using ordinary Kriging (OK) with exponential model for zinc and copper and by using of inverse distance weighting (IDW) for the iron. Sediments geochemical analysis results showed average concentrations of metals copper, zinc and iron, were obtained respectively 22.86, 55.20, 25979.01 microgram per gram of dry weight and natural fraction in ratio to the total concentration is allocated more than 89% percent and man-made fraction more than 10% of the total amount of all elements that studied in sediments of the stations studied. In addition, the amount of elements in the exchange phase was less than 3%, which was considered negligible. On the other hand, the analysis of the zoning map of heavy metals according to their chemical speciation showed that the highest bioavailability of zinc in the northern, southern and western parts has happened and the accumulation of copper and iron are visible respectively more in the western part for copper and central and northern parts for iron.

Keywords: Spatial distribution, Fractionation, Surface sediments, Heavy metals, Shadegan Wildlife Refuge.