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USING MULTIVARIATE STATISTICAL METHODS FOR IDENTIFYING THE PROBABLE ORIGIN OF ARSENIC CONTAMINATION IN GROUNDWATER

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Abstract

The contamination of groundwater resources by heavy metals, especially arsenic (As), is a significant hazard that threatens human health and the environment. In the present study, As contamination and its probable origin were investigated in the groundwater resources of the Sirjan Plain, Iran. For this purpose, groundwater samples were taken from 22 exploitation wells and analyzed for As, Cd, Mo, Se, Fe, Al, Ca^{2+}, Na^{+}, Mg^{2+}, K^{+}, Cl^{-}, SO_4^{2-}, HCO_3^{-}, TDS, EC, TH, and pH in June 2017. The results showed that As had a variation ranging from 1 µg/L to 195 µg/L. In this regard, 68.1% of the groundwater samples contained As concentrations more greater than the 10 µg/L threshold proposed by the World Health Organization. The highest As concentrations were detected in the northeastern and central parts of the plain. Meanwhile, a declining trend was observed in the samples from the north and south of the plain. In the next step, correlation analysis and multivariate statistical analysis, including principal component analysis and cluster analysis, were carried out to extract associations among the studied parameters. The results showed that As from Fe and Al oxyhydroxides surfaces under oxidizing conditions was a significant factor causing As contamination in the Sirjan Plain. The knowledge gained from this study helps to better understand the mechanisms of As contamination, which is useful for decision-makers regularly monitoring As concentrations in the Sirjan area's groundwater. It is concluded that multivariate statistical techniques are helpful tools in the current dataset and the study area.

Key words: arsenic, contamination, groundwater, multivariate statistics, spatial distribution

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