

## Application of multivariate analysis to study water chemistry of groundwater in a semi-arid aquifer, Malayer, western Iran

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### ABSTRACT

Groundwater chemistry is controlled by many natural processes as well as anthropogenic processes. The identification of the influence of anthropogenic processes on groundwater chemistry is difficult particularly in cases of early phase of groundwater anthropogenic transformation. Multivariate analysis (principal component analysis and cluster analysis) was performed to identify a common source for groundwater chemistry and identification of anthropogenic processes affecting groundwater chemistry of a semi-arid aquifer, Malayer, western Iran. The principal component analysis (PCA) performed on groundwater identified three principal components controlling variability of groundwater chemistry. Magnesium, Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> content were associated in the same component (PC1) (salinity), most probably interpret as linked to anthropogenic activities. The Ca<sup>2+</sup>, HCO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, and Si (PC2) content were interpreted as related to the lithogenic. Finally, the NO<sub>3</sub><sup>-</sup> and pH (PC3) was interpreted as reflecting long-term anthropogenic activity as a consequence of application of inorganic fertilizers, atmospheric deposition or industrial wastes. The results of this study demonstrate that multivariate analysis is probably a reliable method for differentiation of natural and anthropogenic processes affecting groundwater chemistry.

*Keywords:* Anthropogenic; Groundwater; Hydrochemistry; Multivariate analysis

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