Irrigation Water Quality Evaluation Based on Multivariate Statistical Analysis: A Case Study of Jiaokou Irrigation District

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Abstract : Groundwater is main source of water supply in the Guanzhong Basin, China. To investigate the quality of groundwater for agricultural purposes in Jiaokou Irrigation District located in the east of the Guanzhong Basin, 141 groundwater samples were collected for analysis of major ions (K^+, Na^+, Mg^{2+}, Ca^{2+}, SO_4^{2-}, Cl^-, HCO_3^-, and CO_3^{2-}), pH, and total dissolved solids (TDS). Sodium percentage (Na%), residual sodium carbonate (RSC), magnesium hazard (MH), and potential salinity (PS) were applied for irrigation water quality assessment. In addition, multivariate statistical techniques were used to identify the underlying hydrogeochemical processes. Results show that the content of TDS mainly depends on Cl^-, Na^+, Mg^{2+}, and SO_4^{2-}, and the HCO_3^- content is generally high except for the eastern sand area. These are responsible for complex hydrogeochemical processes, such as dissolution of carbonate minerals (dolomite and calcite), gypsum, halite, and silicate minerals, the cation exchange, as well as evaporation and concentration. The average evaluation levels of Na%, RSC, MH, and PS for irrigation water quality are doubtful, good, unsuitable, and injurious to unsatisfactory, respectively. Therefore, it is necessary for decision makers to comprehensively consider the indicators and thus reasonably evaluate the irrigation water quality.

Keywords : irrigation water quality, multivariate statistical analysis, groundwater, hydrogeochemical process
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