



# Evaluation of groundwater quality in the Dibdibba aquifer using hydrogeochemical and isotope techniques (Basrah Province, Iraq)

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**Abstract** The Dibdibba aquifer is considered to be the main source in the Al-Zubair area because agriculture depends on it to provide grazing water in the area. The groundwater well samples were collected from the shallow Dibdibba Aquifer in Basra Province, southern Iraq, through the dry and wet period for 37 water samples were collected, to investigate the water quality deterioration, which is a hydrogeochemical modeling study where used to represent the groundwater mixing evaluation. The physicochemical parameter results show the spatial and temporal variations along the groundwater flow path. A Durov diagram of the studied samples shows water type Na-SO<sub>4</sub>, which is represented by mixing waters that may be affected by dissolution. Inverse geochemical model ratio results of the groundwater well samples have shown high mixing ratios in the east and southeast regions of the study area. The stable isotope composition of groundwater samples indicated that the recharge source of the Dibdibba aquifer is meteoric water influenced by vapor water from the Arabian Gulf. The stable isotope results have shown that the enrichment of  $\delta^{18}\text{O}$  values is relatively linked with high

salinity concentration and indicated the mixing between the upper unconfined and the lower confined, especially in the eastern and southern parts of the study area. These findings of geochemical modeling and isotopes indicated an increasing groundwater quality deterioration. Thus, we recommended avoiding these areas for intensive extraction of groundwater.

**Keywords** Safwan–Zubair · Dibdibba formation · Geochemical modeling · Mixing · Stable isotopes · Basra

## 1 Introduction

Controlling and managing water resources are considered the main important problems that are facing most countries in arid and semi-arid regions under the influence of global climate change. These regions suffer from a scarcity of water due to low rainfall rates and high evaporation rates. The scarcity and lack of water and the deterioration of water quality lead the states or countries to develop alternative and future plans to manage water resources and prevent pollution (Al-Mallah and Al-Qurnawi 2018). Groundwater is an important source for human life; it is considered an important source in arid and semi-arid regions. Growing populations, increasing municipal, industrial, and agricultural activities, as well as the natural climatic changes resulting in global warming, have led to significant changes in water resources (surface and groundwater), which these factors have seriously increased the water requirement across the world (Ali 2012; Al-Asadi et al. 2020). Evaluating and monitoring their sources is urgent for hydrogeologists to detect the factors that caused negative anomalies in groundwater quality, in addition to

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