**Highlights**

* The Dammam Eocene aquifer of the Shigaya D-Field of Kuwait was studied using geophysical and hydrochemical data.
* The aquifer has a heterogeneous is composed of limestone, dolomitized at the top, with dispersed argillaceous materials ranges.
* The total matrix porosity ranges from 4 to 35 %, with the highest values recorded at the top of the formation, that was enhanced by dolomitization, fracturing, and dissolution.
* The groundwater type is Na2SO4, with Na+ and Ca++ and strong acids (SO4-- and Cl-) than the weak acids (CO3-- and HCO3-).
* A simple dissolution or mixing nature took place between sodium ions of the meteoric water and the magnesium and calcium ions of the groundwater.
* A remarkable decrease of the Dammam water salinity was detected after 1977, as a result of groundwater exchanges that took place between the overlying, relatively lower salinity, Kuwait Group aquifer through the wellbores whenever the wells are not being pumped.