



## Groundwater Protection around Makkah Sewage Treatment Plant using Hydrological and Transport Models

Makkah is depicted environmentally by scarcity of rainfall, elevated temperatures, and increasing rates of evaporation. These ambience factors have driven the city to a reduction in the water balance. The main water resources in Makkah are renewable groundwater aquifers. Despite numerous studies concerned in the assessment of groundwater quality in Makkah, this paper presents the groundwater pollution remediation near Makkah sewage treatment plant. The methodology of this study depends on the simulation of four scenarios of groundwater remediation under the treated effluent of Makkah sewage plant. These scenarios are injection wells of clean water (with and without surface recharge of the effluent Makkah sewage plant), discharge wells for the contaminated aquifer, and slurry wall to constrict the spread of aquifer pollutants. The simulation is performed using the hydrological model (MODFLOW) and transport model in groundwater systems (MT3D). The results revealed that the case of discharge wells was the best one for cleaning the aquifer. In contrast, the worst case was the injection wells with surface recharge causing the pollution spread over the whole area. The case of using the slurry wall proved an efficient approach for controlling the pollution spread through the path of Makkah sewage plant effluent flow.