



Improvement of urban water cycle and mitigation of groundwater table rise through advanced membrane desalination of shallow urban brackish groundwater of Jeddah basin

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ABSTRACT

Jeddah city depends entirely on desalinated seawater for its fresh water supply which exceeds 1.2 Mm³/d. Around 40% of the water used in the urban area infiltrates into the underlying shallow groundwater from cesspits and wastewater networks. This process resulted in groundwater table rise in many parts of the city and the occurrence of a polluted brackish groundwater (BGW) which is a mix of fresh water, domestic sewage, seawater intrusion, and urban runoff. Membrane technologies such as hybrid membrane systems and membrane bioreactors coupled with reverse osmosis membrane systems have been well established as cost-effective, feasible, and efficient solutions for desalination of contaminated water sources. This study emphasizes on the potential of BGW in Jeddah urban water cycle as one of its main components and the key principles of integrated urban water cycle management applied to Jeddah context. The study assessed the favorable conditions, driving factors, and the feasibility of integrating BGW source of Jeddah basin into the water cycle of the city through the introduction of various options of integrated membrane systems for on-site desalination and treatment. Physiochemical and microbiological analysis of BGW samples taken from selected districts in the basin has been conducted and showed low levels of biological contaminants, as a result of soil aquifer treatment, compared to effluents of wastewater treatment plants. A comparison of costs of current practices of water supply and BGW desalination option for specific on-site uses has been provided as well.

Keyword: Urban water cycle; Brackish groundwater; Groundwater table rise; Desalination; Cost of desalination; Jeddah

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