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Spatial variability in brackish groundwater geochemistry in Texas, USA – Implications for Brackish Groundwater Desalination towards Sustainable Development Goals

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With growing population of USA, traditional fresh groundwater sources are continuously drawn from for a variety of consumer and industrial uses. Attention has now turned to tapping into previously ignored sources of water to help supplement the increasing demand. Brackish Groundwater (BGW) is defined as water that is between 1,000 to 10,000 mg/L of TDS. Although BGW sources have been relatively untapped, they could help supplement freshwater sources, particularly for commercial and industrial uses. For the BGW to be utilized, it must first be desalinated using reverse osmosis (RO), however, the efficiency of this process can be impeded by the supersaturation of certain salts creating scales on the RO membrane. To circumvent this, it is necessary to determine the predominant scalant in the BGW that must be removed. In the current study, hydro-chemical data [1,2] for over 6,000 BGW well samples across 18 aquifers in Texas were investigated and geochemically mapped. Their chemical compositions were assessed to identify precipitants that may need to be removed, and determine a target specific treatment process. Brackish GW in Texas is spatially distributed mainly in the Gulf Coast Aquifer in the South, the Seymour Aquifer to the North, and the Pecos Valley Aquifer to the Northwest at depths 500-1,000 ft, <100 ft, and 100-500 ft respectively. The chemical composition of BGW in the Seymour and Pecos Valley aquifers are mainly dominated by SO42- with concentrations ranging between 15-2,697 mg/L and 27-4,208 mg/L, respectively. On the contrary, the Gulf Coast Aquifer is dominated by high alkalinity with concentrations ranging from 1-1,309 mg/L. Delineation of BGW reserves as well as their individual chemical compositions is important in order to assess their potential for desalination. For example, if BGW is supersaturated with sulfate, then the treatment method would differ than if it were dominated by silica. Overall, our results quantify the geochemical differences across BGW reserves within aquifers in Texas to provide insight into improving the efficiency of the RO treatment process to provide clean water under SDG-6.

[1] McMahon et al. (2016), Groundwater 54(4), pp.464-475.

[2] Stanton et al. (2017), US Geological Survey Report No. 1833