Addressing Global Water Scarcity with a Novel Hydrogel Based Desalination Technique Using Saponified Starch-g-polyacrylamide and Its Hydrophilic Properties to Harvest Fresh Water with a Low Energy and Chemical Footprint

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To address global fresh water scarcity, a novel hydrogel based seawater desalination technique using a superabsorbent starch based polymer is proposed. Current approaches rely on thermal, membrane, or hybrid approaches to desalinate water and impose high energy and environmental costs. Approximately only 3 percent (by weight) of seawater contains dissolved solids (including salt) that are bonded to less than 10 percent of seawater. This study harvested the remaining water using saponified starch-g-polyacrylamide's hydrophilic properties. This required a) the creation of a hydrogel to separate fresh water from seawater, b) the separation of the hydrogel from the brine solution, c) the dewatering of the gel resulting in aqueous sulfuric acid and d) the recovery of fresh water from the aqueous solution. The study demonstrated that a) It is possible to use such a hydrophilic starch based polymer to desalinate water without thermal or electrical energy, b) that the extracted water's conductivity is comparable to fresh water indicating that the salts have been separated, and c) that this approach has promise in mitigating the problems of pre-treatment and post-treatment during desalination. Mass and conductivity analysis confirmed that the extracted water had a total dissolved solids concentration of 513 mg/L, within the WHO guidance for good drinking water (<600 mg/L). Sustainable and accessible means for desalination have potential to improve millions of lives; the implementation of the proposed hydrogel based desalination technique can address this need with very low infrastructure investments and a high yield for irrigation needs (90%) and potable water needs (73%) with no chemical contaminants, while producing a commercially useful fertilizer (CaSO4) as inert byproduct.

Awards Won:
Second Award of $2,000
King Abdulaziz &amp
his Companions Foundation for Giftedness and Creativity: First Award of $1,000
U.S. Agency for International Development: Fourth Award of $500