**Functional analysis of selected ion electrically conductive hydrogel production and applications in seawater treatment**

Mohamed H. Sorour, Marwa M. El Sayed\*, Abdelghani M. G. Abulnour, Hayam, F. Shaalan, Heba A. Hani, Shadia R. Tewfik

*Chemical Engineering and Pilot Plant Department, National Research Centre, Cairo, Egypt*

 *El-Buhouth Street, Dokki; P.O. Box 12622 Phone: +201096170061, Fax: +20-2-33370931*

*\*Corresponding author:eng\_marwa06@yahoo.com*

**Highlights**

* Desalination technology is associated with various technological challenges
* Hydrogel composite is used for removal of seawater hardness.
* The characteristics of the composite and performance via adsorption of Ca++ and Mg++ have been determined.
* The electro-regeneration has been also explored.

**1. Introduction**

Seawater desalination is becoming a crucial intervention for mitigating water shortage in numerous Middle East countries. Desalination technology is associated with various technological challenges that should be resolved to maintain plant sustainability and performance. For instance, seawater hardness is recognized as a challenge for recent large scale desalination plants. Optional technologies including chemical treatment, adsorption and membrane filtration have been developed for hardness removal and recovery of Ca++ and Mg++.

**2. Methods**

This paper addresses the development and application of a new conductive polymeric hydrogel composite exhibiting electrically tunable characteristics. The developed hydrogel composite comprises especially treated zeolite, polyacrylate, polyaniline, hydrolyzed polyacrylamide and special processing aids. The characteristics of the composite have been determined via scanning electron microscopy, Fourier transform infrared spectroscopy and electric conductivity measurements in addition to swelling ratio. Impact of composition and processing conditions on conventional and electrochemically enhanced adsorption experiments have been presented and analyzed. The electro-regeneration has been also explored.

**3. Results and discussion**

The promising features of this novel hydrogel composite are elucidated by the removal and recovery of hardness causing elements in simulated seawater and brines.

**4. Conclusions**

It is concluded that the developed hydrogel is initially qualified for upstream seawater softening. Additional endeavors are still needed for downstream brine management to overcome apparent osmotic effects.

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