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Application of Graphene and Zeolite Absorbents in Water Desalination

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Abstract

The scarcity of freshwater resources increases the importance of seawater and brackish water desalination processes. However, a large amount of specific energy requirements, and high operational costs, present a big challenge in adopting desalination technologies. Due to high expenses of energy, desalination of saline waters by low-cost methods is important. The objective of this research was to investigate the ability of two adsorbents (zeolite and graphene oxide) to remove salinity ions from aqueous solutions in Caspian Sea water and water of the well of the Dark zone in Isfahan. At first, some graphene oxide was made according to Homer's method. Then, the characteristics of graphene oxide were known by Fourier transform infrared spectroscopy and using an electron microscope. After that, the ability of adsorbents to remove salinity agent cations and anions was evaluated. To investigate a fixed-bed zeolite column with graphene oxide (GO) layer was used to remove Na^+, K^+, Ca^{2+}, Mg^{2+}, and Cl^- from 50 cc of saline water. Also, Hexadecyl trimethylamine (HDTMA) was used to modify natural zeolites. The results showed that among the adsorbents for the water of the well in the Dark zone, 30 mg graphene oxide with 13 gr zeolite had the highest adsorption rate (23.84 percent of salinity reduction), and for Caspian Sea water, 13 gr zeolite modified by surfactants had the highest adsorption rate (23.43 percent of salinity reduction). Also, the removal of cations and anion followed the sequence: $K^+ > Ca^{2+} > Mg^{2+} > Cl^- > Na^+$.

Keywords: Graphene oxide, Desalination, Fixed-bed column

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