بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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MONA MAGHRABY

Radiation Modification of Reverse Osmosis Membranes for Desalination of Saline Water

Thesis Submitted for the requirements of
philosophy Degree (Ph. D.)
In Chemistry

By

Hany Marzouk Gayed Marzouk

(M.Sc. in Chemistry 2015)

To

Chemistry Department, Faculty of Science,
Ain Shams University

National Center for Radiation Research and Technology,
Atomic Energy Authority

2020

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ABSTRACT

This research explored surface modification using different irradiated mixtures, at various compositions, of chitosan/Ag (CS/Ag) and Chitosan/TiO_2 (CS/TiO_2) nanodispersions to improve the membrane characteristics and fouling resistance of polyamide membranes as well.

The irradiated CS/Ag and CS/TiO_2 nanodispersions at various concentrations were used for coating, PA membrane to improve its performance. The radiation prepared CS/Ag and CS/TiO_2 nanodispersions were characterized to monitor the shape and particle size of TiO_2 and Ag by transmission electron microscopy (TEM) and X-Ray diffraction (XRD). The surface morphology, membrane chemical composition and surface hydrophilicity were evaluated by scanning electron microscope (SEM) and atomic force microscopy (AFM), FT-IR spectroscopy (FTIR) and contact angle measurements respectively. FT-IR spectroscopy of the modified membranes proved the incorporation of CS, TiO_2 and Ag nanoparticles on the polyamide membrane. The performance of both neat and modified membranes for water desalination was also, evaluated.

Studying the results obtained from various modifications of PA membrane through the coating with different concentrations of irradiated chitosan, chitosan/TiO_2 and chitosan/Ag nanodispersions. The results of contact angle measurements showed that the permeability of the PA membrane was enhanced at low concentrations of the coating mixtures. Also, the water flux and salt

rejection were comparable with that reported in the literature. The biofouling resistance of PA membrane after modification with both CS/Ag and CS/TiO_2 nanodispersion against two types of bacteria gram positive and gram negative models; Staphylococcus aureus and Escherichia coli were examined. The PA/CS/TiO_2 modified membranes significantly reduced the number of viable cells by 90% and 69.5% for E. coli and S. aureus respectively, which is higher than that of the PA membrane which reduced it by 33% and 47.8% for both bacteria, respectively. Whereas the results in case of PA/CS/Ag modified membranes, showed reduction in the number of viable cells by 83% and 97% for E. coli and S. aureus respectively, which also still higher than that of the commercial polyamide membrane.

Aim of work

As the efforts to enhance the performance of neat PA reverse osmosis membrane are still growing many decades ago, it is still interesting and attracting for many researches to do their best in this field. So the aim of this work is mainly, based on; radiation and chemical modification of PA membrane by different examples of nano materials namely CS/TiO_2 and CS/Ag nanodispersions, to reach the optimum values for water flux and salt rejection. Also, it concerns with studying the PA, PA/CS/Ag and PA/CS/TiO_2 membranes by various techniques. This will be carried out to prove the interaction of CS/Ag and CS/TiO_2 nanodispersions with the surface of the PA membrane as FTIR, SEM, AFM, XRD, TGA, and contact angle measurements. In addition, we are going to evaluate the performance of neat and modified membranes. Furthermore, we are concerned with investigating the biofouling resistance of modified membranes.