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Scale-up of zeolite membranes for water treatment

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In the last years, desalination of sea- and brackish water to obtain sweet water in arid regions has gained a growing interest. In this context, membrane distillation (MD) is able to efficiently treat high concentrated brines allow increasing the overall fresh water production. Studies on MD were often made by using polymeric membranes. However, these membranes present fouling problems and also degrade when they are exposed to aggressive environments. Therefore, great attention was directed towards inorganic membranes owing to their high mechanical and chemical stability and the possibility to re-use them numerous times. In the class of inorganic membranes, zeolite membranes present another important characteristic useful in membrane process that is the pore size control. In fact, they are able to separate continuously mixtures of substances on the basis of differences in molecular size, shape and also on the basis of different adsorption properties. However, processing problems and high cost hinder their industrial application. For desalination purposes, the MFI zeolite topology is appropriate having a pore size (about 5.5 Å) lower than the major kinetic diameters of different hydrated ions. In this work, for the first time, tubular silicalite (MFI) membranes with a length of 30 cm were prepared using the secondary growth method coupled with the cross flow seeding procedure. Afterward, the prepared membranes were characterized and tested in vacuum membrane distillation process using both deionized water and NaCl solutions at different concentrations. The obtained results showed that it is possible to reach a good reproducibility in the preparation of uncalcined defect-free membranes. In addition, the prepared membranes showed the best performance leading to interesting fluxes and salt rejection values for feed salt concentrations in the range of 0.2 M-0.9 M.

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Color removal from textile wastewater using a pilot-scale dual-stage MBR and subsequent RO system

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The textile industry not only utilizes large quantities of water, but also produces large quantities of wastewater. Limited information has been published on textile wastewater treatment, for re-use in South Africa (SA), with treatment processes focusing on conventional wastewater treatment methods. A major concern in textile wastewater treatment is the release of highly colored wastewaters polluted with dyes, textile auxiliaries and other chemicals into the environment that are generally toxic and resistant to biological treatment methods. A necessity therefore exists for an effective treatment method capable of removing both the strong color and the toxic organic compounds from textile wastewater. A pilot-scale dual-stage membrane bioreactor (dsMBR) incorporating two ultrafiltration (UF) side stream membrane modules was designed, constructed, operated and evaluated on-site, at a textile company for treating textile wastewater. The wastewater stream was characterized by a color range of 195–2070 ADMI units and a chemical oxygen demand (COD) of between 728 and 1033 mg/L. A consistent reduction in the color of the incoming wastewater was evident in the treatment stages. The residual color and remaining salt in the UF permeate was treated with reverse osmosis (RO). The color in the wastewater was reduced from an average of 660 ADMI units to~12 ADMI units in the RO permeate, a lower ADMI compared to the potable water (~17 ADMI units) used on-site by the textile company.

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