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Yuqing Zhang, Song Wei, Shaomin Liu, Ming Yong, Wei Liu

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Yuqing Zhang[1*], Song Wei[1], Shaomin Liu[2], Ming Yong[1], Wei Liu[1]

[1]School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, P R China

[2]Department of Chemical Engineering, Curtin University, Perth, WA 6845, Australia

*Corresponding author. zhangyuqing@tju.edu.cn (Y.Q. Zhang).

Abstract

In order to save energy consumption of reverse osmosis (RO) process via partial desalination and deep cleaning of oily seawater, $Y_xSi_{1-x}O_2$-SO_3H (YSS) particles were synthesized through co-hydrolysis, silanization and sulfonation, then employed as a functional layer on phosphorylated $Y_xSi_{1-x}O_2/Al_2O_3$ (PYSA) to form YSS self-assembled membrane. YSS particles were characterized by SEM, FT-IR and XRD, while the membranes were analyzed through SEM. The YSS self-assembled membranes formed under the optimum conditions were used to partially desalinate and deeply clean oily seawater. The results indicate that YSS particles were successfully synthesized and particle size is homogeneously distributed between 3 and 5 μm. Furthermore, YSS self-assembled membranes not only perform attractive ultrafiltration properties, but also display a desirable partial desalination ratio of 28.6% through Donnan effect under low operating pressure of 0.14 MPa, and contribute to an energy saving of 254.7 W (about 22.0%) for RO process. Besides, the self-assembled membranes can be recycled by calcination, and still partially desalinate and clean oily seawater. This work suggests that YSS self-assembled membranes with partial desalination property are promising alternatives for oily seawater treatment.