www.elsevier.com/locate/memsci

Poly(sodium vinylsulfonate)/chitosan membranes with sulfonate ionic cross-linking and free sulfate groups: preparation and application in alcohol dehydration

Pei-Yao Zheng, Chun-Chun Ye, Xue-San Wang, Kai-Fan Chen, Quan-Fu An, Kueir-Rarn Lee, Cong-Jie Gao

PII: S0376-7388(16)30117-X
DOI: http://dx.doi.org/10.1016/j.memsci.2016.02.060
Reference: MEMSCI14327

To appear in: *Journal of Membrane Science*

Received date: 12 January 2016
Revised date: 25 February 2016
Accepted date: 26 February 2016

Cite this article as: Pei-Yao Zheng, Chun-Chun Ye, Xue-San Wang, Kai-Fan Chen, Quan-Fu An, Kueir-Rarn Lee and Cong-Jie Gao, Poly(sodium vinylsulfonate)/chitosan membranes with sulfonate ionic cross-linking and free sulfate groups: preparation and application in alcohol dehydration, *Journal of Membrane Science,* http://dx.doi.org/10.1016/j.memsci.2016.02.060

Poly(sodium vinylsulfonate)/chitosan membranes with sulfonate ionic cross-linking and free sulfate groups: preparation and application in alcohol dehydration

Pei-Yao Zheng[a], Chun-Chun Ye[a], Xue-San Wang[a], Kai-Fan Chen[a], Quan-Fu An[a*], Kueir-Rarn Lee[b], Cong-Jie Gao[c]

[a]*MOE Key Laboratory of Macromolecular Synthesis and Functionalization, Department of Polymer Science & Engineering, Zhejiang University, Hangzhou 310027, China*

[b]*R&D Center for Membrane Technology, Department of Chemical Engineering, Chung Yuan University, Chung-Li 32023,Taiwan*

[c]*The Development Center of Water Treatment Technology, Hangzhou 310012, China*

[*]Corresponding authors. Tel.: (+86)-571-87953780; Fax: (+86)-571-87953780. *E-mail address*: anqf@zju.edu.cn (Q. F. An)

Abstract

Polyelectrolyte complexes with sulfonate ionic cross-linking and free sulfate groups were fabricated from chitosan (CS) and poly (sodium vinylsulfonate) (PVS) *via* the "complexation-sulfation" method. Homogenous membranes (S-PVS/CS PECMs) were prepared exhibiting both high flux and water selectivity in dehydrating various alcohols and the separation performance was proportional to the content of free sulfate groups. For example, in dehydrating 10 wt% water/ethanol mixture at 70 ^{o}C, the flux and water content in permeate for the S-PVS/CS-3 PECM was 1980 g/m^{2}h and 99.55 wt%, respectively. Moreover, the separation performance was stable versus an operation time of 120 h and could dehydrate an azeotropic water/ethanol mixture to fuel grade ethanol. Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy, and ζ potential were employed to characterize chemical structures, compositions, and charge properties of S-PVS/CS PECs. Scanning electron microscopy and contact angle measurement were exploited to investigate the morphology and hydrophilicity of S-PVS/CS PECMs. In addition, swelling and sorption behavior of S-PVS/CS PECMs were determined to interpret separation performances.

Keywords: Pervaporation, Alcohol dehydration, Sulfonate ionic cross-linking, Free sulfate groups