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Enhanced butanol selectivity of pervaporation membrane with fluorinated monolayer on polydimethylsiloxane surface

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Abstract

A facile approach to fabricate fluorinated molecular monolayer on the surface of polydimethylsiloxane (PDMS) membrane was conducted using fluoroalkylsilane (FAS) as cross-linking agent. In detail, hydroxyl terminated PDMS were cross-linked with 1H,1H,2H,2H-Perfluorodecyltriethoxysilane and cast on porous polysulfone support to prepare PDMS membranes. X-ray photoelectron spectroscopy showed that fluorinated alkyl chains were enriched at the surface of the membranes. Moreover, the surface fluorine concentration increased with the increasing of FAS and plateaued at around 55 at% (close to that of FAS molecules) when the surface was fully covered by fluorinated monolayers. The surface hydrophobicity was proportional to the surface fluorine content as revealed by water contact angle measurement. When applied in pervaporation separation of 1wt% *n*-butanol/water mixture at 60^{o}C, the membrane prepared with a FAS ethoxy to PDMS hydroxyl equivalents ratio of 35 (PDMS-FAS-35) exhibited a flux of 843 $gm^{-2}h^{-1}$ and an enhanced permeate *n*-butanol concentration of 34.3 wt% compared with PDMS cross-linked with traditional TEOS (1375 $gm^{-2}h^{-1}$, 24.4 wt%). The decrease of permeate flux

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