

论文

聚电解质PDDA/PSS层层自组装膜的渗透汽化性能

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摘要:

采用聚电解质层层自组装(LbL)技术, 在不同盐浓度下制备了聚(二烯丙基二甲基氯化铵)/聚苯乙烯磺酸钠(PDDA/PSS)多层自组装膜, 并用于渗透汽化性能的研究. 重点考察了组装溶液中NaCl的浓度、组装层数及操作温度对自组装膜的异丙醇脱水性能的影响. 同时, 用扫描电镜观测了不同条件下制备膜的表面形貌. 结果表明, 在高NaCl含量的聚电解质溶液中只需组装几个双层的LbL膜, 即能获得较高的分离因子和较大的通量, 并解释了该LbL膜呈现反“trade-off”现象的原因.

关键词: 聚电解质多层膜 层层自组装 渗透汽化 反“trade-off”现象

Pervaporation Performance of Polyelectrolyte PDDA/PSS Layer-by-layer Self-assembly Multilayer Membranes

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Abstract:

Membrane separation is one of the promising applications of layer-by-layer technology. Poly (diallyldimethylammonium chloride)/poly(styrenesulfonate sodium salt)(PDDA/PSS) multilayer membranes were self-assembled in polyelectrolyte solutions with different NaCl concentrations. The influences of NaCl concentration of the dipping solutions, number of bilayers and feed temperature on the pervaporation performance of PDDA/PSS multilayer membranes were investigated. Scanning electron microscope(SEM) was used for measuring the surface morphology of the PDDA/PSS multilayer membrane. The results of the pervaporation tests show that the PDDA/PSS membranes assembled in high NaCl concentration have a good pervaporation performance, which can be explained by the chain size of polyelectrolytes in dipping solutions and the structure of LbL membranes. The (PDDA/PSS)₆PDDA multilayer membrane assembled in 1 mol/L NaCl has separation factor 345 and permeate flux 2.51 kg·m⁻²·h⁻¹ for separating 95% isopropanol isopropanol-water mixture at 55 °C. An anti- “trade-off” phenomenon was found and was explained in term of the dependence of both solvent interaction and the swelling of LbL membrane on the feed composition.

Keywords: Polyelectrolyte multilayer membrane Layer-by-layer self-assembly Pervaporation Anti- “trade off” phenomenon

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