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Ultrathin NaA Zeolite Membrane in Solvent Recovery: Preparation and Application

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Abstract : Solvent recovery process is receiving utmost attention in recent year due to the scarcity of natural resource and consciousness of circular economy in chemical and pharmaceutical manufacturing process. Solvent dehydration process is one of the important process to recover and to purify the solvent for reuse. Due to the complexity of solvent waste or wastewater effluent produced in pharmaceutical industry resulting the wastewater treatment process become complicated, thus an alternative solution is to recover the valuable solvent in solvent waste. To treat solvent waste and to upgrade solvent purity, membrane pervaporation process is shown to be a promising technology due to the energy intensive and low footprint advantages. Ceramic membrane is adopted as solvent dehydration membrane owing to the chemical and thermal stability properties as compared to polymeric membrane. NaA zeolite membrane is generally used as solvent dehydration process because of its narrow and distinct pore size and high hydrophilicity. NaA zeolite membrane has been mainly applied in alcohol dehydration in fermentation process. At this stage, the membrane performance exhibits high separation factor with low flux using tubular ceramic membrane. Thus, defect free and ultrathin NaA membrane should be developed to increase water flux. Herein, we report a simple preparation protocol to prepare ultrathin NaA zeolite membrane supported on tubular ceramic membrane by controlling the seed size synthesis, seeding methods and conditions, ceramic substrate surface pore size selection and secondary growth conditions. The microstructure and morphology of NaA zeolite membrane will be examined and reported. Moreover, the membrane separation performance and stability will also be reported in isopropanol dehydration, ketone dehydration and ester dehydration particularly for the application in pharmaceutical industry.

Keywords : ceramic membrane, NaA zeolite, pharmaceutical industry, solvent recovery
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