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# The Role of Pre-evaporation in the Preparation Process of EVOH Ultrafiltration Membranes via TIPS

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## ABSTRACT:

The poly(ethylene-co-vinyl alcohol) (EVOH) ultrafiltration membrane is prepared via pre-evaporation combined thermally induced phase separation (TIPS), using a novel co-solvent that is a mixture of sulfolane and 1,3-propanediol. The porous surface is mainly caused by the low cooling rate of pre-evaporation stage. Based on the shorter pre-evaporation time, the evaporation of 1,3-propanediol provides a foundation for asymmetric structure. Subsequently, the quenching effect of water bath forms a dense layer below the porous surface. The compact degree of dense layer increases first and then decreases with the increase of pre-evaporation time ( $\tau$ ) or pre-evaporation temperature ( $T$ ) or the mass fraction of 1,3-propanediol in co-solvent ( $\beta$ ). Therefore, the rejection of bovine serum albumin (BSA) increases first and then decreases as  $\tau$  or  $T$  or  $\beta$  increases. Meanwhile, the connectivity of membrane structure can also be adjusted by changing  $\beta$ . Finally, the EVOH ultrafiltration membrane prepared from  $\tau = 20$  s,  $T = 25^\circ\text{C}$  and  $\beta = 15\%$  achieves relatively high BSA rejection of 98% and relatively large pure water flux of  $302 \text{ L}\cdot\text{m}^{-2}\cdot\text{h}^{-1}\cdot\text{bar}^{-1}$ .

## Graphical abstract

Herein we prepare poly(ethylene-co-vinyl alcohol) (EVOH) ultrafiltration membrane via pre-evaporation combined thermally induced phase separation (TIPS), using a novel co-solvent that is a mixture of sulfolane and 1,3-propanediol. The

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