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Influences of solvent-exchange drying on the properties of cellulose hollow fiber membranes

Xingming Jie, Yiming Cao*, Ming Wu, Quan Yuan

Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023, P.R. China

Abstract

Cellulose hollow fiber membranes (CHFM) were prepared from the cellulose/N-methylmorpholine-N-oxide/H_2O system by immersion-precipitation and wet spinning. Different drying methods were carried out to investigate their influences on the properties of CHFM. It was revealed that water-cellulose hydrogen bonds in the bonded region and solvent-solvent molecular affinity in the free region of CHFM were the two crucial factors for membrane shrinkage during its drying procedure. Strong hydrogen bonds existed in water molecules and ethanol molecules, and their evaporation could pull the cellulose molecules congregating together and even destroy the original finger-like macro-voids of CHFM. This always led to so dense membrane structure that the resulted dry CHFM could not show any gas permeation ability. While CHFM from 2-butanone and ethanol-n-hexane exchange drying could greatly protect the original membrane structure because of their weak molecular affinity, and the dry CHFM showed obvious gas permeation performance. What should be mentioned is that the ethanol-n-hexane exchange drying method could best protect the membrane structure and has shown its application potential in the post-treatment of asymmetric cellulose hollow fiber membranes.