Aromatic Polyimide and Crosslinked Thermally Rearranged Poly(benzoxazole-co-imide) Membranes for Isopropanol Dehydration via Pervaporation

Yi Ming Xu[1], Ngoc Lieu Le[1,2], Jian Zuo[1], Tai-Shung Chung[1,2]*

[1] Department of Chemical and Biomolecular Engineering,
National University of Singapore, 4 Engineering Drive 4,
Singapore 117576

[2]Water Desalination & Reuse (WDR) Center,
King Abdullah University of Science and Technology,
Thuwal 23955-6900, Saudi Arabia

In this study, novel crosslinked thermally rearranged polybenzoxazole (C-TR-PBO) membranes, which show impressive results for isopropanol dehydration, have been obtained via in-situ thermal conversion of hydroxyl-containing polyimide precursors. The polyimide precursors are synthesized by the polycondensation of three monomers; namely, 4,4'-(hexafluoroisopropylidene) diphthalic anhydride (6FDA), 3,3'-dihydroxybenzidine diamine (HAB) and 3,5-diaminobenzoic acid (DABA). Due to the incorporation of the carboxylic-group containing diamine DABA into an ortho-hydroxypolyimide precursor, the thermal induced crosslinking reaction can be achieved together with the thermal rearrangement process. Consequently, a synergistic effect of high permeability and high selectivity can be realized in one step. The resultant C-TR-PBO membrane exhibits an unambiguous enhancement in permeation flux compared to their polyimide precursors. Moreover, the newly developed C-TR-PBO membrane displays stable isopropanol dehydration performance

at 60 °C throughout the continuous 200 hours. The promising preliminary results achieved in this study may offer useful insights for the selection of membrane materials for pervaporation and new methods to molecularly design next-generation pervaporation membranes.

Graphic abstract:

