Engineered Polymer Coated Polyetherimide Composite Hollow Fiber Membrane for Dehumidification of Air

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Energy consumption by air conditioning (AC) systems is considered to be a significant problem, especially in tropical and middle-eastern countries. The high demand for energy is due to the dehumidification process of outdoor air, via direct chillers or desiccants, that increase the overall operation cost. Membrane technology is an energy efficient, environmentally friendly and affordable alternative, which can be used in the dehumidification process. In this study, engineered polymer coated polyetherimide hollow fiber membranes were developed and their dehumidification performance was investigated. Polyetherimide was selected due to its high mechanical and thermal stability, plus its commercial availability and affordability. Two porous hydrophobic polyetherimide hollow fiber membranes were fabricated, each with a different bore fluid, ethylene glycol (EG) & NMP-Water. The hollow fibers were then dipped in a 2wt% engineered polymer solution. The membranes produced were characterized for their morphology using scanning electron microscope. The engineered polymer surface coating was characterized using atomic force microscopy (AFM). The performance of vapor transport was evaluated by a modified permeability test method. The use of EG as bore fluid resulted in a highly porous structure compared to NMP-water. The engineered polymer coated hollow fiber with EG has been successfully employed for dehumidification performance, using both sweep-gas and vacuum as a driving force. About 11024 GPU was achieved when vacuum was applied, which is considered very high compared to other membranes. This study is a step forward towards the optimization of membrane dehumidification technology, which will reduce hazardous environmental impacts and the overall operation and production costs of AC systems.

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