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Experimental analysis of transport characteristics for vertically aligned carbon nanotube membranes

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ABSTRACT

Membranes utilizing carbon nanotubes (CNTs) as their pores have been emerged as a novel technique for water and wastewater treatment. CNTs are nanometer–diameter cylinders, allowing fast transport of water molecular and other fluid due to their strong hydrophobic characteristics. A few studies have been done for developing membranes embedding single-wall or multiwall nanotubes and simulating their performance theoretically using molecular dynamics. Nevertheless, only a limited number of experimental works were attempted to analyze the transport phenomena inside the CNT membranes due to lack of techniques for quantitative interpretation of the experimental results. Accordingly, this study aimed at developing protocols to quantify the efficiency of CNT membranes and apply them for better understanding of transport mechanisms of the CNT membranes. Membranes made of vertically aligned CNTs, which has 3–5 nm inner diameter and 150∼250 μm length, were used. Special experimental techniques were applied to obtain reliable data from the CNT membranes having small surface areas (less than 0.1 cm^2). The slip-modified Hagen–Poiseuille equation was applied to analyze flux enhancement for the CNT membranes.

Keywords: Vertically aligned carbon nanotube; CNT membrane; Slip-modified Hagen–Poiseuille equation; The enhancement factor; Filtration model

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