Nanocomposite ultrafiltration membranes incorporated with Zeolite and Carbon Nanotubes for enhanced water separation

N. H. W. Hazmoa , R. Naim[a]; A. F. Ismail[bc]; W.J. Lau[bc]; I. Wan Azelee[bc]; M. K. N. Ramli[bc]

[a] Faculty of Chemical Engineering and Natural Resources, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

[b] Advanced Membrane Technology Research Centre (AMTEC), Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

[c] School of Chemical and Energy Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

ABSTRACT

The objective of this work is to develop a new class of nanocomposite ultrafiltration (UF) membranes with excellent solute rejection rate and superior water flux using zeolitic imidazolate framework-8 (ZIF8) and multi-walled carbon nanotubes (MWCNTs). The effect of ZIF-8 and MWCNTs loadings on the properties of polyvinyldifluoride (PVDF)-based membrane were investigated by introducing respective nanomaterial into the polymer dope solution. Prior to filtration tests, all the membranes were characterized using several important analytical instruments, i.e., SEM-EDX and contact angle analyzer. The addition of the nanoparticles into the membrane matrix has found to increase the membrane pore size and improve its hydrophilicity compared to the pristine membrane. The separation performance of membranes was determined with respect to pure water flux and rejections against bovine serum albumin (BSA) and humic acid (HA).The experimental findings indicated that the nanocomposite membranes in general demonstrated higher permeation flux and solute rejection compared to the pristine membrane and the use of ZIF-8 was reported to be better than that of MWCNTs in preparing nanocomposite UF membranes owing to its better flux and high percentage of solute rejection.

KEYWORDS:

Multi-Walled Carbon Nanotubes; Nanoparticles; Ultrafiltration; Zeolitic Imidazolate Framework-8