Effect of metal and metal oxide nanoparticle impregnation route on structure and liquid filtration performance of polymeric nanocomposite membranes: a comprehensive review

Maryam Homayoonfal\textsuperscript{a}, Mohammad Reza Mehrnia\textsuperscript{a,}\textsuperscript{*}, Yasaman Mohades Mojtahedi\textsuperscript{a}, Ahmad Fauzi Ismail\textsuperscript{b}

\textsuperscript{a}School of Chemical Engineering, University College of Engineering, University of Tehran, Tehran, Iran, P.O. Box 11155-4563
\textsuperscript{b}Advanced Membrane Technology Research Center (AMTEC), Universiti Teknologi Malaysia, 81310 Skudai, Johor Bahru, Malaysia

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ABSTRACT

Nanocomposite membranes benefit from both flexibility and processability of polymers and the thermal and mechanical stability of nanoparticles at the same time. This paper discusses the effect of the presence of various nanoparticles on the morphology and efficiency of the polymeric membranes in the separation of liquid phase. The presence of nanoparticles usually increases the hydrophilicity and decreases the fouling of polymeric membranes during the filtration process. The presence of TiO\textsubscript{2}, Al\textsubscript{2}O\textsubscript{3}, ZrO\textsubscript{2}, SiO\textsubscript{2}, Fe\textsubscript{3}O\textsubscript{4}, Ag, and Fe nanoparticles increases the mechanical and thermal resistant of the polymeric membranes. The TiO\textsubscript{2} and Ag result in anti-bacterial characteristics, ZrO\textsubscript{2} and Fe create catalytic properties, SiO\textsubscript{2} nanoparticle causes conductivity properties, and Fe\textsubscript{3}O\textsubscript{4} nanoparticle gives magnetic characteristics to polymeric membranes. Understanding the synthesis method (in situ or ex situ) and the combination routes (blending with polymeric matrix or deposition on the surface) of the used nanoparticles is very important in determining the structure and performance of the composite membranes during liquid filtration. Findings from such studies are highlighted and the future possibility of nanocomposite membrane application in liquid filtration is also discussed.

Keywords: Polymeric nanocomposite membrane; Nanoparticle; Blending; Deposition

\*Corresponding author.

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