IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project title Zeolite-polymer nanocomposite membranes for gas separation

Project number: IMURA0107

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Research Academy theme/s

Nanotechnology

The research problem

Polymeric membranes are extensively used in RO and are becoming increasingly important for gas separations because they are relatively inexpensive and can be fabricated into compact membrane modules with a very high separation area to volume ratio. In RO, problems of increasing salt rejection without compromising water flux remain, as do problems of membrane fouling and corrosion. In gas separations, polymeric membranes usually have low selectivities, significantly limiting their widespread applications. Incorporation of nanoparticles in the polymer matrix seems to have the potential of addressing some of these outstanding problems in both applications. Zeolites are microporous crystalline solids with uniform molecular-sized pores and have been used in powder composite form as molecular sieving separation media. Recent studies have shown that incorporation of zeolite crystals into a polymer matrix could significantly improve its gas-selectivity. Likewise, incorporation of other nanostructures such as carbon nanotubes have been shown to create channels for water flow and hence improve water flux while keeping the salt rejection high. The polymer composite membranes (also known as a mixed-matrix membrane) thus offer great flexibility in developing high-performance membranes for separation applications.

Project aims

This project aims to develop polymer nanocomposite membranes for industrial RO and gas separations.

Expected outcomes

Polymer nanocomposite membranes with enhanced functional properties.
A good understanding of transport mechanisms of the nanocomposite membranes

Which of the above Theme does this project address?

Nanotechnology and Water

How will the project address the Goals of the above Themes?

Successful preparation of polymer nanocomposite membranes relies on controlling the dispersion of particles in polymers at the nanoscale, and eliminating interfacial defects.