



Indian Institute of Science
Centre for BioSystems Science and Engineering



Thesis Colloquium

At 4:00 PM on 17th September 2018 (Monday)
MRDG Seminar Hall, 1st Floor, Biological Sciences Building

Porous polymeric membranes with engineered surface for water remediation

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Abstract

The main barrier towards quick water remediation in modern membrane based technology is multiple pre-filtration steps which target impurities like pathogens and macromolecules prior to reaching the membrane module or else the membranes lose their effectiveness due to biofilm. Further, each stage contributes to the cost of purification making it cost intensive. The aim of this thesis is to design cost effective membrane modification strategies that can render bactericidal response, prevent fouling and can provide unimpeded permeation of water through porous architecture.

In the first half of the presentation microporous membranes derived from poly (vinylidene fluoride) (PVDF) will be discussed. PVDF based membranes are inert and hydrophobic, which makes them susceptible to biofouling. To address this, PVDF was blended with hydrophilic polymers like styrene maleic anhydride (SMA) and poly (butylene succinate-co-adipate) (PBSA)) and immobilized with quaternized pyridine derivative and phosphonium chloride on the surface to meet the key requirements. These modifications not only increase the hydrophilicity but also the antibacterial and antifouling properties of PVDF membranes. The antimicrobial action manifested by the modifications was assessed by taking E.coli and S.aureus as model bacterial organisms. This strategy can complement the present domestic RO system.

In the in the next half of the presentation, I will talk about designer membrane modules fabricated using new polymeric materials with surface sensitive biocide (quaternary ammonium compounds (QACs), amines, phosphonium based moieties etc.) incorporated in the polymer backbone using RAFT polymerization technique. A multilayer stacked approach was adopted which can be directly integrated with RO and 2D materials (like MoS₂ and GO) and 3D materials (MOFs) as the interlayer. Finally, I will talk about an in-line point of use pre-filter which can provide bactericidal response and can adsorb heavy metals for quick decontamination of water.