SYNTHESIS OF FUNCTIONALIZED MEMBRANES FOR METAL CAPTURE TO TUNABLE SEPARATIONS

D. Bhattacharyya, Dept. of Chemical and Materials Engineering, University of Kentucky, USA
db@uky.edu
S. Hernandez, Dept. of Chemical and Materials Engineering, University of Kentucky, USA
A. Saad, Dept. of Chemical and Materials Engineering, University of Kentucky, USA
A. Colburn, Dept. of Chemical and Materials Engineering, University of Kentucky, USA

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Membrane pores functionalized with appropriate macromolecules provide applications ranging from tunable flux and separations at low pressure, toxic metal capture, chemical synthesis, to protein separations. The synthesis may involve direct pore surface grafting of macromolecules or in-situ polymerization in MF type membrane pores. Traditionally, microfiltration membranes have been used for filtration of suspended solids, bacteria, viruses, etc. However, microfiltration membranes (eg, cellulosics, silica, polysulfone, polycarbonate, alumina) can be functionalized with a variety of reagents. Depending on the types of functionalized groups (such as, chain length, charge of groups, biomolecule, etc.) and number of layers, these types of membranes could be used in applications A. Colburn ranging from environmental applications to various organics separations.. In addition, electrostatic self assembly in pores (layer-by-layer, LBL) can also be achieved through alternate adsorption of cationic and anionic polyelectrolytes under convective flow conditions. Non-stoichiometric immobilization of charged multilayers within a confined pore geometry leads to an enhanced volume density of ionizable groups in the membrane phase. For example, the use of polypeptides with helix-coil transitions allows nano-domain interactions in membrane pores for selective environmental separations (using layer-by-layer nano-assembly in pores), and for the capture of various toxic metals. Multilayer assemblies of polyelectrolytes also provide excellent platform for protein/enzyme immobilization by providing reusability and high reactivity. The (1) presentation will include the media synthesis and the role of nano-domain interactions for selective separations, (2) polypeptide/polyeletrolyte assembly in membrane pores for high capacity metal capture to other separation applications, and (3) tunable separations with pH and temperature responsive membrane systems.
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