Facile deposition of photo-mobile materials on polymeric membranes achieving self-cleaning properties

Sankara Narayanan Ramanan[a], Nima Shahkaramipour[a], Thien Tran[a], Surender R. Venna[b], Ajay Singh[c], Chang-Keun Lim[c], Paras N. Prasad[c] and Haiqing Lin[a,*]

[a]Department of Chemical and Biological Engineering, University at Buffalo, The State University of New York, Buffalo, NY 14260, USA
[b]National Energy Technology Laboratory/AECOM, 626 Cochrans Mill Rd., Pittsburgh, PA 15236, USA
[c]The Institute for Lasers, Photonics and Biophotonics, University at Buffalo, The State University of New York, Buffalo, NY 14260, USA

Stimuli-response membranes have been widely explored to mitigate fouling on the membrane surface to achieve the long-term performance of water purification. Herein, we demonstrate a facile, one-step coating of photo-mobile materials on membrane surface to impart self-cleaning property upon exposure to ultraviolet (UV) light. Specifically, we successfully deposited 4,4'-azodianiline (AZO) on the surface of ultrafiltration (UF) membranes by co-depositing with a bio-glue of polydopamine (PDA). In the presence of UV light, the AZO undergoes photoisomerization from *trans*-AZO to *cis*-AZO while increasing surface hydrophilicity and shrinking the volume. When the UV light is switched off, the *cis*-AZO transits reversibly to the *trans* configuration. The photo-mobile behavior and the resulting volume reversible change contributes to the self-cleaning properties. The effect of the coating layer on the surface hydrophilicity and pure water permeance is systematically evaluated. The photoresponsive properties of AZO in DMF solutions and thin films with PDA is characterized using UV-Vis absorption spectroscopy. The self-cleaning behavior of the modified membranes is demonstrated in treating water containing bovine serum albumin (BSA) as a model foulant. For example, the self-cleaning of polysulfone UF membranes increases water flux by 200% when treating 1 g/L BSA aqueous solution.

