Preparation and Screening of Membranes to Control NOM Fouling via High-Throughput UV Graft Polymerization

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Membrane fouling is a significant factor that must be considered in all applications of membrane filtration, including water production. Low-fouling membranes are needed to maximize production (permeate throughput), minimize costs and environmental impacts of cleaning, and reduce process energy requirements. We have developed a new high-throughput (HTP) approach to synthesize new polymeric membrane materials for specific filtration applications, using photo-induced graft polymerization (PGP). This approach was used to synthesize new natural organic matter (NOM)-resistant surfaces. We used the HTP-PGP method to modify poly(ether sulfone), which has excellent physical and transport characteristics. During photo-induced graft polymerization, poly(aryl sulfone) membranes are UV-irradiated, leaving trunk polymer chains and forming reactive radical sites (Figure x[1]). Either water or ethanol-soluble vinyl monomers (Figure x[2]) covalently bond to these radical sites and undergo free-radical polymerization.

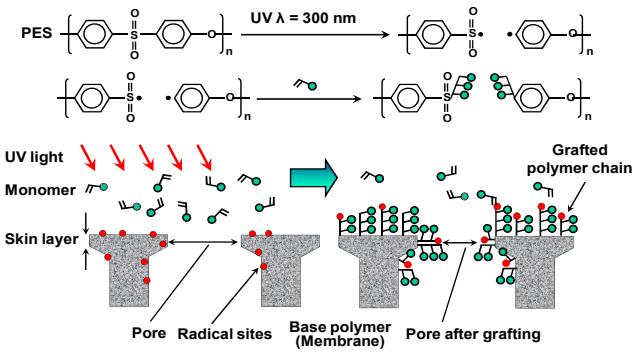

Figure x.[1] Grafting mechanism

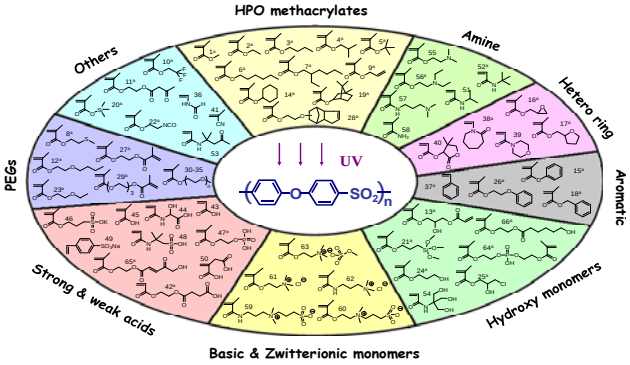

Figure x.[2] Initial monomer library.

We have identified many surfaces that perform significantly better than the as-received membrane in terms of offering lower resistance due to fouling. The best-performing monomers were the zwitterion [2-(methacryloyloxy)ethyl]dimethyl-(3-sulfopropyl)ammonium hydroxide (#60), and diacetone acrylamide, a neutral monomer containing an amide group (#53). The scalability of the high-throughput results was confirmed in bench-scale filtration experiments with mixing.

Reference/Publication

Zhou, M., J.E. Kilduff, R. Langer, D.G. Anderson, and G. Belfort. Preparation and screening of membranes to control NOM fouling via high throughput UV graft polymerization. Submitted to *Environmental Science and Technology*, Jan. 2009.

Patents or other steps toward commercialization: U.S. Patent applied for.