Aquaporin-Based Biomimetic Polymeric Membranes: Approaches and Challenges

In recent years, aquaporin biomimetic membranes (ABMs) for water separation have gained considerable interest. Although the first ABMs are commercially available, there are still many challenges associated with further ABM development. Here, we discuss the interplay of the main components of ABMs: aquaporin proteins (AQP), block copolymers for AQP reconstitution, and polymer-based supporting structures. First, we briefly cover challenges and review recent developments in understanding the interplay between AQP and block copolymers. Second, we review some experimental characterization methods for investigating AQP incorporation including freeze-fracture transmission electron microscopy, fluorescence correlation spectroscopy, stopped-flow light scattering, and small-angle X-ray scattering. Third, we focus on recent efforts in embedding reconstituted AQP in membrane designs that are based on conventional thin film interfacial polymerization techniques. Finally, we describe some new developments in interfacial polymerization using polyhedral oligomeric silsesquioxanes cages for increasing the physical and chemical durability of thin film composite membranes.