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Biomimetic membranes

Genetically engineered membrane proteins such as aquaporins, incorporated into synthetic membranes, are considered a promising biomimetic separation technology and have been intensively studied over the last few years. The most common strategies to synthesize Aquaporin Biomimetic Membranes (ABM) are to deposit the aquaporin incorporated lipid or block copolymer vesicles onto porous substrates or to integrate them within the active layer of polyamide membranes. However, ABMs with orders of magnitude improvement in permeability and perfect salt rejections proposed in initial work have not been realized. Early results were based on materials and methods that were rudimentary, especially considering the progress that has been made in this field. We have conducted a comprehensive evaluation of the true promise of these membranes using improved methods for protein expression and purification, polymer synthesis, self-assembly, experimental evaluation as well as calculations that more directly compare the outcome of biophysical evaluations to those used in the separations membrane industry. We propose these as standard methods for use in ABM research. We further describe an example of improved techniques and methodology in application to colloidal coating of aquaporin enabled separations membranes. Development activities at Applied Biomimetics Inc. focused on incorporation of membrane proteins polymer vesicles and development of a coating platform using colloidal particles as building blocks. Block-co-polymer vesicles have shown to be a versatile coating platform allowing for utilization of membrane protein function in the form of flat-sheet membrane. Membranes characterized by a wide range of molecular cut-offs were coated, and pure water flow was regulated by the amount of incorporated protein. This approach allowed for a 3-4-fold increase in flow over existing commercial membranes at a wide range of molecular cut-offs with modest aquaporin levels.

Biography

Mariusz Grzelakowski is Chief Scientific Officer at Applied Biomimetic. Before joining Applied Biomimetic in 2011, he has held positions at NanoH2O in Los Angeles, Novartis Pharma in Basel, and Zachem in Bydgoszcz in Poland. He holds a PhD in Chemistry from the University of Basel (2009), and MSc and BSc in Chemistry from Nicholas Copernicus University, Toruń, Poland (2002 and 2000, respectively).

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