Water Purification via Membrane Separations

Filtration and separation processes play an important role in a variety of industrial applications, ranging from pharmaceutical manufacturing to polymer processing to water purification. Often the application requires removal of a contaminant (e.g., water purification), but separation processes are also developed to retrieve components of solutions needed to develop other compounds or materials (e.g., obtaining biological proteins from animal sera).

In this project, students will generate three-dimensional simulations of various fluid flows through membranes. Removal of materials will be modeled using different separations methods, including adsorption and deep bed filtration, and students will explore membrane designs which lead to improvement of the filtration process. The students will develop simulation tools and generate experimental design arrays to evaluate the designs using techniques from statistics, optimization, and numerical partial differential equations. The designs will be analyzed under uncertainties inherent in the filtration process, including filter efficiency and fluid characterization.

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