

Abstract – Jessika Pazol

Improving the packing density of an enzyme/block-copolymer conjugate as a reactive layer to design anti-endotoxin water purification membranes

Purified water is the most abundant raw material used in the formulation, cleaning, and manufacturing of pharmaceutical products, analytical reagents, intermediates, and active pharmaceutical ingredients (API). The United State Pharmacopeia monograph <1231> establishes the minimum quality requirements of water when it is used as Water for Injection (WFI) or Water for Hemodialysis (WFH). Traditional treatments includes ultra-filtration modules that retains bacteria and minimize the endotoxin content in the purified water. Even though most of the bacteria are removed, the lipopolysaccharide (LPS) content are not completely inhibited by the existing technology. LPS are substances shed by bacterial cells during growth, become present as residues associated with dead cells, and are known to produce fever in humans (e.g. pyrogenic). Due to the recognized negative impact with endotoxins in water used for medical devices herein, we propose to design a bio-reactive water purification membrane that inhibits LPS. The aim of this research is to study the packing density of the membrane's active layer that will consist of two main components: 1) the design of a thin polymeric film layer with self-organized nano-pores that will immobilize 2) a reactive enzyme that ultimately can inhibit LPS. Upon completion of the fundamental aspects of the reactive thin film layer are addressed and optimized, the next goal is to translate the optimized active layer to an actual membrane support to study important filtration parameters such as the membrane reactivity, water flux, and water permeability. The surface morphology will be examined using, among others, atomic force microscopy (AFM) and scanning electron microscopy (SEM) to evaluate morphological information such as pore size, thickness, enzyme attachment.