A Weak Cation Exchange Macroporous Hydrogel Membrane for Monoclonal Antibody Capture

Huayu Niu and Christine Moresoli

Department of Chemical Engineering, University of Waterloo
200 University Avenue West, Waterloo, ON, N2L 3G1, Canada

Abstract

The recent development of ion exchange membrane materials with increased binding capacity represents a promising purification avenue for the capture of monoclonal antibodies (mAbs). Compared to conventional Protein A resins, the macropores of ion exchange membranes reduce pore diffusion and display higher throughput due to the convective flow characteristics. Weak cation exchange membranes capture protein by electrostatic interactions. These materials possess variable ionization according to pH, which can be used to tailor protein selectivity. This charge modulation will also affect charge repulsion and alter the 3-dimensional porous structure of the material. While ion exchange materials represent a promising alternative to Protein A resins for mAbs capture, their binding mechanisms and performance are not well understood.

The objective of our work is to better understand protein binding and the effect of charge and buffer environment for macroporous weak cation exchange membrane materials. Specifically we have used the Langmuir and the steric mass action binding models to outline key features of protein binding and comment on the contributions of the buffer co-ions and counter-ions in protein binding for weak cation exchange membrane materials. The benefits and limitations of these binding models will also be discussed. The characterization of the porous structure for macroporous hydrogel materials will be presented and related to protein binding.