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Binding of Polyclonal Antibodies on a Multimodal Membrane Adsorbents

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Antibodies play a crucial role in the treatment of various diseases, including asthma, cancer, autoimmune disorders, and transplant rejection. With advancements in recombinant technology, the ability to produce high titers of antibodies in culture media has significantly increased. However, this increase in product concentration has led to higher demands in downstream processing. It is estimated that an increase in the product concentration to 10 g L^{-1} increases the specific costs downstream from 61 to 97 %.

The common separation section contains several chromatographic steps supplemented by multiple additional devices such as filters or desalination modules. One potential solution to reduce the complexity and cost of this process is the use of multimodal membrane adsorbents. Unlike conventional chromatographic adsorbents, these resins provide more than one type of interaction with the target protein. Another advantage of membranes compared to beads is lower pressure loss, lower mass transfer resistance, and higher flow rates. These are the advantages that allow such adsorbents to process large volumes of media.

In this study, we evaluated three prototype membrane adsorbents with varying agarose content for their binding capacities to polyclonal antibodies and bovine serum albumin (BSA). We first measured the ligand density for each membrane. The highest ligand density, 104 mmol mL^{-1}, was measured for the membrane with the highest agarose content. In contrast, the membrane with the least agarose has a ligand density of approximately 77 mmol mL^{-1}.

The second step in our work was devoted to the measurement of static binding capacities (SBC) of membrane adsorbents. For polyclonal antibodies, the SBC ranged from 9.7 to 11.7 mg mL^{-1}, with the highest value observed in the membrane with the highest ligand density. In contrast, for BSA, significantly higher binding capacities were observed. They range from 50 to over 80 mg mL^{-1}, with increasing ligand densities.

Finally, we tested membranes under dynamic conditions using antibodies. Although the binding capacities were lower in the dynamic conditions, we were able to separate the monomeric form of protein from its aggregates.

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