CHROMATOGRAPHY MEDIA

Cellufine

# Adsorption Study of Cellufine cation IEX Resins

Cellulose is a well-known natural material, which has high mechanical strength, low non-specific adsorption and good biocompatibility. Additionally, cellulose particles have unique pore size characteristics appropriate for chromatography of bio-pharmaceuticals. Ion exchange chromatography (IEX) is an important step for biopharmaceutical manufacturing. Cation ion exchange chromatography (CEX), especially, can be utilized as a capture step in monoclonal antibody (mAb) purification. Recently, advanced IEX resins have been developed using polymer modification techniques. Initial screening of buffer conditions such as pH and ionic strength is important for IEX resin. The objective of this study is to reveal the differences in adsorption properties of polymer modified, cellulose-based CEX resins.

**Screening for optimal adsorption conditions with Cellufine CEX resins**

Three different strong CEX resins, Cellufine S-500 (conventional type), Cellufine MAX S-h (dextran modification) and Cellufine MAX GS (graft polymer modification) were used for the study (Table 1). Dynamic adsorption capacity (DBC) with polyclonal antibodies was examined to draw the contour plots for analyzing optimal conditions of pH and conductivity.

The contour plots analysis showed there were significant differences in optimal adsorption conditions among the three cellulose based cation resins (Figure 2). Cellufine MAX S-h was shown to need careful pre-examination of pH and conductivity conditions to obtain higher adsorption capacity. On the other hand, Cellufine MAX GS was less susceptible to pH and conductivity for adsorption. It is well known that mass transfer is highly affected by pore size in conventional IEX resins. Cellufine S-500 showed low DBC under conditions that provided strong binding between ligand and material for the other resins.

DBC was also examined under different pH conditions (Figure 3). Cellufine MAX GS, in particular, showed only a slight difference of mAb DBC between pH 4.5 and pH 6.0. This means Cellufine MAX GS can be used over a broad range of conditions in mAb purification, especially in the mild pH conditions preferred for protein stability.

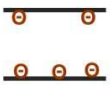
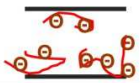
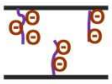
| | Cellufine S-500 | Cellufine MAX S-h | Cellufine MAX GS |
|---|---|---|---|
| Matrix | Cross-linked cellulose | Highly cross-linked cellulose | |
| Particle size (μm) | 40 – 130（ca 90 μm in average） | | |
| Ligand technique | Conventional  | Dextran modification  | Graft  |
| Ligand | Sulfo butyl | | 2-methylpropane Sulfonate (amide spacer) |

Table 1: Cellufine strong CEX resins used in this study.

Figure 2: Contour plots analysis for optimal adsorption conditions for cellulose based CEX resins

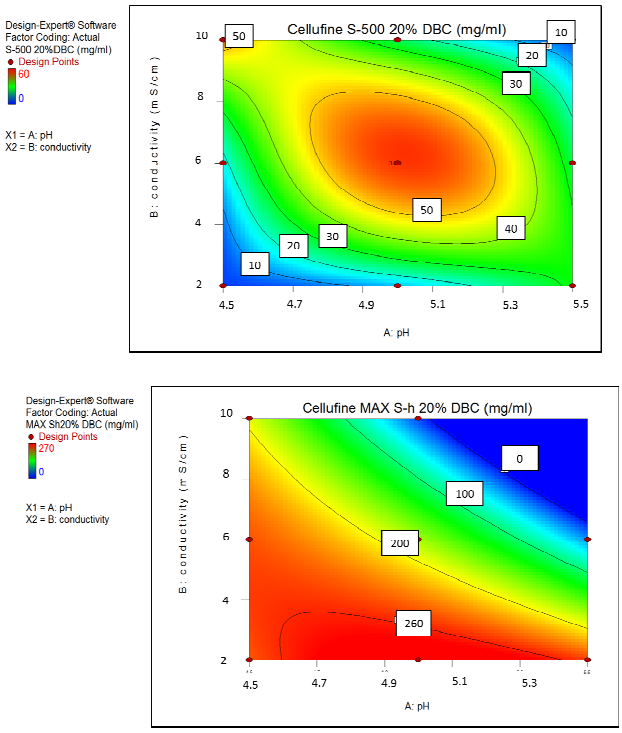
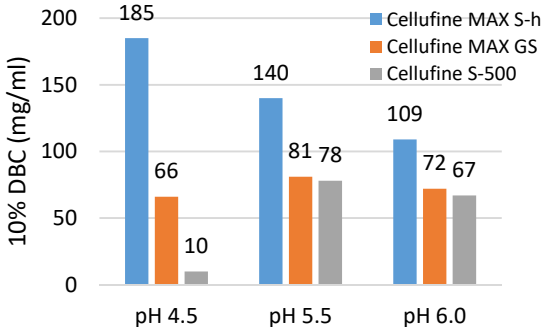



Figure 3: mAb DBC with Cellufine CEX resins




Adsorption condition；10 mM Acetate (pH 4.5, 5 mS/cm) or 10 mM MES-NaOH (pH 5.5 and 6.0, 5 mS/cm)
Residence time; 2 min

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