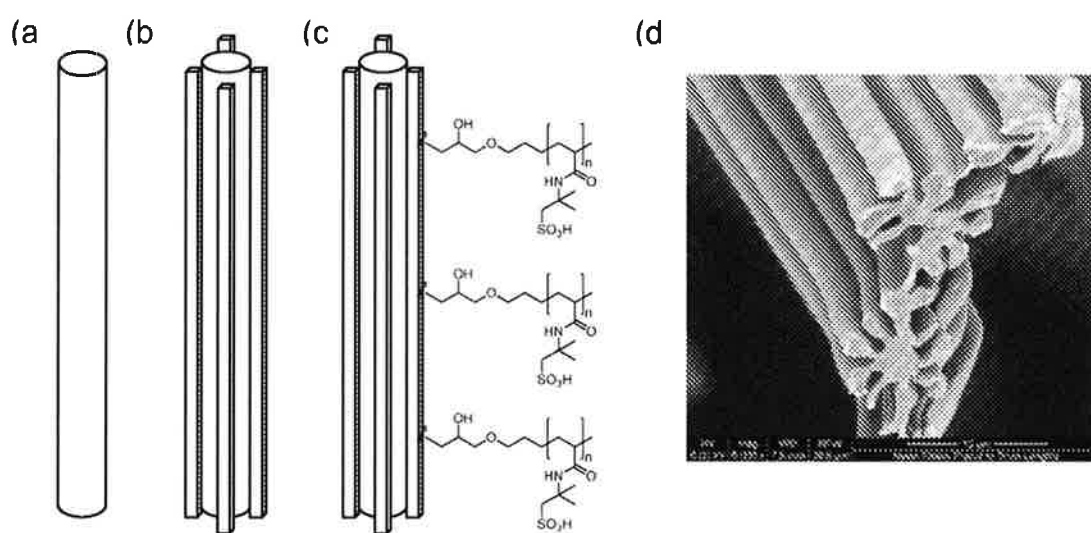
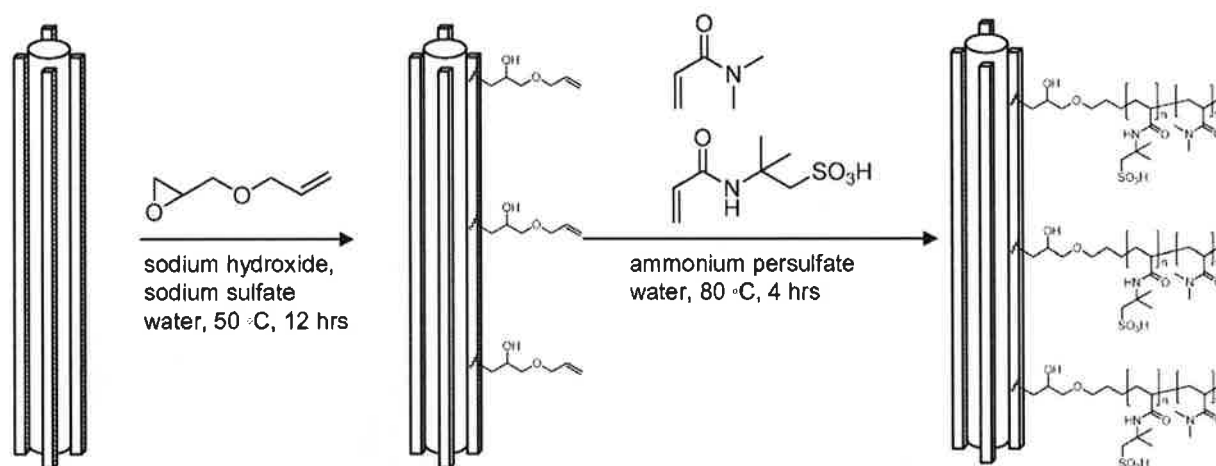


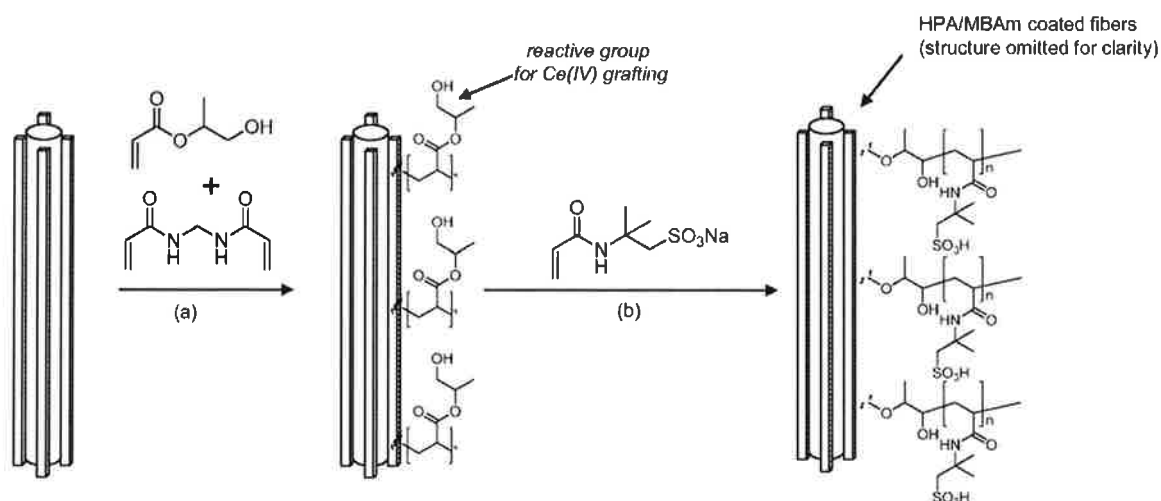
FIG. 1a-1d

1(a)-c): A schematic illustration of fibers of the inventive concept. 1(d): SEM image of Allasso Industries Corporation winged fibers.

FIG. 1e

Surface modification of high surface area fibers with pendant sulfopropyl cation exchange functionality (SP) (a) allyl glycidyl ether, sodium hydroxide, sodium sulfate, water, 50 °C, 12 hours. (b) 2-acrylimido-2-methyl-1-propane sulfonic acid, N,N-dimethylacrylimide, water, ammonium persulfate, 80 °C, 4 hours.

FIG. 1f



Surface modification of high surface area fibers with a pendant sulfopropyl cation exchange tentacle functionality (a) hydroxypropylacrylate, N,N' -methylenebis(acrylamide), ammonium persulfate, water, 80 °C, 4 hours. (b) 2-acrylamido-2-methyl-1-propanesulfonic acid sodium salt, water, ammonium cerium(IV) nitrate, HNO_3 , 35 °C, nitrogen, 18 hours. *Note.* In the third graphic, the structure of the cross-linked HPA/MBAm coating is not shown.

Typical chromatogram: IgG CEX B/E on SP fiber media

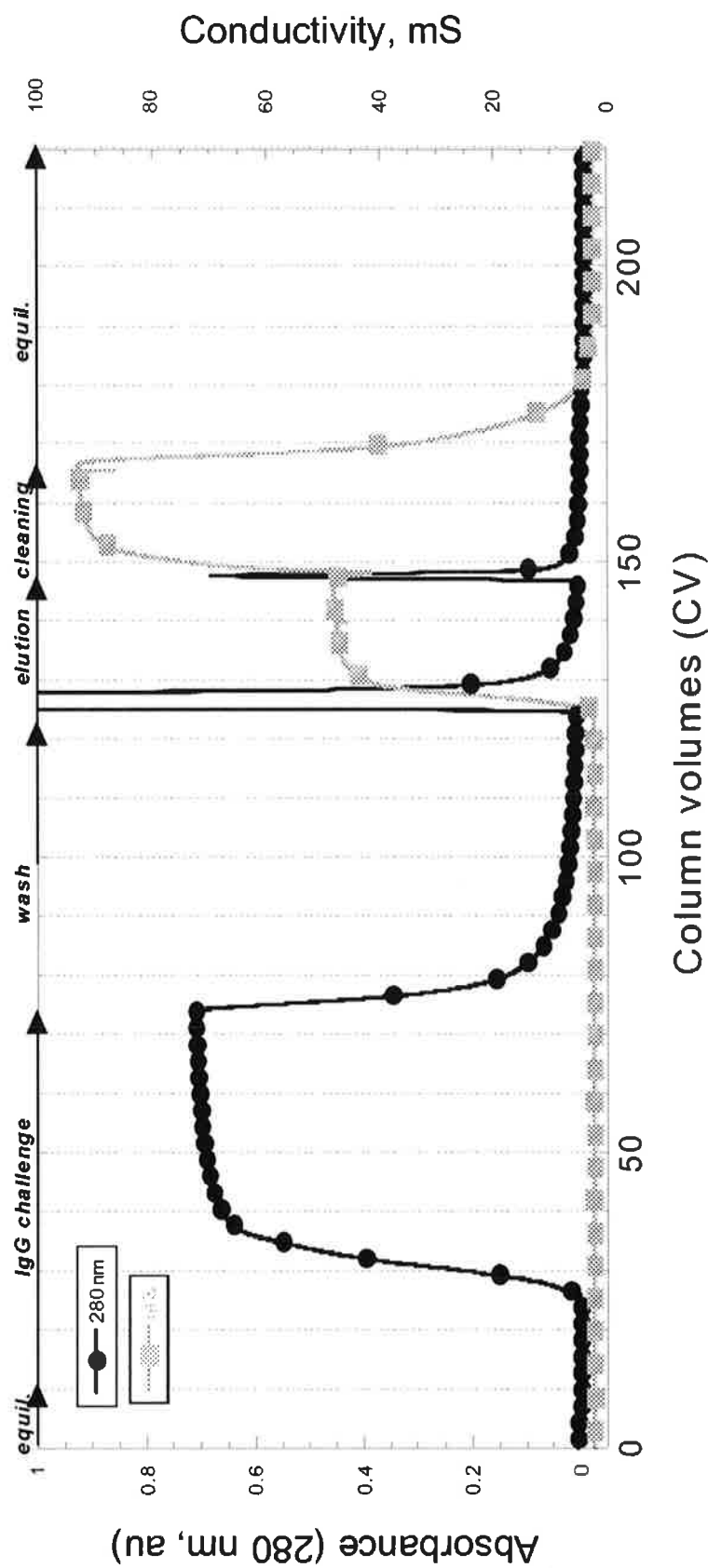


FIG. 2. Typical IgG breakthrough curve and elution peak for the SP-functionalized Allasso winged fiber cation-exchange media (SPF1). Equilibration/wash buffer: 50 mM NaOAc, pH 5; IgG load: 1.75 g/L IgG in 50 mM NaOAc, pH 5; Elution buffer: 0.5 M NaCl in 50 mM NaOAc, pH 5; Cleaning buffer: 0.5 M NaOH.

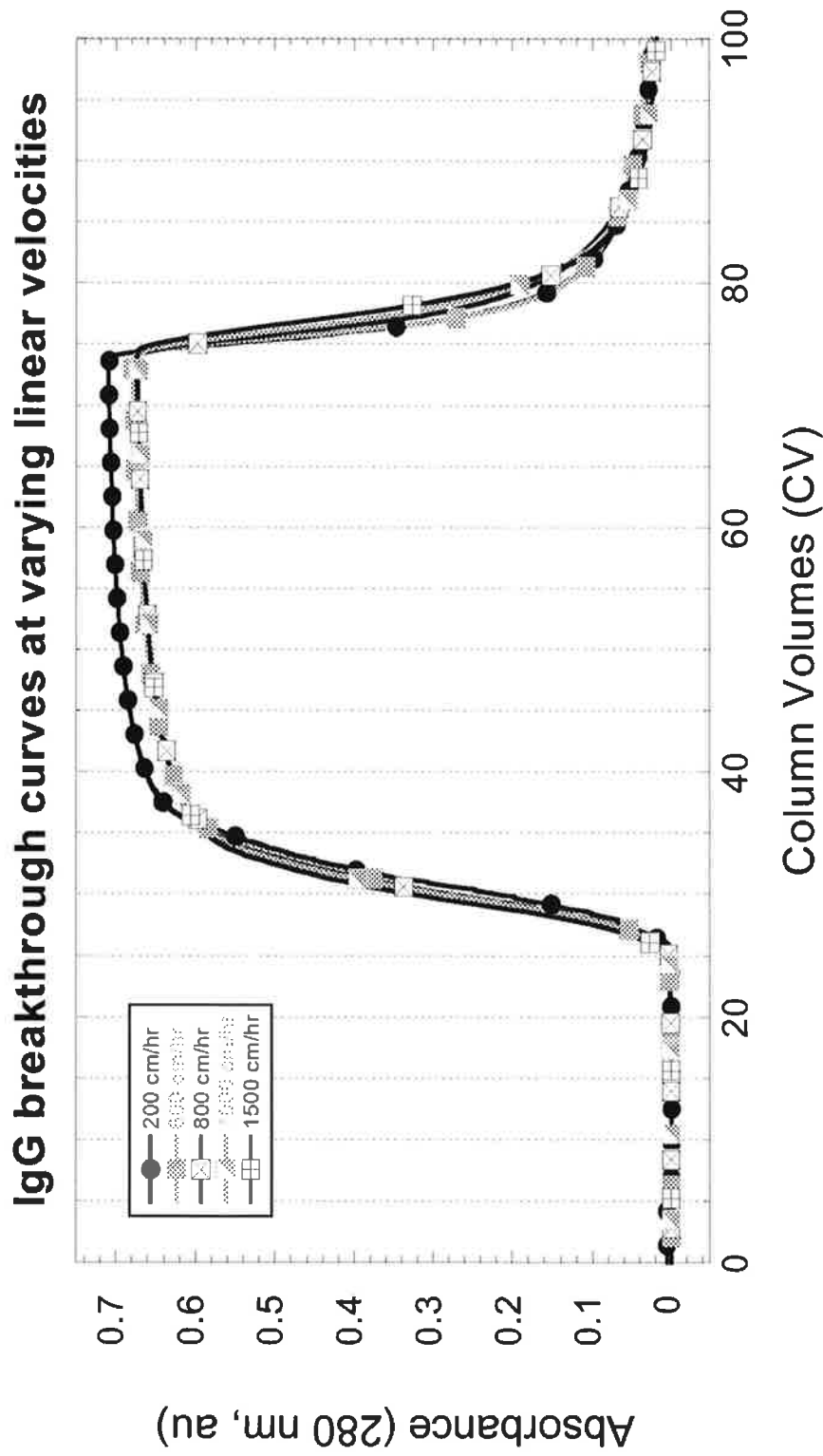


FIG. 3. IgG breakthrough curves for the SP-functionalized Allasso winged fiber cation-exchange media (SPFI) at varying linear velocities.

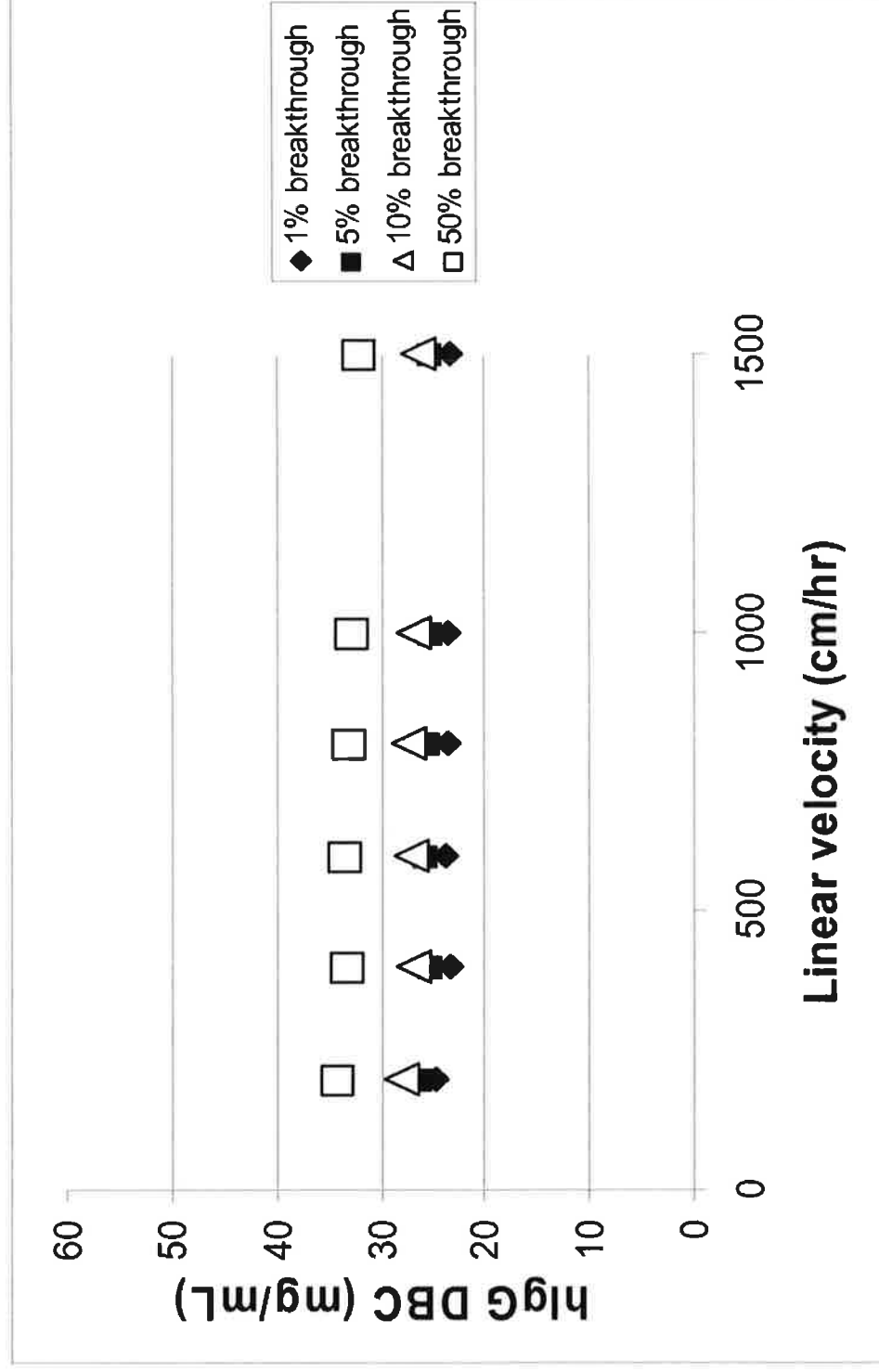


FIG. 4. Plot of IgG DBC for SPF1 at 1, 5, 10, and 50% breakthrough at varying linear velocities.

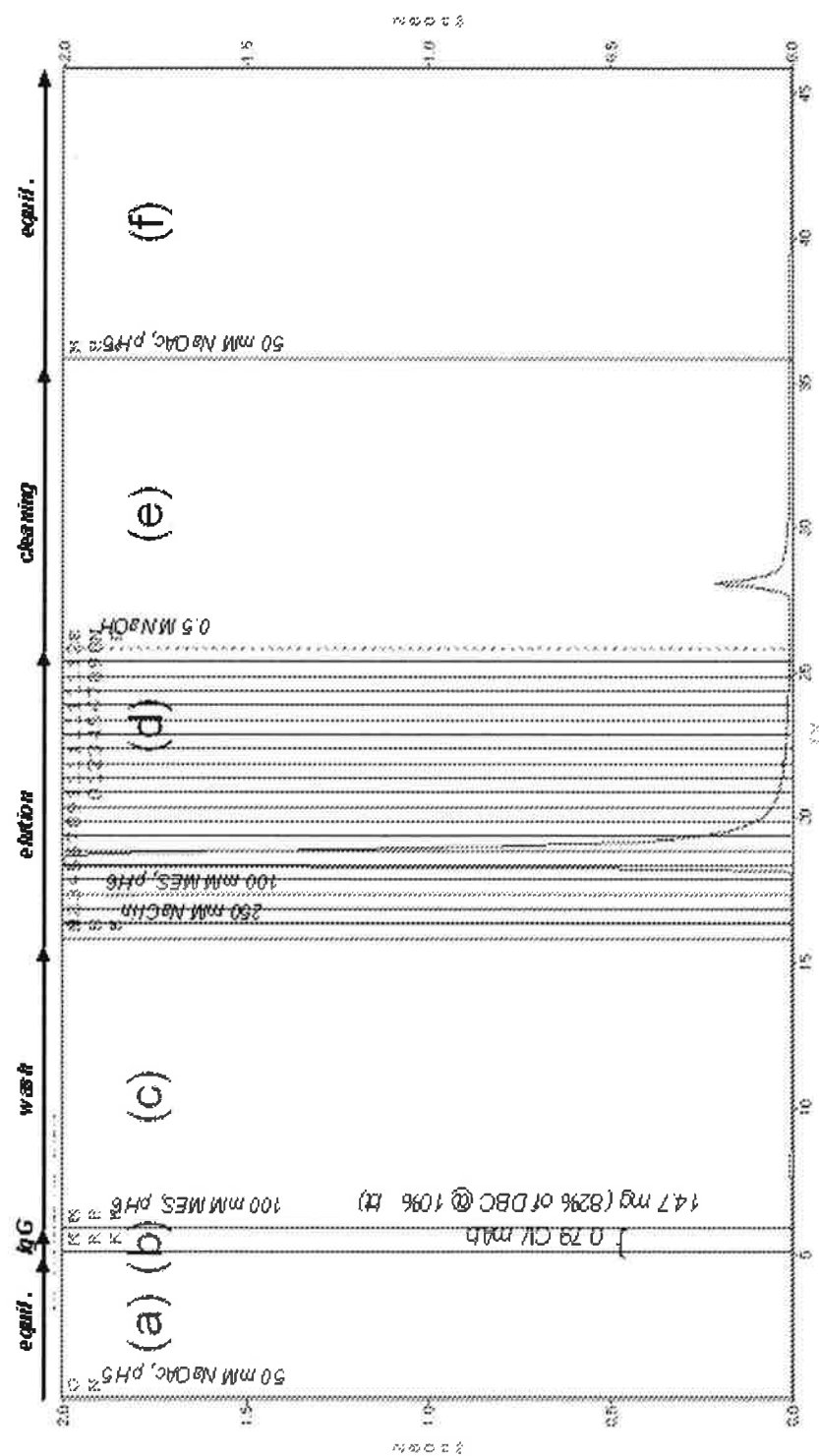


FIG. 5. Chromatogram from a mAb challenge experiment for the SP-functionalized Allasow winged fiber cation-exchange media (SPF1). Process details: (a) equilibration buffer, 50 mM sodium acetate, pH 5 (5 CV); (b) sample load, 6.7 g/L mAb challenge solution (Protein A eluate, 0.79 CV); (c) wash buffer, 100 mM MES buffer, pH 6 (10 CV); (d) elution buffer, 250 mM NaCl in 100 mM MES buffer, pH 6 (10 CV, 20 0.5 CV fractions collected); (e) cleaning buffer, 500 mM NaOH (10 CV); (f) equilibration buffer, 50 mM sodium acetate, pH 5 (5 CV).

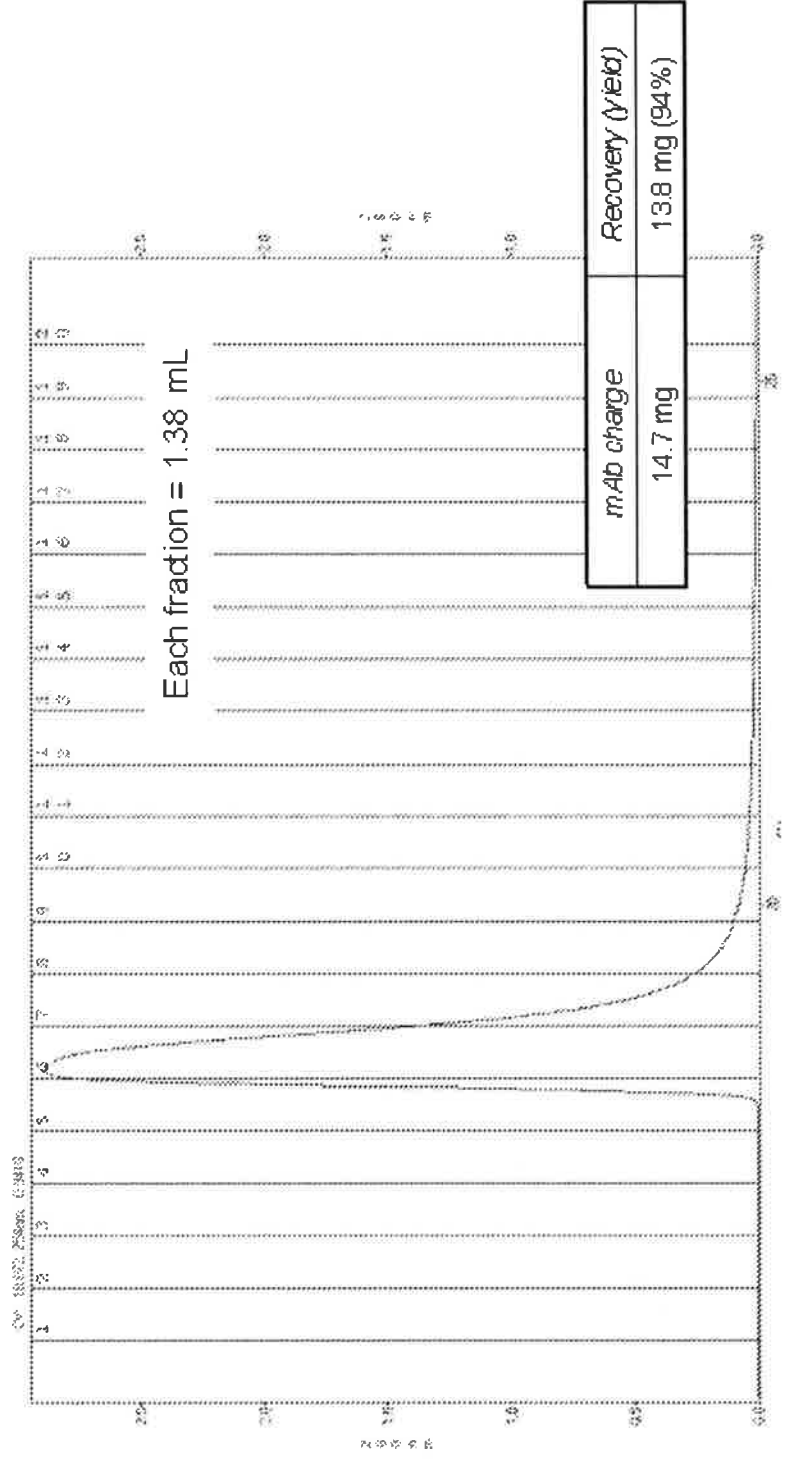


FIG. 6. Typical mAb elution peak for the SP-functionalized Allasso winged fiber cation-exchange media (SPF1). *inset:* Recovery analysis of the elution fractions by measurement of UV absorbance at 280 nm indicates 94% recovery of mAb.

Report T-100609-3859 P1A-HPLC report.doc
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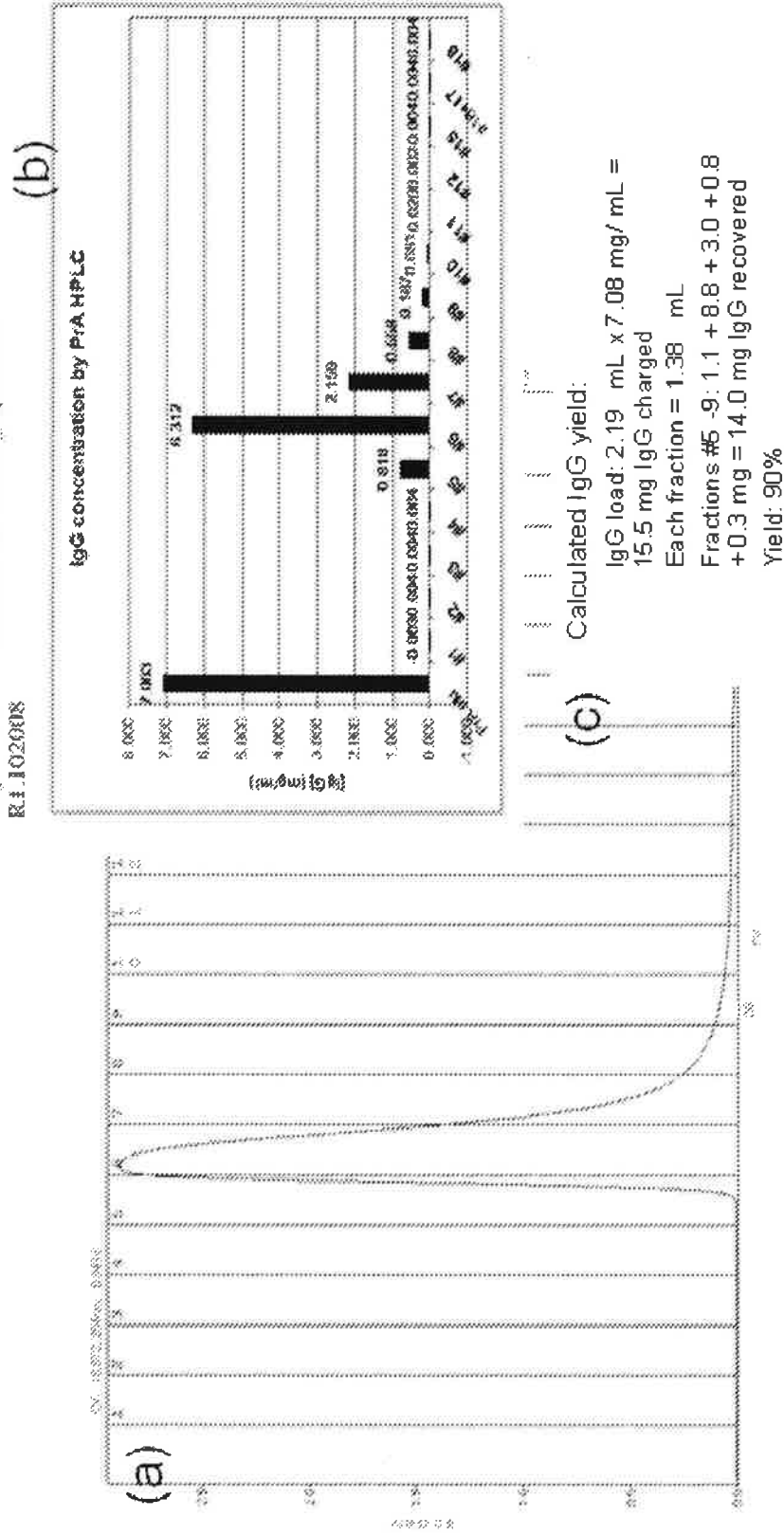


FIG. 7. IgG quantification by Protein A HPLC (a) The elution fractions from a mAb challenge experiment using the SP-functionalized Allasow winged fiber cation-exchange media (SPF1). **(b)** IgG concentration (mg/mL) by protein A HPLC for the elution fractions #1-20. The mAb feed has a IgG concentration of 7.083 mg/mL (first column). **(c)** Calculation of IgG recovery by analysis of the measured IgG concentrations in elution fractions # 5-9.

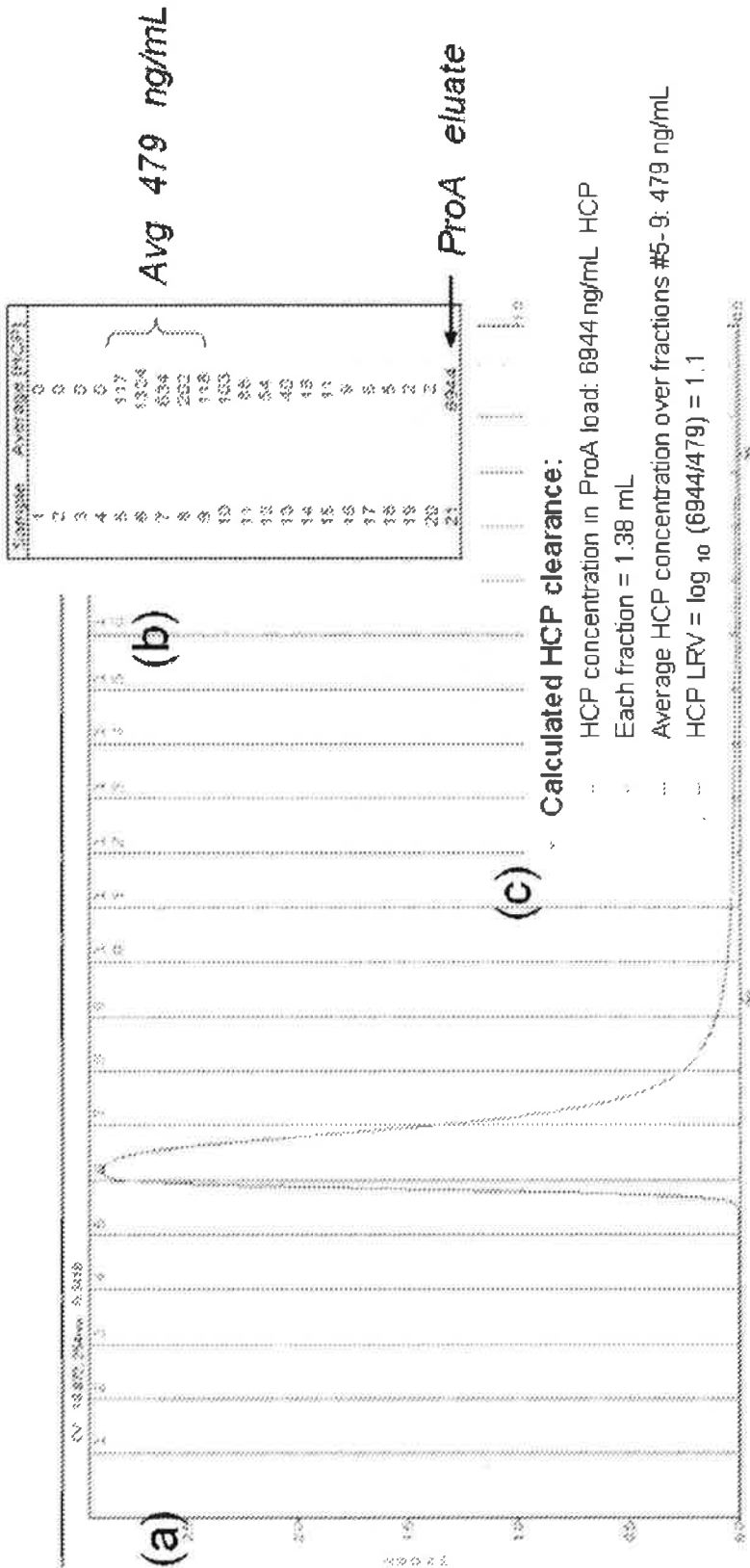


FIG. 8. CHO-HCP quantification by ELISA. (a) The elution fractions from a mAb challenge experiment using the SP-functionalized Allasoo winged fiber cation-exchange media (SPF1). (b) CHO-HCP concentration (ng/mL) by ELISA for the elution fractions #1-20. The mAb feed has an HCP concentration of 6944 ng/mL (line 21). (c) Calculation of HCP clearance (LRV) by analysis of the measured HCP concentrations in elution fractions.

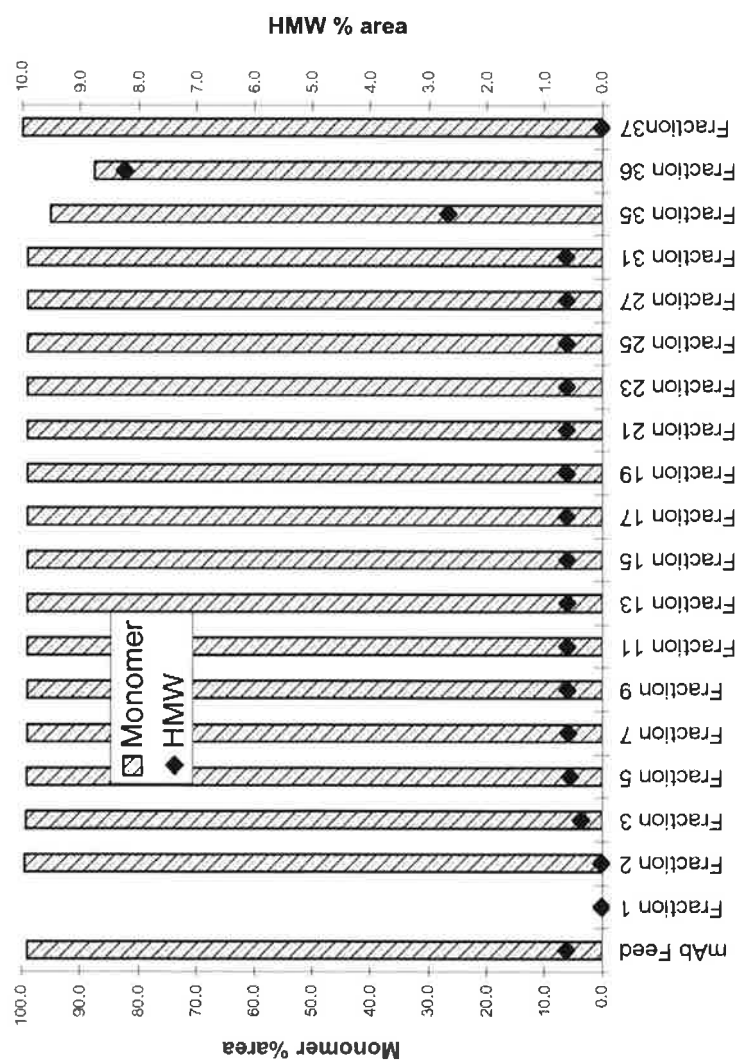


FIG. 9. Flow through aggregate clearance of a monoclonal antibody feed. Evaluation of a flow through aggregate clearance process comprising sulfopropyl-functionalized fiber media in a packed bed format (2.85 mL column volume, 0.35 g/mL packing density). Fractions analyzed by size exclusion chromatography (SEC) to find % monomeric and % HMW aggregated monoclonal antibody compositions for 31 flow through and 3 elution fractions (Fraction #35, 36, 37). Challenge: 6.9 g/L of a monoclonal antibody Protein A elution (pH 5, 19 mS) at a flow rate of 3.2 mL/min (residence time = 54 seconds).

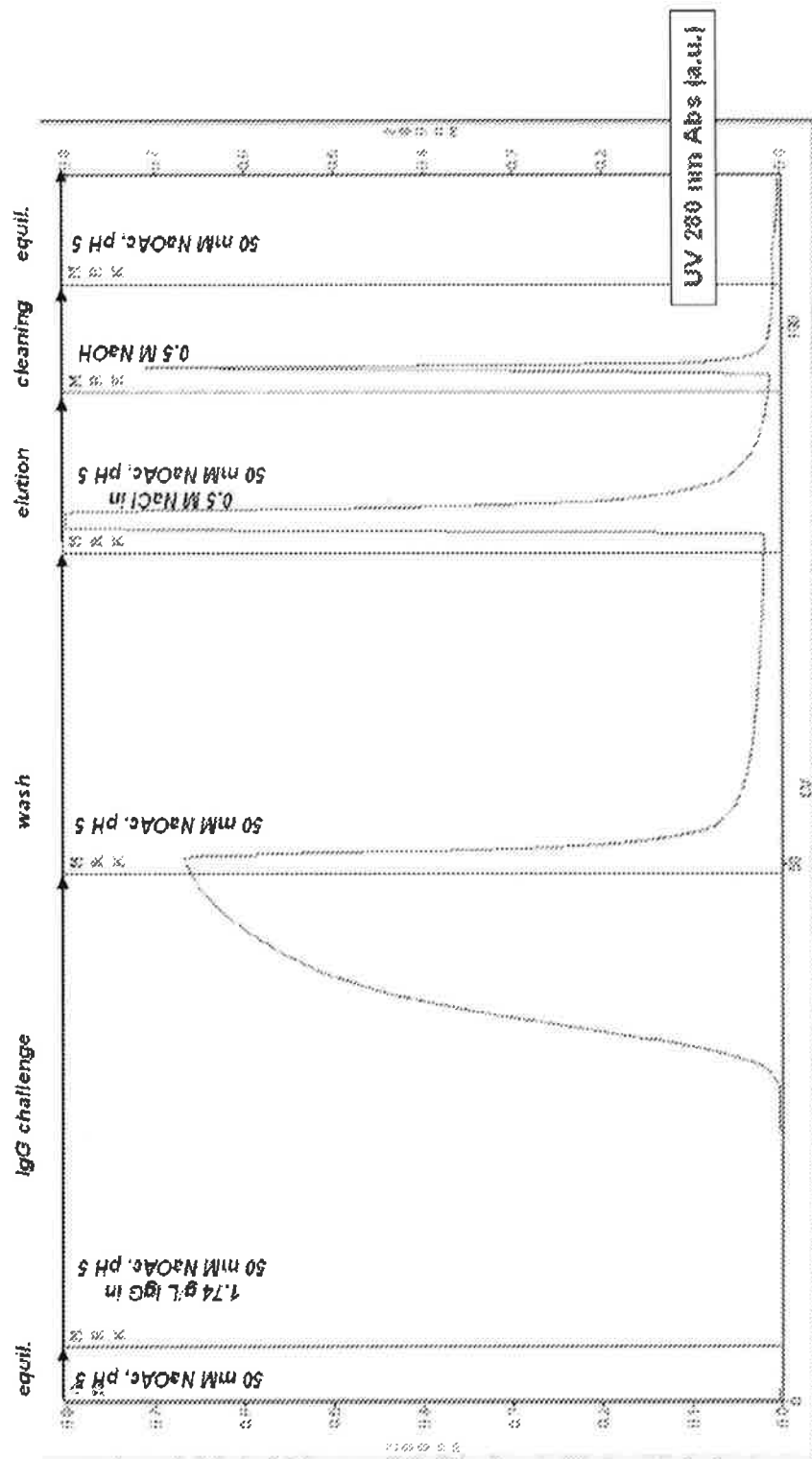


FIG. 10. Typical IgG breakthrough curve and elution peak for the SP-tentacle functionalized Allasoo winged fiber cation-exchange media.

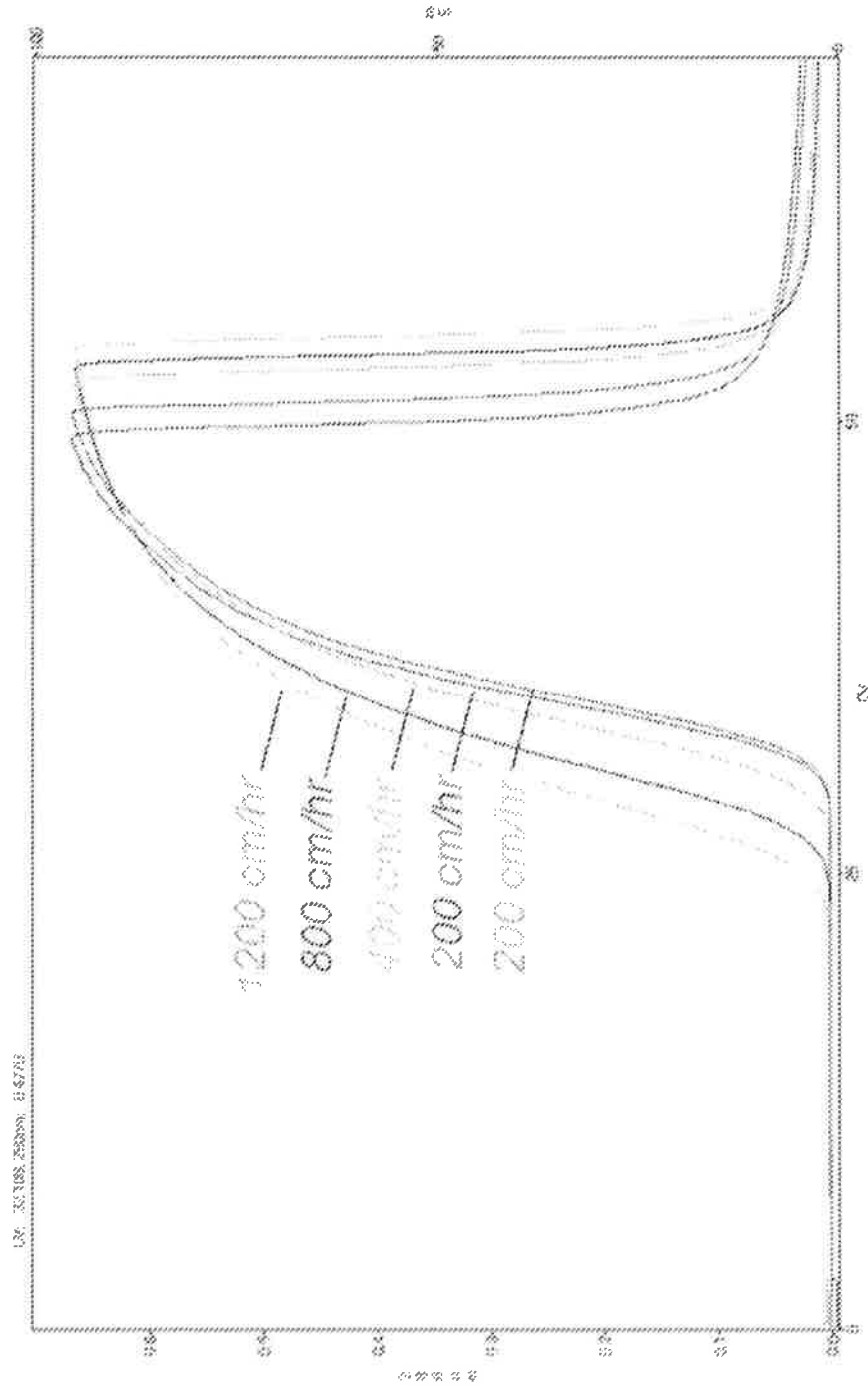


FIG. 11. IgG breakthrough curves for the SP-tentacle functionalized Allasso winged fiber cation-exchange media at varying linear velocities.

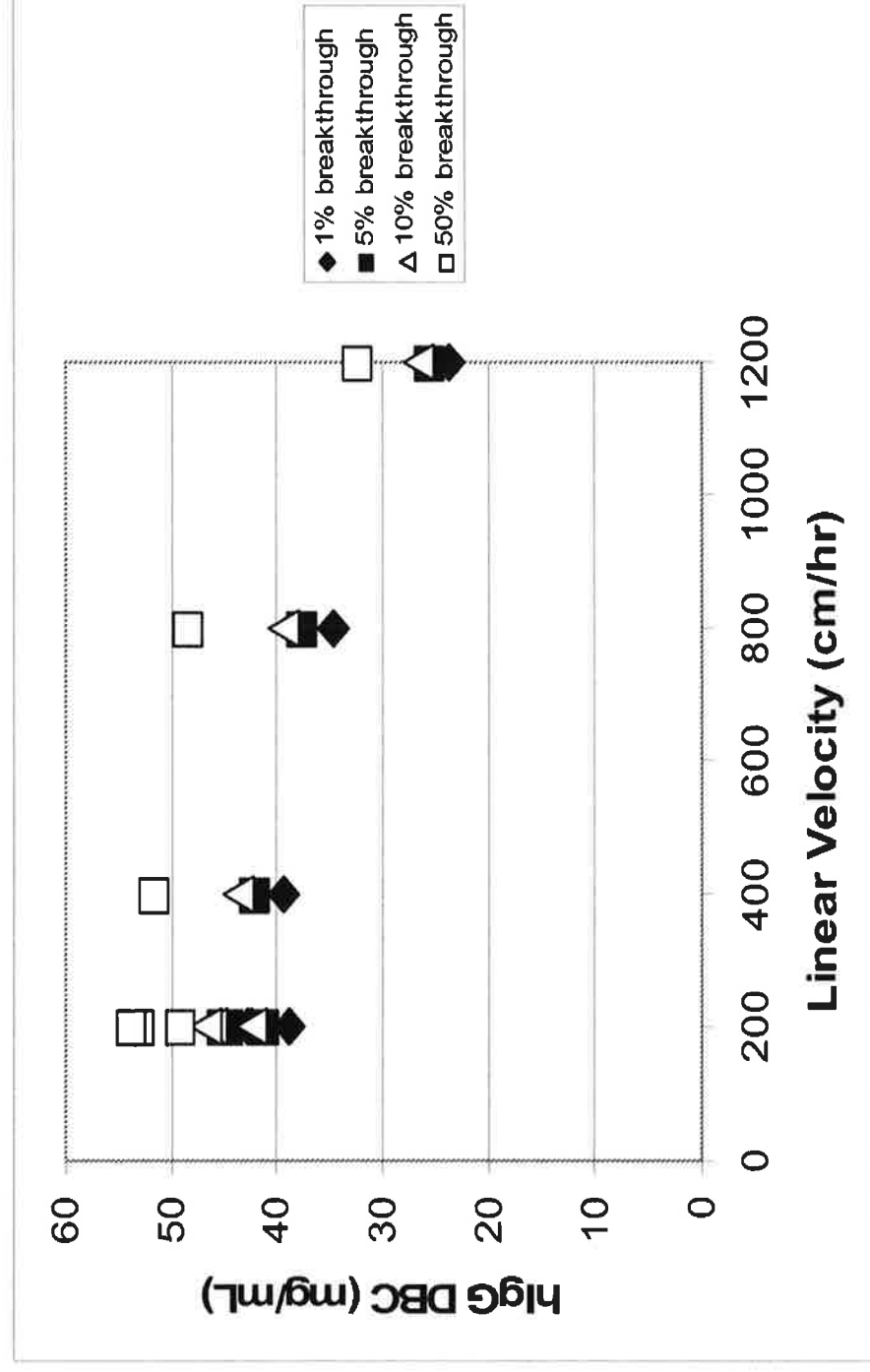


FIG. 12. Plot of IgG DBC for the SP-tentacle functionalized Allasso winged fiber cation-exchange media at 1, 5, 10, and 50% breakthrough at varying linear velocities.