

## CHROMATOGRAPHY: BIOTECHNOLOGY APPLICATIONS

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*Advances in Biochemical Engineering. Volume 25. Chromatography. Edited by A. Fiechter. Pp. 145. ISBN 0-387-17829-2 (Springer-Verlag: 1982) \$25.*

The central theme of this brief collection of articles is the steadily growing area of affinity chromatography. The editor has apparently selected four technical papers with diverse approaches to this subject. The first chapter by Che-ming Yang and George T. Tsao (Purdue University), discusses general theories of chromatography and their relevance to affinity chromatography. The second chapter, by the same authors, addresses specific characteristics and principles of affinity chromatographic methods. The third chapter, authored by Jan-Christer Janson and Per Hedman, is an excellent overview of chromatographic technology, discussing affinity chromatography from a unit operational point of view. Janson works with Pharmacia and Hedman is with the Biochemical Separation Center, both in Upsala. The last chapter by Gerhard Kopperschlager, Hans-Joachim Bohme, and Eberhard Hofmann (Karl Marx University, Leipzig), describes the specific application of affinity chromatographic techniques to anthroquinone dyes/protein interactions.

In that affinity chromatography is still in the early stages of industrial scale application, the extent of information presented in this volume is quite impressive. For the most part the contributors and editor have succeeded in establishing a cohesive source of information on this topic.

The first chapter, "Packed-Bed Adsorption Theories and Their Applications to Affinity Chromatography," presents a cursory review of the basic theories of chromatography with emphasis placed on the suitability of application to affinity chromatography. Included are: plate theories, rate theories of frontal analysis (e.g., surface adsorption and film diffusion rate, rate equation with particle diffusion resistance); the rate theory of elution development (e.g., statistical moments theory); HETP: (height-equivalent-to-theoretical-plate) equations and stochastic theory.

It was noted at the conclusion of the first chapter that over the past ten years extensive *experimental* work has been accomplished on affinity chromatography, yet very little *theoretical* work has been done. Thus, Yang and Tsao are to be commended for their efforts and inroads in the latter direction. Yang and Tsao ended chapter one with an in-depth explanation about the lack of theoretical work in affinity chromatography. I found this to be confusing and I would be more cognizant of the impact of their research efforts had they begun their chapter by stating this at the outset.

Aside from this misplaced, though comprehensive, synopsis of theoretical research efforts, Chapter 2—"Affinity Chromatography" thoroughly covers the specifics relative to: solid matrix supports, chemistry of adsorbent preparation and its characteristics, attached ligands, spacer-arm (leash) structure, interferences in affinity chromatography (e.g., hydrophobic and ionic), significance and determination of gel capacity, equilibrium constants and reaction rate constants, and applications of affinity chromatography.

By far the most useful chapter for a process design engineer is the third, "Large-Scale Chromatography of Proteins." This part is a very comprehensive treatment of this subject, covering: resolution and zone spreading, effect of flow rate, particle size, bed height, bed compression and loading capacity, gel filtration media, ion exchange and affinity chromatography media, maintenance of column packing materials and construction materials for gel support, column end pieces, height diameter ratios, annular columns and accessory equipment. Effective techniques in this chapter include the extensive use of design equations, flow diagrams, tables listing various properties of commercially available media, and specific references to other sources of additional information.

Relative to the concluding chapter, "Cibacron Blue F3G-A and Related Dyes as Ligands in Affinity Chromatography," an even mixture of theoretical and practical concepts were covered. These included: chemical structure and properties of dyes; nature of the dye-protein interactions;

procedures for dye immobilization (e.g., coupling by means of the reactive chlorine group, coupling via the primary amino group, entrapment in polyacrylamide gel); and application of immobilized dyes in the purification of enzymes and of other proteins.

Overall, this publication would best serve as a brief reference manual for a process development engineer with some previous knowledge of chromatographic techniques. It provides both general and specific guidelines for designing chromatography column/processes, as well as citing a multitude of references for further investigation of the concepts which were superficially discussed. With the exception of the first chapter, involving exclusively theoretical treatment of the subject, the book was geared towards developing an understanding of the practical aspects of chromatography as it pertains to biotechnology applications. These four very different approaches to the subject of affinity chromatography work well to form a cohesive package of information. ■

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## PROTECTING BIOTECHNOLOGY

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*Legal Protection For Microbiological And Genetic Engineering Inventions. By Roman Saliwanchik. Pp. 256. ISBN 0-201-10938-7. (Addison-Wesley: 1982.) \$34.95.*

Technological breakthroughs in the biosciences during the past decade have created wide-ranging commercial possibilities. Among these are the following: production of limitless quantities of pharmaceutically important peptides such as insulin and growth hormones; highly sensitive diagnostic methods utilizing monoclonal antibodies; improved crops such as drought-resistant wheat and cold-tolerant corn produced by recombinant DNA techniques; and vaccines against diseases such as foot