

5. *Dynamic Modeling of a PSA System*
6. *PSA Processes*
7. *Extension of the PSA Concept*
8. *Membrane processes: Comparison with PSA*

*Appendix A. The Method of Characteristics*

*Appendix B. Collocation Form of the PSA Model Equations*

*Appendix C. Synopsis of PSA Literature*

Several excellent monographs on adsorption processes are already in print, covering much of the materials in pressure swing adsorption. This new book is, however, the first one to focus specifically on the subject of PSA. From my own vantage point, its most notable features are the treatment of PSA dynamics and its cyclic behavior by the method of characteristics, and the comparison between PSA and membrane separations.

The book is coauthored by highly accomplished researchers in the field who reside in three different countries. The fine quality of the final product is an indication that the three-way collaboration has worked well.

I would highly recommend *Pressure Swing Adsorption* as a reference book for any advanced graduate course on separations. Needless to say, anyone working on PSA should own a copy of this book. □

## ChE book review

### **BIOPROCESSING**

by Owen P. Ward

Van Nostrand Reinhold, 7625 Empire Drive, Florence, KY 41042; 198 pages, \$52.95 (1991)

Reviewed by

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This slim book is a comprehensive treatment of the various processes that are used to make commercial quantities of biological materials. The author, an Irishman transplanted to Canada, is Industrial Research Professor in Microbial Technology at the University of Waterloo.

Although advances in making formerly unknown molecules or in making known molecules, but from new sources, by biological means has captured the attention of both scientists and the general public, the scaleup of the methods to produce these molecules is still of prime concern. Even when achieving the lowest possible price is not the most important consideration, as with pharmaceuticals and other medicines, there is growing pressure to cut processing costs and to make purer materials. This is the province of

bioprocessing, the area covered in this book.

*Bioprocessing* is composed of twelve chapters that range from what is commonly considered biochemical engineering all the way to standard food processing. Each chapter is divided into sections of one to several pages that cover different topics, and each ends with an extensive list of references for further reading. A list of the chapter titles is as good a way as any in such a wide-ranging book to describe what is covered:

- Biomaterials and Bioprocessing
- Bulk Bioprocessing Operations
- Bioreactors in Bioprocessing
- Biochemical Separations
- Sterilization and Preservation in Bioprocessing
- Bulk Bioprocessing of Animal and Plant Materials
- Purification of Fine Chemicals from Non-Microbial Sources
- Fermentation and Cell Culture Processes
- Recovery of Cell Products
- Enzyme Bioprocessing Applications
- Waste Treatment
- Good Manufacturing

The treatment of the material in *Bioprocessing* is entirely descriptive; a few viscosity and heat transfer equations appear in the second chapter, but no others follow. Instead there are many figures and some tables presenting different pieces of equipment and process flow sheets, along with some generalized experimental data. Given that so many areas are covered in so few pages, there is little explanation of the basic material. Facts inexorably follow facts, making this book difficult to read in large gulps. The difficulty is compounded by the rather stodgy appearance of the book—it would have benefited from typefaces and graphics with more flair.

Where does such a book find its niche? In this case, the niche is not as a textbook. The treatment is not at all theoretical or mathematical, prerequisites for any text used by engineers. On the other hand, *Bioprocessing* is not a review of a specific area; it spreads over too much terrain. Although it has extensive lists of other articles and publications at the end of each chapter, it has few references to other work within its text, so tracking down more detailed information on any particular statement would be a hit-or-miss proposition.

It is probably best employed as a primer—for finding the first information about a new topic and acting as a starting point to dig deeper. For this, *Bioprocessing* is admirably suited: each topic is concisely covered, there are a great number of topics, and the index at the end is very comprehensive, making each topic easy to find. □