placement is important to cake washing, and, furthermore, fluid displacement is porous media is a well studied subject.

If one reads the book with the expectation of learning how to design filtration posttreatment processes, he probably will be disappointed. The book does give good descriptions of the phenomena and problems associated with cake dewatering and washing, and it should be a valuable addition to the libraries of those who are interested in fluid-particle separation, since this is the only book on this subject currently available.

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Mass Transfer, Thomas K. Sherwood, Robert L. Pigford, and Charles R. Wilke, McGraw-Hill Book Company (1975). 677 pages. $21.50.

It has been known by many that the third version of the book titled "Absorption and Extraction" was in preparation and that it has been a long time a-coming. The reason for the latter fact is clear after a few minutes' perusal of the text. Its pages contain a massive and thoroughly analyzed treatment of a central heartland of chemical engineering. Its 1043 references, 229 figures—many of which are correlations and summaries of voluminous data—and generous selection of numerical examples and original problems provide a rich resource for chemical engineers: a textbook for the student, a source of class material for the professor, and a lead-in to the handbooks and literature for the practicing engineer. The profession will be grateful to the three authors for their labor in making the book available.

Eight of the eleven chapters, constituting three fifths of the book, cover the scientific foundations and empirical bases of molecular and turbulent diffusion; mass transfer across physical boundaries, with or without simultaneous heat transfer; and mass transfer accompanied by chemical reaction. The last three chapters cover the design and performance of mass transfer equipment.

"Mass Transfer" belongs in a class of books that, because of the stature and diligence of the authors, serves two purposes; contents of the books show not only what is known about their subjects, but, indirectly, what is not known. What is known is in the book. What is not in the book is not known.

As to the state of knowledge about mass transfer, I have a feeling, which is supported by this book, that at present our understanding has moved well out of its first phase of over-simplified and naive models and is well into a second stage of an amorphous mix of sound science, semi-empirical observation ranging from fair to excellent, and questionable empiricism used only because there is nothing better. I hope that ahead of us there will emerge a third phase of both a simpler and more general understanding based on a more phenomenological picture of the passage of one or two phases through actual equipment, perhaps based on movement, separation, and recombination of boundary layers within the apparatus, and enhancing the power of the engineer to achieve more realistic optimizations in more extreme situations and a better understanding of the interactions of energy and transfer rates. Who knows, perhaps we may find out just what does happen in a packed tower!

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Polymer Engineering, H. L. Williams, Elsevier Scientific Publishing Company, Amsterdam, New York (1975) 166 pages, $14.75.

The book is a qualitative exposition of elements of polymer science and, to a limited extent, polymer engineering, notwithstanding the title of the book. The book is not a treatise on such processes as extrusion, injection molding, and calendering. It covers the following subjects: the nature of high polymers, molecular interactions, the amorphous state, the crystalline state, adhesion and autohesion, rheology, viscous flow, elastic liquids, viscoelasticity, properties and failure processes, and degradation.

A well-written book which is easy to follow, it gives a good introduction to polymer behavior and the use of polymers. For the intended purpose of the book, which is to provide a text for seniors and graduate students without any prior exposure to polymers, it is quite adequate.

The book could have been much more useful to the student if homework problems were available to show how some of the basic knowledge can be used in practice. Also, parts of the book could have been more quantitative to provide further understanding of the subjects discussed. A more serious shortcoming might be that some parts of the book, such as the treatment of abrasive wear, are inaccurate, perhaps because the book covers a wide range of topics.

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Principles of Microbe and Cell Cultivation, S. John Pirt, Halsted Press, Division of John Wiley and Sons, New York, 274 pages, $34.00.

This compact little book is a delightful and long-awaited addition to biochemical engineering literature. I am sure that Professor Pirt, who is a professor of microbiology at the University of London, did not write this book with only engineers in mind. In fact, this rather short document containing a surprisingly large amount of information meticulously organized is useful to all those dealing with the cultivation of microbes for whatever purposes. In addition to its fundamental significance in microbiology, cultivation of microbes is involved in a broad spectrum of technological fields including fermentation, biomass production, biological waste disposal, food processing, as well as in medical, pharmaceutical, and sanitary applications. We find in recent years an increasing number of chemical engineers engaging in these areas; to them Professor Pirt's book is valuable for easy self-study or as an excellent supplement to a biochemical engineering textbook. Unless under special circumstances, I will not recommend Professor Pirt's book by itself as a textbook for biochemical engineers. It lacks in places the necessary depth to be useful as a text for a graduate course, and it is too specialized for a general introductory course of biochemical engineering.

In dealing with advanced topics of microbe cultivation, Professor Pirt included a chapter (Chapter 20) on mixed cultures, in which he has uniquely classified and skillfully analyzed six basic conditions for maintenance of two microbial species in a chemostat culture. This chapter should prove to be a useful contribution to the literature. The treatment of growth inhibition in Chapter 17, on the other hand, seems to fall short of total satisfaction. With increasing interest in the cultivation of microbes on substances like hydrocarbons, alcohols, aldehydes, and organic acids, many of which act as inhibitors at high concentrations, an adequate treatment of the non-Monod type of growth behavior deserves much more attention. In this regard, I am also rather disappointed in the total omission of any analysis of the growth of microbes in systems involving two liquid phases (one aqueous broth and one liquid hydrocarbon substrate). Literature in this area is growing rather rapidly. Inclusion of even a brief summary of this subject would add greatly to this valuable book.

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