ChE book review

Separation Process Technology

By *Jimmy L. Humphrey and George E. Keller II*
Published by McGraw-Hill, New York, 408 pages including index, $54.95 (1997)

Reviewed by
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This is a book of tips, industrial applications, practical flow sheets, new developments, and some theory, including empirical expressions for industrially important separations in the Chemical Process Industry (CPI). It contains a significant amount of useful information gathered by the authors during their years in consulting and industry—I took 19 pages of hand written notes while reading it.

The separations considered are those that are commercially important within the CPI, with an emphasis on separation at the molecular level. Thus, distillation and its variants, extraction, absorption/stripping, adsorption, and membrane separation processes are covered in detail. The sections on distillation, absorption/stripping, and adsorption appear to be most authoritative. Mechanical separations such as settling, cyclones, centrifuges, filtration and magnetic separators are not included. Processes that have some importance in the CPI or are important in other industries, such as flotation, crystallization, electrophoresis, and chromatography (except for simulated moving bed systems), are also not covered.

Although not a textbook (the authors assume the reader understands basic theories and there are no homework problems), this book is an excellent resource for professors who teach separations. The authors discuss the latest commercial advances and present a variety of applications; many tables and figures collect useful information. Examples can be used to provide a practical, industrial flavor to lectures. There are useful ideas for the size ranges employed in industry for different separations. The presentation is also particularly good on rules of thumb that predict when to use particular separations. For example, the authors compare air separation alternatives such as adsorption versus cyrogenic distillation versus membranes. They clearly keep economics in mind throughout the book. They note that the value of the exponent in the "six-tenths" power rule explains why distillation scales up well but doesn't scale down well, and why membrane separations do the opposite. They discuss new separation devices such as membrane contactors for absorption/stripping. Other examples include the extensive discussions on new trays and structured packings.

For all its strengths, this book does have a few weaknesses. Some of the flow sheets (*e.g.*, Figures 2.51, 2.59, and 5.22c) are clearly missing streams since they are not possible as drawn. The selection of topics is occasionally mystifying (*e.g.*, the new rate analysis of distillation columns is predicted to eventually replace equilibrium analysis, but the former is ignored while the equilibrium staged analysis is explained in detail). There are a few places where the book is a core dump instead of being fully digested. For example, on p. 143 a figure and table from different sources presenting extractor efficiency data don't agree, but the authors do not comment on this discrepancy. In addition, some of the practical wisdom, such as "Although HTU is more rigorous, HETP is used more frequently," may not sit well with professors. These are really minor points considering the practical information and useful features in this book.

A wealth of practical information not available in textbooks is included. For example, the authors state that composite polymer membranes may have the dense layer separate from the support layer if they are back flushed. This ruins the membrane and should normally be avoided. The authors have collected a number of empirical equations that give useful shortcuts. Examples include estimates of HETP, the flooding pressure drop from the packing factor, the minimum L/D, and the reboiler heat duty.

Additional useful features include tables of resources for VLE data and predictions; an annotated list of suppliers of simulation programs; a large number of references; an index; and appendices that include detailed design of distillation, lists of equipment suppliers, terminology for membrane and membrane processes, and conversion factors.

Overall, this is a very good book. Every chemical engineer who teaches, researches, or uses these separation processes should have ready access to it. ❐