Solid-Liquid Filtration and Separation Technology

By A. Rushton, A. S. Ward, and R. G. Holdlich, VCH, Weinheim, Germany, 1996, 529 pp., DM268.

As the title implies, this work is concerned with the engineering practice of solid-liquid separation with emphasis on filtration and sedimentation. Three authors were involved in its preparation, with each contributing a number of chapters.

The book consists of eleven chapters. Following the introductory chapter, the other ten chapters may be grouped into three categories: basic principles of solid-liquid separation (Chapters 2 and 3), various industrial separation processes (Chapters 5 through 9), and a description of equipment (Chapters 4, 10, and 11). Among these chapters, there is significant overlap. The authors view this as an advantage believing that it minimizes the need for back-referencing when using this book.

In the preface, the authors express the opinion that many of the problems encountered in the solid-liquid separation industry can be avoided by the application of available scientific data. They explain that their book aims to provide theoretical and practical information which can be used to improve the possibility of selecting the best equipment for a particular separation. The authors' stated goal is praiseworthy. There is an urgent need to bring current engineering practice in solid-liquid separation in line with recently-developed theoretical knowledge in this field. However, accomplishing this purpose is a rather difficult task, as proven by reading this book.

First, the success of a book intended to help engineers solve practical problems based on theoretical considerations hinges on precisely what theories are included. Naturally, the difficult task of determining which theories warrant attention falls to the authors of such a book. Yet, one might question the choices of the authors here with respect to the material in Chapters 2 and 3. For example, in regard to filtration, the discussions of cake filtration (Chapter 2) are largely confined to Ruth's work of more than seventy years ago, despite the relative abundance of more recent literature, such as the results based on the multiphase theory and the alternate approach advanced by soil physicists. Likewise for sedimentation fundamentals (Chapter 3), the seminal work of Kynch, which has served as the starting point for discussions of sedimentation based separation, is only given a cursory and incomplete coverage (pp. 94–97). In contrast, nearly twice as much space is devoted to the fairly simple calculation of the settling velocity from drag coefficient correlations (pp. 86–93).

In addition to the substantive issues mentioned above, the book's effectiveness is undermined by omissions, incomplete information, and simple mistakes. To cite a few: in each chapter, the notation section (which appears at chapter's end) does not include all the symbols introduced in the chapter; the same symbol is often used to denote two different quantities, terms in figure captions and corresponding text are inconsistent (see, for example, Figure 5.1 and the explanation given on p. 155). Perhaps the most egregious mistake is found in the data shown in Example 7.1 (p. 223), which gives $3.9/5.0 = 0.787$, $2.5/5.0 = 0.52$, etc. This book is marred by these simple and easily correctable mistakes.

Still, the book is not without merit. It collects and collates a large body of information on a variety of equipment such as the filter press, centrifugal filter, vacuum filter, classifier, thickener, and hydroclone in a single volume, without appearing to sell merchandise. It offers insight and understanding of the complexities of the problems encountered in solid-liquid separation. It inspires appreciation for the engineers who ingeniously solved such problems, often when they did not have full access to understanding all of the issues involved. Finally, the numerous example problems given in the book are very useful in illustrating the current engineering practice of equipment design and selection. The materials discussed in Chapter 4 (filter media) are particularly valuable. Many of them are not available elsewhere, and the various phenomena mentioned include cake cracking, cake cleaning and cake residues which are germane for future study. Any shortcoming notwithstanding, there is value and usefulness to be found here.

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Optical Rheometry of Complex Fluids

By G. G. Fuller, Oxford University Press, New York, 1995, 268 pp, $60.00

The use of optical techniques to investigate the structure and dynamics of polymeric liquids experiencing flow is undergoing something of a renaissance. Possible motives for employing an optical approach are many: speed of response, sensitivity to small changes in properties, good signal-to-noise even at very low concentrations, spatial resolution within the sample, and isolation of the contributions of different components to the properties of a complex fluid. The last of these arises from the many and selective ways in which light and molecules interact, and represents a powerful advantage over conventional rheology. Yet, it is fair to say that optical rheometry has not attained the status of a routine characterization approach, particularly in industrial laboratories. One major impediment to greater application of optical methods is their relative unfamiliarity to those who might benefit most; the lack of a suitable monograph certainly contributes to this unfortunate situation. Fuller's book is the first that attempts to cover this field in all its breadth; it is an admirable and an ambitious undertaking. The author is highly qualified to produce such a book; to a substantial extent, Fuller and his coworkers have done the most in recent years to extend the applications of rheo-optical techniques, to develop accessible instrumentation, and to demonstrate the unique power of flow birefringence, dichroism, and scattering.

Chapter 1 recaps Maxwell's equations, and briefly summarizes the basics