

Book reviews

Emerging Separation and Separative Reaction Technologies for Waste Reduction — Adsorption and Membrane Systems

Peter P. Radecki, John C. Crittenden, David R. Shonnard and John L. Bulloch (Ed.), Center for Waste Reduction Technologies, American Institute of Chemical Engineers 1999, 319 pp, £45.50 (hardback), ISBN: 0-8169-0789-7

This Monograph is a summary of the long-term experience of the Center for Waste Reduction Technologies (CWRT) and the findings of the National Workshop on Process Waste Reduction via Separation Technology and Separative Reactors. The book is primarily focused on adsorption and membrane technology. The authors are well-experienced specialists.

The readership is given a comprehensive overview of adsorption and membrane technologies as well as possible operations and their theoretical treatments. The book contains verbal explanations, as well as some fundamental equations, diagrams and technical applications. It successfully combines basic principles of the technologies, technical applications and research and development needs for the future.

By describing both adsorption and membrane technologies in the same book, an interesting and informative comparison of alternative processes has been achieved.

Chapter 1 gives a comprehensive overview of adsorption and membrane systems. In Chapter 2.1 a clear and structured explanation of adsorption fundamentals and the general adsorbents is given. Informative tables and helpful figures are used in Chapter 2.2 to explain process set-ups and conditions. Especially from the scientists point of view, Chapter 2.3 gives some interesting ideas on research needs. Application oriented readers will find interesting examples in topics such as petrochemistry and natural gas purification. Useful lists of suppliers are given in chapters 2.4 and 2.5. Chapter 2.6 deals with references for non-reactive adsorbents. A more theoretical treatment is given in Chapter 2.7, 'Adsorptive Chemical Reactors'. More tables and figures would be useful for understanding.

Chapter 3.1 gives a detailed overview of membrane technology. Clear definitions of technical vocabulary, many schemes and diagrams of all the important streams and necessary coefficients lead to an easy understanding of the subject. Tables with characteristics of commercialised membrane processes, membrane materials, module types, manufacturer and suppliers are appropriate for practical use.

In Chapter 3.2 selected emerging non-reactive membrane applications for in-process source reduction are discussed. Gas separation applications are described in the context of the control of the Greenhouse Effect and are illustrated with efficiency data as well as with data on the economics of CO₂ removal. In addition to the membrane systems, competitive technologies are presented. In the field of waste water treatment, one example is the recovery of metal from aqueous waste streams via membranes and ligand enhanced processing with various membranes. For pervaporative separations, typical factors for volatile organic compounds are given.

In Chapter 3.3 selected emerging separative reactors using membranes are described with reference to hydrocarbon-selective oxidation, dehydrogenation reactions and methane reforming reactions. Chapter 4 gives a brief summary of the findings of the National Workshop on Process Waste Reduction. It covers subjects like sustainability, new areas of waste reduction, process design and optimisation and process integration. Of great importance are applications in the future as well as research and development needs specific to waste reduction. A well-reported subject is the evaluation of membrane based processes in every chapter of the membrane section. A table of processes and process stream recommendations concludes the Monograph.

Although several authors with differing writing styles have participated in drawing up the Monograph, this has not significantly detracted from its clarity, structure or completeness. The use of SI-Units in all the chapters would have been useful for European readers. Many references of fundamental interest and to the latest developments are given at the end of each chapter.

With regard to comprehension, the book is well structured with details such as important technical vocabulary printed in italics. It contains many tables with comparative data on, for example, materials, suppliers, and amounts of technical applications world-wide, etc., which are very helpful for the reader seeking good ideas for their own tasks. The environmental aspect is worked out very well in each chapter.

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