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Unit Operations of Chemical Engineering

SEVENTH EDITION

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This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 0 DOC / DOC 0 9 8 7 6 5 4

ISBN 0-07-284823-5

Publisher: *Elizabeth A. Jones*
Senior Sponsoring Editor: *Suzanne Jeans*
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(USE) Cover Image: Section of Molecular Model, ©*Roz Woodward/Getty Images*
Senior Photo Research Coordinator: *Lori Hancock*
Supplement Producer: *Brenda A. Ernzen*
Compositor: *Interactive Composition Corporation*
Typeface: *10/12 Times*
Printer: *RR Donnelley*

Library of Congress Cataloging-in-Publication Data

McCabe, Warren L. (Warren Lee), 1899–
Unit operations of chemical engineering. — 7th ed. / Warren L. McCabe, Julian C. Smith, Peter Harriott.
p. cm. — (McGraw-Hill chemical engineering series)
Includes bibliographical references and index.
ISBN 0-07-284823-5
1. Chemical processes. I. Smith, Julian C. (Julian Cleveland), 1919–. II. Harriott, Peter. III. Title. IV. Series.

TP155.7.M3 2005
660'.2842—dc22 2004055184
CIP

www.mhhe.com

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Over 80 years ago, fifteen prominent chemical engineers met in New York to plan a continuing literature for their rapidly growing profession. From industry came such pioneer practioners as Leo H. Baekeland, Arthur D. Little, Charles L. Reese, John V. N. Dorr, M. C. Whitaker, and R. S. McBride. From the universities came such eminent educators as William H. Walker, Alfred H. White, D. D. Jackson, J. H. James, Warren K. Lewis, and Harry A. Curtis. H. C. Parmlee, then editor of *Chemical and Metallurgical Engineering,* served as chairman and was joined subsequently by S. D. Kirkpatrick as consulting editor.

After several meetings, this committee submitted its report to the McGraw-Hill Book Company in September 1925. In the report were detailed specifications for a correlated series of more than a dozen texts and reference books which became the McGraw-Hill Series in Chemical Engineering—and in turn became the cornerstone of the chemical engineering curricula.

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PREFACE

The seventh edition of this text on the unit operations of chemical engineering contains much new material and many additional problems, but the basic structure, general level of treatment, and overall length are largely unchanged. This is an introductory text, written for undergraduates in their junior or senior year who have completed the usual courses in mathematics, chemistry, physics, and an introduction to chemical engineering. An elementary knowledge of material and energy balances is assumed. Because it contains up-to-date correlations for heat transfer, mass transfer, and equipment design, this text should also be useful to chemists and engineers in industry.

Separate chapters are devoted to each of the principal unit operations, grouped into four sections: fluid mechanics, heat transfer, mass transfer and related separations, and operations involving particulate solids. One-semester courses may be based on any of these sections or combinations of them. Bioengineering is not treated as a separate topic, but examples of food processing, bioseparations, and diffusion in biological systems are included in various chapters.

Nearly all equations are written for SI units, but the older cgs and fps systems have not been completely eliminated. Chemical engineers must be familiar with all three systems of units. Most of the equations are dimensionless and may be used with any set of consistent units.

NEW TO THIS EDITION

- Thirty percent of the end-of-chapter problems are new or revised for this edition. Nearly all the problems can be solved with the aid of a pocket calculator, but for a few, a computer solution is preferable.
- The section on fluid viscosity in Chap. 3 is expanded to include simple theories for gases and liquids. In later chapters, similar theories for thermal conductivity and diffusivity are discussed and comparisons made.
- The analogies among momentum transfer, diffusion, and heat conduction are given more emphasis, and the section on transient diffusion is expanded to include an example of controlled-release drug delivery.
- New material in Chap. 25 deals with the use of powdered carbon to treat aqueous waste in tanks, and expanded-bed adsorption that can be used for purification of fermentation broths.
- Chapter 29 has a new section on diafiltration, a process often used in protein purification. There is also an expanded treatment of ultrafiltration and microfiltration of protein and polymer solutions.
- The discussion of filter cake washing is completely revised and a plot of some data is included.

- Heat pipes and plate-type exchangers are included in the chapter on heat-exchange equipment
- The distillation chapters contain revised sections on flash distillation, flooding limits, and plate efficiency
- Correlations for drying rates and a treatment of dryer thermal efficiency have been added

WEB RESOURCES

An Instructor and Student Resource Web site is available at http://www.mhhe.com/mccabe7e. Users will find the password-protected solutions to the end-of-chapter problems, PowerPoint Slides of text figures, and general textbook information.

ACKNOWLEDGMENTS

We appreciate the help given to us by Merck scientists Ann Lee, Russel Lander, Michael Midler, and Kurt Goklen who provided valuable information about bioseparations. We also thank Joseph Gonyeau of Klickitat Energy Services for the photograph of a natural-draft cooling tower.

We would like to acknowledge the following people for their comments, suggestions, and criticisms:

B. V. Babu
Birla Institute of Technology and Science

James R. Beckman
Arizona State University

Stacy G. Bike
University of Michigan, Ann Arbor

Man Ken Cheung
The Hong Kong Polytechnic University

K. S. Chou
National Tsing Hua University

Tze-Wen Chung
Yun-Lin University of Science and Technology

James Duffy
Montana State University

Raja Ghosh
McMaster University

Vinay K. Gupta
University of Illinois–Urbana Champaign

Keith Johnston
University of Texas

Huan-Jang Keh
National Taiwan University

Kumar Mallikarjunan
Virginia Polytechnic Institute and State University

Parimal A. Parikh
S. V. National Institute of Technology

Timothy D. Placek
Auburn University

A. Eduardo Sáez
University of Arizona

Baoguo Wang
Tianjin University

G. D. Yadav
University Institute of Chemical Technology, India

I-Kuan Yang
Tung Hai University

Shang-Tian Yang
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