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Second Edition

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LIQUID DETERGENTS

Second Edition

Edited by
Kuo-Yann Lai
Colgate-Palmolive Company
Piscataway, New Jersey, U.S.A.



Taylor & Francis
Taylor & Francis Group

Boca Raton London New York Singapore

A CRC title, part of the Taylor & Francis imprint, a member of the
Taylor & Francis Group, the academic division of T&F Informa plc.

Published in 2006 by
CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

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CRC Press is an imprint of Taylor & Francis Group

No claim to original U.S. Government works
Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-10: 0-8247-5835-8 (Hardcover)
International Standard Book Number-13: 978-0-8247-5835-6 (Hardcover)
Library of Congress Card Number 2005044033

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Library of Congress Cataloging-in-Publication Data

Liquid detergents / edited by Kuo-Yann Lai.-- 2nd ed.
p. cm. -- (Surfactant science series ; v. 129)
Includes bibliographical references and index.
ISBN 0-8247-5835-8 (acid-free paper)
1. Detergents. I. Lai, Kuo-Yann, 1946- II. Series.

TP992.5.L56 2005
668'.14--dc22

2005044033



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About this book ...

This revised and expanded edition of *Liquid Detergents* covers all fundamental theories, practical applications, and manufacturing aspects of liquid detergents, from hand dishwashing liquids, liquid laundry detergents, to shampoos and conditioners. More than 30% of new material has been added, and this covers all the advances in liquid detergent products and technologies in the last decade.

Over 1800 relevant and up-to-date references are cited; these include books, book chapters, journal articles and patents for each product category. A wealth of information is presented in 300 helpful figures and tables.

Twenty-three international researchers from academia and industry have contributed their expertise to the book. This second edition of *Liquid Detergents* will continue to serve as a convenient, comprehensive and useful reference for researchers, and product development chemists and engineers, in the detergent field.

Preface

Since its publication in 1996, the first edition of *Liquid Detergents* has been well received around the world by researchers in the detergent field. However, since its first publication there have been significant advances in this area. This second edition is intended to capture these advances and maintain the book as a useful, up-to-date reference.

Every chapter has been updated and expanded. This is true for both theoretical and application aspects. Over 30% of the information is new and updated. [Chapter 2](#), “Hydrotropy,” has been rewritten to incorporate a significant number of updated references. In [Chapter 3](#), “Phase Equilibria,” the discussion of emulsion has been expanded, and a section on nanoemulsions added. For [Chapter 4](#), “Rheology of Liquid Detergents,” in addition to general updating, data on the rheology of current commercial detergent raw materials and finished products are included, emphasizing those with particularly unique properties. [Chapter 5](#), “Rheology Modifiers and Thickeners for Liquid Detergents,” has been rewritten with expanded coverage of all the different rheology modifiers and thickeners for detergent applications. [Chapter 6](#), “Nonaqueous Surfactant Systems,” has been expanded to give a more comprehensive theoretical review of aggregation in nonaqueous solvents. [Chapter 7](#), “Light-Duty Liquid Detergents,” has been significantly rewritten and expanded; the new trends in recent years, including the success of antibacterial products and sensorial products, are a major focus of discussion. An extensive review of recent patent trends and a new discussion of “high-efficiency detergents,” “color/fabric care” and “wrinkle reduction” have been added to [Chapter 8](#), “Heavy-Duty Liquid Detergents.” [Chapter 9](#), “Liquid Automatic Dishwasher Detergents,” has been updated to cover the evolution of products in recent years, and includes complete summaries of a large number of new patents granted since the mid-1990s. [Chapter 10](#), “Shampoos and Conditioners,” has been completely rewritten to align with the other application chapters; it has also been significantly expanded, with extensive summaries of patents for various new technologies and new products for shampoos and conditioners. [Chapter 11](#), “Liquid Hand Soap and Body Wash,” is a newly written chapter that covers not only liquid hand soaps, but also the

exciting developments in shower gel/liquid body wash products in recent years. [Chapter 12](#), “Fabric Softeners,” has been rewritten and updated. New sections, especially on household cleaning wipes, have been added to [Chapter 13](#), “Specialty Liquid Household Surface Cleaners.” New discussions of continuous vs. batch process, aeration avoidance and microbial contamination have been added to [Chapter 14](#), “Manufacture of Liquid Detergents.”

It is hoped that, with these updates and additions, the second edition of *Liquid Detergents* will continue to serve as a useful and handy reference for researchers in the field.

Acknowledgments

I would like to express my gratitude to Colgate-Palmolive Company for allowing me to undertake this project. I am especially grateful to Dr. Robert Pierce who introduced me to the world of detergents nearly 30 years ago. It was in his laboratory and through his teaching and many stimulating discussions, that I have learned much about detergents.

My sincere thanks go to all the contributors for taking time from their busy schedule and making personal sacrifices to contribute to this second edition.

I also would like to thank Anita Lekhwani, Senior Acquisition Editor, for her support, patience and encouragement. Thanks also to Jill Jurgensen and Tao Woolfe for all their help in coordinating the book for production.

Finally, I would like to thank my wife, Jane, and my children, Melody, Amy, and Peter, for their loving support throughout the project.

Kuo-Yann Lai
Colgate-Palmolive Company

About the editor ...

Kuo-Yann Lai, Ph.D., is Worldwide Director at Colgate-Palmolive Company's Global Technology, Piscataway, New Jersey. He has nearly three decades of industrial R&D experience in consumer products, spanning from basic research, product development, technology transfer, manufacturing operation, and purchasing, to product commercialization. The products that he has worked on include detergents, soaps, and dentifrices.

Most recently, he served as Technical Director for Colgate-Palmolive Company's Greater China operation. He is the author of *Material and Energy Balances* as well as being author or co-author of several scientific papers and book chapters, including a chapter on foam additives in *Foams: Theory, Measurements, and Applications* (Marcel Dekker, Inc.), and two chapters in the first edition and four chapters in this second edition of *Liquid Detergents*.

Dr. Lai holds seven U.S. and numerous international patents. He was the recipient of Colgate-Palmolive's "President's Award for Technical Excellence" in 1984, the Organization of Chinese Americans' "National Asian American Corporate Achievement Award" in 1992, and was the New Jersey Inventors' Hall of Fame "Inventor of the Year" in 1994.

Dr. Lai received his B.S. degree in Chemical Engineering from National Cheng Kung University (1969) in Taiwan, Republic of China, his M.S. degree in Physical Chemistry from the University of Texas at El Paso (1974), and a Ph.D. degree in Colloid and Surface Science from Clarkson College of Technology (1977), Potsdam, New York.

Contributors

Evangelia S. Arvanitidou Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Irena Blute YKI, Institute for Surface Chemistry, Stockholm, Sweden

Guy Broze Advanced Technology Department, Colgate-Palmolive Research and Development, Inc., Milmort, Belgium

Arno Cahn (deceased) Arno Cahn Consulting Services, Inc. Pearl River, New York

André Crutzen Advanced Technology Department, Colgate-Palmolive Research and Development, Inc., Milmort, Belgium

Nagaraj Dixit Research and Development, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Stig E. Friberg Institute for Formulation Science, University of Southern Mississippi, Hattiesburg, Mississippi

Joan Gambogi Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Philip A. Gorlin Research and Development, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Subhash Harmalker Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Santhan Krishnan Research and Development, GOJO Industries, Inc., Akron, Ohio

Kuo-Yann Lai Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Paul Reeve Rohm and Haas France S.A.S., Sophia Antipolis, France

Charles Reich Advanced Technology/Hair Care, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

R.S. Rounds Fluid Dynamics, Inc., Flemington, New Jersey

Amit Sachdev Research and Development, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Jan Shulman Rohm and Haas Company, Research Laboratories, Spring House, Pennsylvania

Marie Sjöberg Institute for Surface Chemistry, Stockholm, Sweden

Jiashi J. Tarng Advanced Technology/Hair Care, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Tom Tepe Rohm and Haas Company, Research Laboratories, Spring House, Pennsylvania

Torbjörn Wärnheim ACO HUD AB, Upplands Väsby, Sweden

Karen Wisniewski Research and Development, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

Len Zyzyck Research and Development, Global Technology, Colgate-Palmolive Company, Piscataway, New Jersey

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