CONTENTS

Preface ..... *v*
Contributors ..... *xiii*

PART I CONTROL OF ENZYME ACTIVITY IN NONAQUEOUS SOLVENTS
Peter J. Halling *1*

1 Salt-Induced Activation of Enzymes in Organic Solvents: *Optimizing the Lyophilization Time and Water Content*
Michael T. Ru, Jonathan S. Dordick, Jeffrey A. Reimer, and Douglas S. Clark *3*

2 Imprinting Enzymes for Use in Organic Media
Joseph O. Rich and Jonathan S. Dordick *13*

3 Entrapment of Biocatalysts by Prepolymer Methods
Atsuo Tanaka and Takamitsu Iida *19*

4 Microencapsulation of Enzymes and Cells for Nonaqueous Biotransformations
Jeffrey A. Khan and Evgeny N. Vulfson *31*

5 Immobilization of Lipases on Hydrogels
Abu Bakar Salleh, Norhaizan M. Esa, Mahiran Basri, Che Nyonya A. Razak, Wan Md Zin W. Yunus, and Mansor Ahmad *41*

6 Polyethylene Glycol-Modified Enzymes in Hydrophobic Media
Ayako Matsushima, Yoh Kodera, Misao Hiroto, Hiroyuki Nishimura, and Yuji Inada *49*

7 Chemical Modification of Lipase for Use in Ester Synthesis
Mahiran Basri, Kamaruzaman Ampon, Che Nyonya A. Razak, and Abu Bakar Salleh *65*

8 Preparation and Properties in Organic Solvents of Noncovalent PEG–Enzyme Complexes
Francesco Secundo, Gianluca Ottlina, and Giacomo Carrea *77*

9 Preparation of a Lipid-Coated Enzyme and Activity for Reverse Hydrolysis Reactions in Homogeneous Organic Media
Toshiaki Mori and Yoshio Okahata *83*

10 Very High Activity Biocatalysts for Low-Water Systems: *Propanol-Rinsed Enzyme Preparations*
Barry D. Moore, Johann Partridge, and Peter J. Halling *97*

11 Methods for Measurement and Control of Water in Nonaqueous Biocatalysis
George Bell, Peter J. Halling, Lindsey May, Barry D. Moore, Donald A. Robb, Rein Ulijn, and Rao H. Valivety *105*

12 Water Activity Control in Organic Media by Equilibration Through Membranes
Ernst Wehtje and Patrick Adlercreutz *127*

13 Water Activity Control for Lipase-Catalyzed Reactions in Nonaqueous Media
Joon Shick Rhee, Seok Joon Kwon, and Jeong Jun Han *135*

14 Immobilization of Enzymes and Control of Water Activity in Low-Water Media: *Properties and Applications of Celite R-640 (Celite Rods)*
Lucia Gardossi *151*

15 Enzyme Activity and Enantioselectivity Measurements in Organic Media
Amélie Ducret, Michael Trani, and Robert Lortie *173*

16 Calorimetric Methods in Evaluating Hydration and Solvation of Solid Proteins Immersed in Organic Solvents
Mikhail Borisover, Vladimir Sirotkin, Dmitriy Zakharychev, and Boris Solomonov *183*

17 Detection of Structural Changes of Enzymes in Nonaqueous Media by Fluorescence and CD Spectroscopy
Hideo Kise *203*

18 The Effects of Crown Ethers on the Activity of Enzymes in Organic Solvents
Dirk-Jan van Unen, Johan F. J. Engbersen, and David N. Reinhoudt *213*

19 Control of Acid–Base Conditions in Low-Water Media
Johann Partridge, Neil Harper, Barry D. Moore, and Peter J. Halling *227*

20 Enzymatic Acylation of α-Butylglucoside in Nonaqueous Media
Marie-Pierre Bousquet, René-Marc Willemot, Pierre Monsan, and Emmanuel Boures *235*

PART II SYNTHETIC APPLICATIONS
Herbert L. Holland *241*

21 Choosing Hydrolases for Enantioselective Reactions Involving Alcohols Using Empirical Rules
Alexandra N. E. Weissfloch and Romas J. Kazlauskas *243*

22 *Candida antarctica* Lipase B: *A Tool for the Preparation of Optically Active Alcohols*
Didier Rotticci, Jenny Ottosson, Torbjörn Norin, and Karl Hult *261*

23 Enantioselective Lipase-Catalyzed Transesterifications in Organic Solvents
Fritz Theil *277*

24 *Pseudomonas cepacia* Lipase-Catalyzed Enantioselective Acylation of 2-Substituted-1-alkanols in Organic Solvents
Patrizia Ferraboschi and Enzo Santaniello *291*

25 Preparation of 2-, 3-, and 4-Methylcarboxylic Acids and the Corresponding Alcohols of High Enantiopurity by Lipase-Catalyzed Esterification
Per Berglund and Erik Hedenström *307*

26 Optimization of Enzymatic Enantiomeric Resolutions Through Solvent Selection
Gianluca Ottlina, Francesco Secundo, Giorgio Colombo, and Giacomo Carrea *319*

27 Chemoselective Amidification of Amino-Polyols Catalyzed with Lipases in Organic Solvents
Thierry Maugard, Magali Remaud-Simeon, and Pierre Monsan *325*

28 Synthesis of Esters Catalyzed by Lipases in Water-in-Oil Microemulsions
Haralambos Stamatis, Aristotelis Xenakis, and Fragiskos N. Kolisis *331*

29 Enzymatic Conversion of Organosilicon Compounds in Organic Solvents
Takuo Kawamoto and Atsuo Tanaka *339*

30 Synthetic Applications of Enzymes in Nonaqueous Media
Valérie Rolland and René Lazaro *357*

31 Enzymes in Nonaqueous Solvents: *Applications in Carbohydrate and Peptide Preparation*
Shui-Tein Chen, Boonyaras Sookkheo, Suree Phutrahul, and Kung-Tsung Wang *373*

32 Interface Bioreactor: *Microbial Transformation Device on an Interface Between a Hydrophilic Carrier and a Hydrophobic Organic Solvent*
Shinobu Oda, Takeshi Sugai, and Hiromichi Ohta *401*

33 Yeast-Mediated Reactions in Organic Solvents
Andrew J. Smallridge and Maurie A. Trewhella *417*

34 Biocatalysis in Pharmaceutical Process Development: *SCH56592, a Case Study*
Brian Morgan, David R. Dodds, Michael J. Homann, Aleksey Zaks, and Robert Vail *423*

PART III REACTION SYSTEMS AND BIOREACTOR DESIGN
Evgeny N. Vulfson *469*

35 Enzymatic Solid-to-Solid Peptide Synthesis
Markus Erbeldinger, Uwe Eichhorn, Peter Kuhl, and Peter J. Halling *471*

36 Enzymatic Synthesis and Hydrolysis Reactions of Acylglycerols in Solvent-Free Systems
Cristina Otero, Jose A. Arcos, Hugo S. Garcia, and Charles G. Hill, Jr. *479*

37 Solid–Gas Catalysis at Controlled Water Activity: *Reactions at the Gas–Solid Interface Using Lipolytic Enzymes*
Sylvain Lamare and Marie Dominique Legoy *497*

38 Solvent-Free Biotransformations of Lipids
Tsuneo Yamane *509*

39 Lipase-Catalyzed Synthesis of Sugar Fatty Acid Esters in Supercritical Carbon Dioxide
Haralambos Stamatis, Vasiliki Sereti, and Fragiskos N. Kolisis *517*

40 Transformations in Frozen Aqueous Solutions Catalyzed by Hydrolytic Enzymes
Marion Haensler and Hans-Dieter Jakubke *523*

41 Enzymatic Synthesis of Sugar Fatty Acid Esters in Solvent-Free Media
Douglas B. Sarney and Evgeny N. Vulfson *531*

42 Biotransformations in Supersaturated Solutions
David A. MacManus, Anna Millqvist-Fureby, and Evgeny N. Vulfson *545*

43 Enzymatic Transformations in Suspensions (I): *One Solid Substrate and Product*
Volker Kasche and Antje Spieß *553*

44 Biotransformations in Supercritical Fluids
Nuno Fontes, M. Conceição Almeida, and Susana Barreiros *565*

45 Reverse Micellar Systems: *General Methodology*
Andrey V. Levashov and Natalia L. Klyachko *575*
46 Enzymatic Transformations in Supercritical Fluids
Alain Marty and Jean-Stéphane Condoret *587*
47 Enzymatic Transformations in Suspensions (II)
Adrie J. J. Straathof, Mike J. J. Litjens, and Joseph J. Heijnen *603*
48 Characterization and Operation of a Micellar Membrane Bioreactor
Cristina M. L. Carvalho, Maria Raquel Aires-Barros, and Joaquim M. S. Cabral *611*
49 Immobilization of Lipase Enzymes and Their Application in the Interesterification of Oils and Fats
Alan D. Peilow and Maha M. A. Misbah *627*
Index *651*