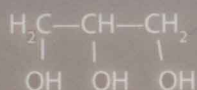
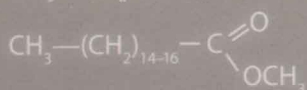
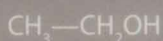


Biocatalysis and Bioenergy



Edited by

CHING T. HOU • JEI-FU SHAW

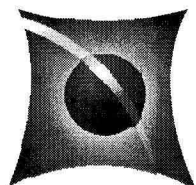
BIOCATALYSIS AND BIOENERGY

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Ching T. Hou and Jei-Fu Shaw



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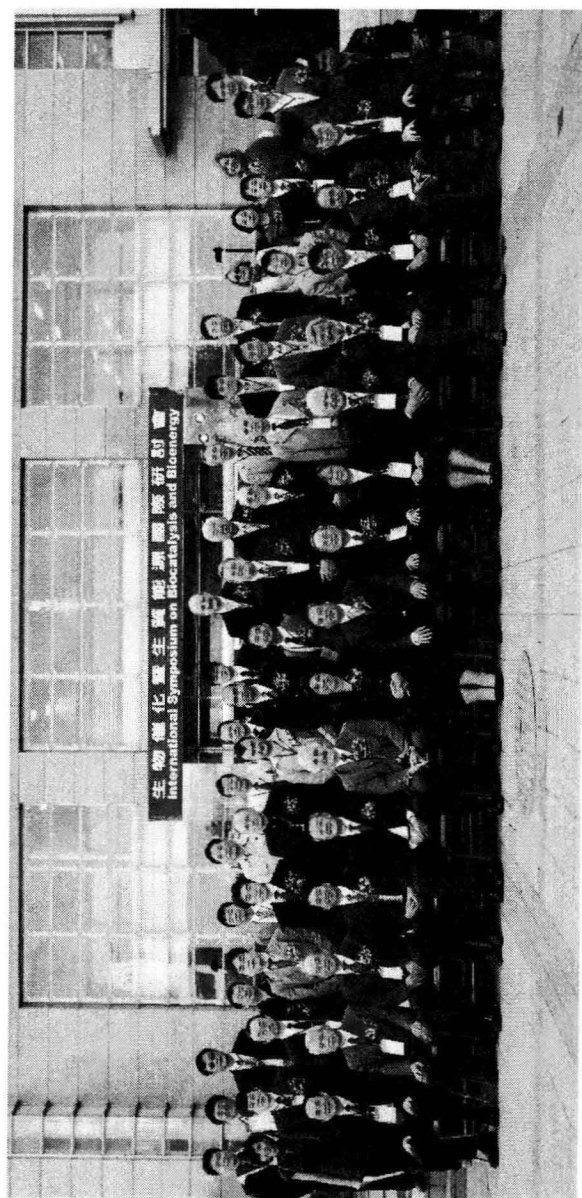
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生物催化暨生質能源國際研討會

International Symposium on Biocatalysis and Bioenergy
December 6-8, 2006, National Chung-Hsing University, Taichung, Taiwan

PREFACE

This book was assembled with the intent of bringing together current advances and in-depth reviews of biocatalysis and bioenergy, with emphasis on biodiesel, bioethanol, biohydrogen, and industrial products. The book consists of selected papers presented at the International Symposium on Biocatalysis and Biotechnology held at the National Chung Hsing University, Taichung, Taiwan, on December 8–10, 2006. At this symposium, 47 distinguished international scientists shared their valuable research results. Additionally, there were 16 selected posters, 12 bioenergy exhibitions, and over 400 attendees. A few chapters contained in this book were contributed by distinguished scientists who could not attend this symposium. The meeting was a great success, and we greatly appreciate the contribution of local organization committee members at NCHU, including Dr. C. H. Yang, Director of NCHU Biotechnology Center, Dr. T. J. Fang, Dr. C. S. Wang, Dr. C. C. Huang, Dr. S. W. Tsai, Dr. Fuh-Jyh Jan, Dr. C. Chang, and their colleagues and students.

Biocatalysis and bioenergy as defined in this book include enzyme catalysis, biotransformation, bioconversion, fermentation, genetic engineering, and product recovery. Bioenergy includes energy derived from biomass, and all kind of biological resources. Due to the high cost of petroleum products, biofuels have drawn great attention recently. There is no comprehensive book on bioenergy or biofuels. The authors are internationally-recognized experts from all sectors of academia, industry, and governmental research institutes. This is the most current book on bioenergy and industrial products. Production of biofuels in the United States is forecast to exceed 16 billion gallons by 2015; ethanol will account for 9.4% of gasoline consumption, and biodiesel will be approximately 4% of the total estimated diesel consumption. Global production of ethanol is expected to exceed 120 billion gallons by 2020, while the worldwide production of biodiesel is expected to reach 3.2 billion gallons by the end of 2010.

Biocatalysis presents the advantages of high specificity, efficiency, energy conservation, and pollution reduction. Therefore, Biocatalysis and biotechnology are increasingly important for bioenergy production.

This book is composed of 32 chapters divided into three sections. The first 10 chapters describe the world's newest biodiesel research. Included is biodiesel research at NCAUR, USDA, production of biodiesel fuel through bioprocesses, a biodiesel cost optimizer-least cost raw material blending for standard quality biodiesel, new catalytic systems for vegetable oil transesterification

based on tin compounds, noncatalytic alcoholysis of vegetable oils for production of biodiesel fuel, improvement to the biodiesel batch process and impact on low temperature performance, development of new products from biodiesel glycerin, industrial products from biodiesel glycerols, optimization of lipase-catalyzed biodiesel through a statistical approach, and the production of biofuel from lipids and alternative resources. Five chapters in the second section are for bioethanol, and include biotechnology of holocellulose-degrading enzymes, from biogas energy to keratinase technology, emerging technologies in dry grind ethanol production, Gram positive bacteria as biocatalysts to convert biomass-derived sugars into biofuel and chemicals, and biological hydrogen production by strict anaerobic bacteria.

The final seventeen chapters discuss industrial products by biocatalysis and include the catalytically self-sufficient cytochrome P-450 monooxygenase system from *Bacillus megaterium* ALA2, the biocatalysis-based development of oligosaccharides in Japan, the synthesis of chiral intermediates for drugs, the screening of novel microbial enzymes and their application to chiral compound production, hydrogenation technologies for the production of high quality of biobeneficiary conjugated fatty acids, biotechnology of mannitol production, the physiological function of DHA phospholipids, the conversion of fishery by-products and waste into value-added products, the chemo-enzymatic synthesis of structured lipids, the regiospecific analysis of castor triacylglycerols by ESI-MS, composition, functionality and potential applications of seaweed lipids, the enzymatic production of marine-derived protein hydrolysates and their bioactive peptides, bioengineering and application of glucose polymers, peroxidase-catalyzed polymerization of phenolic compounds containing carbohydrate residues, the production of lipase and oxygenated fatty acids from vegetable oils, production of biologically active hydroxyl fatty acids by *Pseudomonas aeruginosa* PR3, and the biotransformation of oils to value-added compounds.

This book serves as reference for teachers, graduate students, and industrial scientists who conduct research in biosciences and biotechnology.

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March 2008

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PART I

BIODIESEL