

## CONTENTS

vi Foreword

### **Keynote addresses**

- 1 Plant Lipid Biotechnology Through the Looking Glass
- 7 Lipid Biotechnology : A Wonderland for the Microbial Physiologist
- 17 Enzyme Technology for the Lipids Industry : An Engineering Overview

### **Session I – Biotechnological Modification of Oil Plants : Fat Metabolism and Genetic**

#### **Implication**

- 23 Biosynthesis of Triacylglycerol in Plant Storage Tissue
- 30 Fatty Acid Synthesis in Plant Cells
- 35 Recent Advances in Oil Crops Breeding
- 39 Plant Fatty Acid Biosynthesis : Sites of Metabolic Regulation and Potential for Genetic Engineering
- 43 Genetic Transformation for the Improvement of Canola
- 47 Commercial Development of Oil Palm Clones
- 51 Biotechnology for Coconut Improvement
- 55 Genetic Modification of Polyunsaturated Fatty Acid Composition in Flax
- 58 Biotechnology for Soybean Improvement
- 65 Biotechnology for Brassica and Helianthus Improvement
- 72 Discussion

### **Session II – Biotechnology : New and Unique Oil Sources and Byproducts**

- 73 Genetic Diversity of lipids in Plants Germplasm
- 78 Development of New Industrial Oil Crops
- 87 Molecular Approaches to the Study and Modification of Oilseed Fatty Acid Synthesis
- 93 Genetic Control of Fatty Acid Biosynthesis in yeast
- 102 Technical and Economic Aspects and Feasibility of Single Cell Oil Production Using Yeast Technology

110 Production of  $\gamma$  - Linolenic Acid by Fungi and Its Industrialization

117 Microalgae as a Source of EPA-containing Oils

122 Discussion

### **Session III – Biotechnological Modification of Fats, Oil, Fatty Acids and Glycerol**

123 Immobilized Lipases in Organic Solvents

131 Enzymatic Fat Splitting

134 Ester Synthesis with Immobilized Lipase

138 Enzymatic Conversion of Diglycerides to Triglycerides in Palm Oils

142 Omega-Hydroxylations

148 Production of Dicarboxylic Acids by Fermentation

153 Enzymic Modification at the Mid-chain of Fatty acids

164 A Simple Test for the Determination of Lipase Fatty acid Specificity

168 Discussion

### **Session IV – Biotechnology and the Preparation of Unique Fats, Fatty Acids and Biosurfactants**

169 Unusual Fatty Acids and Their Scope in Biotechnology

173 Production of Arachidonic Acid and Elcosapentaenoic Acid by Microorganisms

178 Biotransformation of Oleic Acid to Ricinoleic Acid

180 Temperature Effects in the Biosynthesis of Unique Fats and Fatty Acids

184 Lipids of Acinetobacter

189 Strategies for Biosurfactant Production

195 Biosurfactants as Food Additives

202 Biosurfactants for Petroleum Recovery

206 Biosurfactants in Cosmetic Applications

210 Discussion

### **Session V – Biotechnology : Engineering and Scale-up in Fat and Fatty Acid**

#### **Biotransformations**

211 Bioreactors for Hydrolysis of Fatt Oils

215 Biosensors for Lipids

## 9 Modifications of Fats and Oils in Membrane Bioreactors

226 Mass Transfer in Bioreactors

230 Continuous Use of Lipases in Fat Hydrolysis

238 Economic aspects of Lipid Biotechnology

244 New Process for Purifying Soybean Oil by Membrane Separation and Economical Evaluation  
of the Process

251 Justifying and Commercializing Biotechnology

255 Discussion

## **Session VI – Regulatory Aspects of Biotechnology in the Fats and Oils Industry**

256 Toxicological Evaluation of Biotechnology Products : Regulatory Viewpoint

258 Toxicological Evaluation of Biotechnology Products

262 General Regulatory Aspects of Biotechnology : Europe

270 General Regulatory Aspects of Biotechnology in Japan

277 Toxicology of Technological Products – Dietary Fat, Cancer and Other Chronic Diseases

282 Dilemma of Patenting for Oilseed Breeders and Biotechnologists

284 Discussion

## **Poster Sessions**

285 Production of Eicosapentaenoic and Arachidonic Acids by the Red Alga *Porphyridium*  
*Crruentum*

288 Comparison of Biointeresterification and Conventional Processes for the preparation of  
Vanaspati  
and Other Valuable Products

290 Biochemical Characteristics of a Genetic Trait for Low Palmitic Acid Content in Soybean

294 Substrate Specificity of Diacylglycerol Acyltransferase Purified from Soybean

298 Oleic Acid Conversion to 10-Hydroxystearic acid by *Nocardia* Species

301 Molecular Biological Studies of Plant Lipoxygenases

305 Synthesis of Fatty Acids in Cocoa Beans at Different Stages of Maturity

308 Enzymatic Acidolysis Reaction of Some Fats

310 Oil Body Formation in Developing Repeseed, *Brassica Napus*

314 Improvement of the Economic Feasibility of Microbial Lipid Production

- 3** Effect of Temperature and pH on the Saturation of Lipids Produced by *Rhodosporidium Toruloides* ATCC 10788
- 321 A Non-Destructive Method for Seed Phenotype Identification in Plant Breeding
- 323 *Candida cylindracea* Lipase-catalyzed interesterification of Butter Fat
- 328 Interesterification of Lipids by an sn-1, 3-Specific Triacylglycerol Lipase
- 330 Radiochemical Techniques for the Assay of Lipase-catalyzed Reactions
- 332 Differential Determination of Free Fatty Acids Using Acyl-CoA Synthetase and Acyl-CoA Oxidase Enzymes Purified from Microorganisms
- 335 Immunological Characterization of Lipases from a Wide Range of Oilseed Species
- 339 Characteristics of Spiculisporic Acid as a Polycarboxylic Biosurfactant
- 343 Engineering Parameters for the Application of Immobilized Lipases in a Solvent-free System
- 346 Nutritional Attributes of Fatty Acids
- 351 Conversions of Lipophilic Substances by Encapsulated Biocatalysts
- 356 Registrants