

Table of Contents

Preface

Chapter 1: Biomass Pre-Treatment Technologies

Torrefaction of Empty Fruit Bunch as Fibrous Biomass Pre-Treatment E. Laksmi Nugraha and R. Hantoro	3
Upgrading Bagasse Quality by Torrefaction for a Biomass Power Plant S. Sirijuncheon, V. Seithtanabutara and T. Wongwuttanasatian	8
Experimental Investigation of the Performance of a Spouted Bed Dryer for Biomass: Drying Kinetics and Energy Evaluation B.R.S. Silva, M. Nascimento, L.G. Marques and M.M. Prado	15
Effect of Electron Beam Irradiation and Ionic Liquid Combined Pretreatment Method on Various Lignocellulosic Biomass N.A.A. Jusri, A. Azizan, Z.S.Z. Zain and A.M.F. Rahman	25
Combining Wet Rendering with Torrefaction to Improve the Fuel Characteristics of Biochar from Food Waste R.A. Rasid, T.X. Yee, R.N.U.A. Rahman and M. Ismail	33

Chapter 2: Biomass Pyrolysis

Bio-Oil Characterizations of <i>Spirulina Platensis</i> Residue (SPR) Pyrolysis Products for Renewable Energy Development S. Jamilatun, A. Rahayu, Y.S. Pradana, B. Budhijanto, Rochmadi and A. Budiman	45
Influence of Natural and H-Beta Zeolites on Yield and Composition of Non-Polar Fraction of Bio-Oil in Slow Co-Pyrolysis of Biomass and Polypropylene D. Supramono and S. Tiaradiba	51
Utilization of <i>Casuarina montana</i> Pruning Waste Biomass as Chemical or Energy Resources D. Irawati, D. Usman and N.N. Pradipta	57
Catalytic Intermediate Pyrolysis of Cellulose for Hydrocarbons Production in the Presence of Zeolites by Using TGA-FTIR Method K. Lazdovica and V. Kampars	64
Effect of Acidic Activated Natural Zeolite on Characteristics of Bio Oil Derived from Pinus Merkusii's Cone Pyrolysis A. Zulkania, A. Chafidz, P. Maharani and S. Ade Putri	70
In Situ Pyrolysis of Pine Flowers to Produce Bio-Oil: Effect of Temperature and Catalyst Treatment A. Zulkania, N.Z. Yasha, S.A. Rachman and A. Chafidz	75
Pyrolysis of Sugarcane Bagasse: The Effects of Process Parameters on the Product Yields A.G.H. Saif, S.S. Wahid and M.R.O. Ali	80
An Investigation on the Interaction between Biomass and Coal during their Co-Pyrolysis E.E. Samy Berthold, S.L. Fang, Y.T. Xue, Y. Wang, Z. Xiong, J.H. Guo, S. Hu, J. Xiang and S. Su	89
Aspen Plus Simulation of Bio-Char Production from a Biomass-Based Slow Pyrolysis Process Y.A. Dahawi, A. Abdulrazik, M.N.A. Seman, M.A.A. Aziz and M.Y.M. Yunus	99
Thermo Distillation and Characterization of Bio Oil from Fast Pyrolysis of Palm Kernel Shell (PKS) D. Qarizada, E. Mohammadian, A.B. Alis, S.M. Yusuf, A. Dollah, H.A. Rahimi, A.S. Nazari and M. Azizi	105
Catalytic Cracking of Oleic Acid over Zeolites M.A.A. Kanak, J.Y. Park and I.G. Lee	111

Chapter 3: Biomass Gasification

Utilization of Tea Tree Branches as a Source of Thermal Energy R. Firyanto, H. Susanto, R.S.L. Ambarwati, Suherman and Widayat	119
Gasification of Oil Palm Shells and Empty Fruit Bunches to Produce Gas Fuel A. Aktawan, Maryudi, S. Salamah and E. Astuti	125
Potential Application of Sago Pulp Briquette for Electricity Generation Using Gasification Technology in Papua Province, Indonesia M. Syamsiro, M.N. Aridito and S. Ma'arif	130

Chapter 4: Biomass Liquefaction

Production of Bio-Crude Oil from Microalgae <i>Chlorella</i> sp. Using Hydrothermal Liquefaction Process A.A. Bawono, H. Adhisatrio, L. Prasakti and Y.S. Pradana	139
---	-----

Chapter 5: Biodiesel Synthesis

Reusability of the Deep Eutectic Solvent - Novozym 435[®] Enzymes System in Transesterification from Degumming Palm Oil R. Manurung and A.G.A. Siregar	147
Evaluation of Catalysts Mordenite and MoO₃/Mordenite in the Production of Biodiesel F.M. do Nascimento Silva, E.G. Lima, T.L. de Almeida Barbosa and M.G.F. Rodrigues	156
Characterization and Application of Catalysts Hard Green Clay and MoO₃/ Hard Green Clay in Transesterification Reaction of Soybean Oil F.M. do Nascimento Silva, E.G. Lima, T.L. de Almeida Barbosa and M.G.F. Rodrigues	162
Chrom/Nanocomposite ZrO₂- Pillared Bentonite Catalyst for Castor Oil (<i>Ricinus communis</i>) Hydrocracking K. Wijaya, A. Syoufian, A. Fitroturokhmah, W. Trisunaryanti, D. Adi Saputra and Hasanudin	168
Optimization of Biodiesel Production from Used Cooking Oil: Aspen HYSYS Simulation and Experimental Validation A. Giwa and K.S. Umanah	175
Gas Chromatography and Fourier Transform Infrared Analysis of Biodiesel from Used and Unused Palm Olein Oil I.A. Daniyan, E.I. Bello, T.I. Ogedengbe and P.B. Mogaji	186
Kinetic Study of Catalytic Hydrocracking Ceiba Pentandra Oil to Liquid Fuels over Nickel-Molybdenum/HZSM-5 Y.W. Mirzayanti, D.H. Prajitno, A. Roesyadi and E. Febriyanti	204
Lipase Acrylic Resin Catalyzed Interesterification of Sewage Sludge in Micro Packed Bed Reactor: Box-Behnken Design A. Jazie, R.I. Jaddan, M.F. Al-Dawody and S.A. Abed	213
Rapeseed Oil Interesterification Reaction with Metylacetate in the Presence of BuOK/BuOH at Different Temperatures V. Kampars, R. Gravins and K. Lazdovica	229
Analysis of Products Obtained in Chemical Interesterification of Rapeseed Oil with Methyl Formate L. Laipniece, Z. Abelniece and V. Kampars	234
<i>Turritella terebra</i> Shell Synthesized Calcium Oxide Catalyst for Biodiesel Production from Chicken Fat M.N. Mohiddin, A.S. Ahmed, A.N.R. Reddy and S. Hamdan	239
Enhanced Biodiesel and Ethyl Levulinate Production from Rice Bran through Non Catalytic <i>In Situ</i> Transesterification under Subcritical Water Ethanol Mixture S. Zullaikah, S. Utami, R.P. Herminanto and M. Rachimoellah	248
Biodiesel Synthesis from Used Cooking Oil Using Red Mud as Heterogeneous Catalyst A. Hidayat, G.K. Roziq, F. Muhammad, W. Kurniawan and H. Hinode	254

Biofuel Production from Jatropha Bio-Oil Derived Fast Pyrolysis: Effect of Catalysts Supported	
T. Rodseanglung, T. Ratana, M. Phongaksorn and S. Tungkamani	260
The Use of Super Base CaO from Eggshells as a Catalyst in the Process of Biodiesel Production	
Y. Pasae, L. Bulo, K. Tikupadang and T.T. Seno	265
The Production of Biodiesel from Waste Cooking Oil (Simultaneous Esterification and Transesterification Using Fe/Zelite Catalysts from Waste Geothermal)	
N.L. Muna, A.A. Mu'alimah, D.B. Pridiana, A.K. Widodo, S.R. Adiyar and E.H. Elinda	270
Synthesis of CaO@CoFe₂O₄ Nanoparticles and its Application as a Catalyst for Biodiesel Production from Used Cooking Oil	
T.R. Primadi, F. Fajaroh, A. Santoso, Nazriati and E. Ciptawati	277
Synthesis of Methyl Ester from Rice Bran Oil through the Esterification Reaction	
A. Santoso, Abdurrohman, A.R. Wijaya, D. Sukarianingsih, Sumari and D.E. Putri	287
Study of the Feasibility of Biodiesel Production, from Vegetable Oils and Catalysts of Seafood Residues, in a Batch Hydrogenation Reaction Unit, Assisted by Microwave and Conventional Heating	
S.G. de Araújo, L. Landini, V.L.R. Salvador, M.A. Scapin, B.F. Massanares and A.B. Urbaninho	295
Utilization of Modified Coal Fly Ash (CFA) as a Catalyst for Production of Biodiesel from Coconut Oil: Part 1 - Characteristics of the Catalyst	
A. Hidayat, A. Chafidz and B. Sutrisno	301
CaO/Natural Dolomite as a Heterogeneous Catalyst for Biodiesel Production	
B. Sutrisno, A.D. Nafiah, I.S. Fauziah, W. Kurniawan, H. Hinode and A. Hidayat	307
The Synthesis of Polyethersulfone (PES) Derivatives for the Immobilization of Lipase Enzyme	
N. Rahmahwati, D. Wahyuningrum and A. Alni	313
Utilization of Silica from Indonesian Solid Wastes as Catalyst Materials	
F. Kurniawansyah, A.D. Istiqomah, A.J. Malahayati, H.T.B.M. Petrus and A. Roesyadi	321
Transesterification of Kapok Seed Oil (<i>Ceiba pentandra</i>) Using Heterogeneous Catalyst Bimetallic Oxide of Zinc and Copper Supported by γ-Alumina	
N.P. Asri, W.D. Prasetyo, A. Kafidhu, A. Atiqoh, E.A. Puspitasari, H. Hindarso and S. Suprpto	327
Transesterification Catalytic Performance of Mechanically Alloyed Eggshell Ash, Magnesium and Aluminum Oxides for Sustainable Biodiesel Production	
O.S. Okwundu, A.H. El-Shazly, M.F. El-Kady and M.A. Shouman	335
Study of the Use of Mamasa Natural Zeolite which is Activated by Acid as a Catalyst for Cracking Palm Oil Methyl Esters	
S.S. Rosalia, L.H. Wilhelmus, Denny, H.S. Nunuk and T. Paulina	340
Preparation of Monometallic Catalysts on Carbon Support for Synthesis of Biodiesel Fuel	
T. Longprang, P. Udomsap, N. Chollacoop, M. Fuji and A. Eiad-Ua	346
Impact of Pulsed Electric Field on Glycerin Sedimentation from Biodiesel Production Process	
T. Hinthao, T. Wongwuttanasatian and A. Sukstri	352

Chapter 6: Bioethanol Synthesis

Effect of Simultaneous Saccharification and Fermentation (SSF) Time on Ethanol Production from Spent Medium of Oyster Mushroom (<i>Pleurotus ostreatus</i>)	
D. Irawati, N.N. Pradipta and M.A. Umar	359
A Novel Immobilization Method of <i>Saccharomyces cerevisiae</i> on Fermentation of Nipa Palm Sap for Fuel Grade Bioethanol Production	
Chairul, Evelyn, S. Bahri and E. Awaltanova	367
Alternative Energy from Fresh Water Weed, <i>Hydrilla verticillata</i>	
S. Sawekwiharee and N. Albutt	372
Production of Bio-Ethanol via Hydrolysis and Fermentation Using Cassava Peel and Used Newspaper as Raw Materials	
T. Mutiara, S. Widiawati, S. Rachmatyah and A. Chafidz	377
The Effect of Mixed Culture of <i>Zymomonas mobilis</i> and <i>Pichia stipitis</i> in Ethanol Production of Sugar Palm (<i>Arenga pinnata</i>)	
A.S. Dewi, R.A. Stevanus, M.A. Sandra, D.F. Nury, L. Pudjiastuti and T. Widjaja	383

Chapter 7: Biogas Synthesis

Enhancement of Biogas Production in Anaerobic Digestion from Sludge of Dairy Waste with Fixed Bed Reactor by Using Natural Zeolite H. Pampang, C.W. Purnomo and R.B. Cahyono	391
Bioconversion of Dried Leaves from Algerian Date Palm (<i>Phoenix dactylifera</i> L.) to Biogas by Anaerobic Digestion M. Djaafri, S. Kalloum, A.E. Soulimani and M. Khelafi	398
Hydrogen Sulfide Separation from Biogas Using Laterite Soil Adsorbent S. Adisasmito, C.B. Rasrendra, M.Q. Alfadhli and M.F. Al Ghifary	412
Hydrogen Sulfide Removal by Iron Oxide-Based Clay from Biogas for Community Use C. Mingchai, S. Sakunphun, S. Palas and S. Samposree	419
Evaluation of Biogas Production from Bio-Digestion of Organic Wastes O.J. Odejobi, O.A. Olawuni, S.O. Dahunsi and A.A. John	426
Performance of Activated Carbon Made from <i>Gigantochloa verticillata</i> Bamboo for Biogas Purification I.P.H. Wangsa, T.G.T. Nindhia, D.N.K.P. Negara and I.W. Surata	437

Chapter 8: By-Product Processing Technologies

Triacetin Synthesis as Bio-Additive from Glycerol Using Homogeneous and Heterogeneous Catalysts Z. Mufrodi, E. Astuti, M. Syamsiro, Sutiman and S. Purwono	445
Synthesis of Zeolite Catalyst from Geothermal Solid Waste for Crude Glycerol Dehydration to Acrolein Widayat, J. Philia, T. Farsha and F. Rifaldi	451
Triacetin Production by Selective Esterification of Glycerol over Activated Zeolite and Lewatite as Catalyst L. Setyaningsih, I.A. Ali, A. Chafidz, S. Septiyan and P.A. Eka	458
Esterification of Glycerol with Acetic Acid in Bioadditive Triacetin with Fe₂O₃/Activated Carbon Catalyst Z. Mufrodi and S. Amelia	464

Chapter 9: Analysis of the Exploitative Efficiency of Biofuel

Feasibility of Studying Fuel Mixer Design for High Power Engines Using Completely Biogas T.P. Tran, Q.M. Nguyen and Q.C. Tran	471
A Study on Bio-Diesel and Jet Fuel Blending for the Production of Renewable Aviation Fuel R.M. El-Maghraby	484
Study of Performance, Combustion and Emission Characteristics of DI Diesel Engine Fuelled with Neem Biodiesel with Carbon Nano Tube as Additive D.K. Ramesha, H.N. Vidyasagar, G. Trilok, A. Lakshmi Prasad and V. Vinay Kumar Reddy	498
Effect of Titanium Dioxide (TiO₂) Nano-Fluid on Performance and Emission Features of a Diesel Engine Operated on Aphanizomenon Flos Biodiesel-Diesel Blend G. Jayabalaji and P. Shanmugasundaram	505
Combustion Characteristics of Single Cylinder Diesel Engine Fueled with Blends of Thumba Biodiesel as an Alternative Fuel M. Singh, M.Y. Sheikh, D. Singh and P.N. Rao	511
The Explosion Severity of Biogas(CH₄-CO₂)/Air Mixtures in a Closed Vessel N.A.M.H. Khan, S.Z. Sulaiman, I. Izhah, S.K.A. Mudalip, R. Che Man, S. Md Shaarani, Z.I. Mohd Arshad, R.M. Kasmani and S. Sulaiman	521
Experimental Studies of Biogas in a Single Cylinder Diesel Engine by Dual Fuel Mode of Operation C. Jagadish and G. Veershetty	528
Performance of a Diesel Engine Fuelled with Nanoparticle Blended Biodiesel S. Kanth, S. Debbarma and B. Das	534

Experimental Study of Ignition and Combustion Characteristics of Mixed Rice Straw and Sewage Sludge Solid and Hollow Spherical Pellets in a Plasma Combustion System M.E. Mostafa, H. Tang, J. Xu, H.Y. Chi, K. Xu, S. Su, S. Hu, Y. Wang, S.A. El-Sayed and J. Xiang	540
Performance Analysis of Pongamia Biodiesel as an Alternative Fuel for CI Engine A. Anand, B.S. Nithyananda and G.V. Naveen Prakash	549
The Effect of Biodiesel Composition on Characteristics of Blended Summer Diesel Fuel V. Kampars, R. Kampare and A. Naumova	554

Chapter 10: Compatibility of Biofuel and Exploitative Equipment

Study of Corrosion of AA 3003 Aluminum in Biodiesel, Diesel, Ethanol and Gasoline Media M. Soares, L.O. Berbel, C. Vieira, D.C.S. Oliszeski, C.B. Furstenberger and E.d.P. Banczek	561
Study on the Effect of Si-Al Components in Pulverized Coal Ash on Corrosion in Heating Surface of Biomass Boiler Y.G. Li, Y.Z. Wang, W.B. Zhu and Y. Sun	566
Effect of Additives on Ash Corrosion on Heat Exchanging Surface of Biomass Boilers Y. Sun, Y.Z. Wang, K. Zhang and Y.G. Li	572
Dynamic Matrix Control of a Reactive Distillation Process for Biodiesel Production A. Giwa, J.O. Owolabi and S.O. Giwa	579
Continuous Methyl Ester Production Process from Refined Palm Oil Using 3D-Printed Static Mixers K. Pongraktham and K. Somnuk	595
Compatibility of Palm Biodiesel Blends on the Existing Elastomer Fuel Hose in Diesel Engine with Approach of Dynamic Test Rig: A Concept Study N. Sa'at, A. Samsuri, N.A. Latif, N.F. Nasir, R.H. Madon and S.A. Osman	601

Chapter 11: Engineering Management of Biofuel Production

A Lifecycle Sustainability Assessment of CO₂ Emissions, Energy Consumption and Social Aspects of Methylic and Ethylic Biodiesel Using Principal Component Analysis S.F. Interlenghi, J.L. de Medeiros and O.d.Q.F. Araújo	609
Water and Power Consumption, Ethanol Production and CO₂ Emissions: High-Scale Sugarcane-Based Biorefinery Toward Neutrality in Carbon R.d.F. Dias, H.B. Carminati, O.d.Q.F. Araújo and J.L. de Medeiros	621
Hybrid Approach for Optimizing Process Parameters in Biodiesel Production from Palm Oil P. Luangpaiboon and P. Aungkulanon	630
Prospects for the Development of Green Gasoline and Green Diesel from Crude Palm Oil in Indonesia A. Sugiyono, I. Fitriana, A.H. Budiman and A. Nurrohim	638