



"Frontiers in Bioenergy and Biofuels",

book edited by Eduardo Jacob-Lopes and Leila Queiroz Zepka, INTECH,

ISBN 978-953-51-2892-2, Print ISBN 978-953-51-2891-5, Published: January 25, 2017
under CC BY 3.0 license. © The Author(s).

- Chapter 1 **Introductory Chapter: Life Cycle Assessment as a Fundamental Tool to Define the Biofuel Performance** by Mariany Costa Deprá, Leila Queiroz Zepka and Eduardo Jacob- Lopes
- Chapter 2 **Cell Wall Proteomics as a Means to Identify Target Genes to Improve Second-Generation Biofuel Production** by Maria J. Calderan-Rodrigues, Juliana G. Fonseca, Carlos A. Labate and Elisabeth Jamet
- Chapter 3 **Advances in the Application of Spectroscopic Techniques in the Biofuel Area over the Last Few Decades** by João Cajaiba Da Silva, Alex Queiroz, Alline Oliveira and Vinícius Kartnaller
- Chapter 4 **Liquid Scintillation Spectrometry as a Tool of Biofuel Quantification** by Romana Krištof and Jasmina Kožar Logar
- Chapter 5 **Chromatographic Methods Applied to the Characterization of Bio-Oil from the Pyrolysis of Agro-Industrial Biomasses** by Maria Silvana A. Moraes, Débora Tomasini, Juliana M. da Silva, Maria Elisabete Machado, Laíza C. Krause, Claudia A. Zini, Rosângela A. Jacques and Elina B. Caramão
- Chapter 6 **Perceptions on Internal and External Factors Impacting the U.S. Nonfood Advanced Biofuel Industry** by Henry Jose Quesada-Pineda, Jeremy Withers and Robert Smith
- Chapter 7 **The Biofuel Crops in Global Warming Challenge: Carbon Capture by Corn, Sweet Sorghum and Switchgrass Biomass Grown for Biofuel Production in the USA** by Roland Ahouéléyé Yaovi Holou and Valentin Missiakô Kindomihou
- Chapter 8 **Theoretical Considerations for Economics of Second- and Third-Generation Biofuels** by Fouzia Tabssum and Javed Iqbal Qazi
- Chapter 9 **Emerging Green Technologies for Biodiesel Production** by Hanifa Taher and Sulaiman Al-Zuhair
- Chapter 10 **Biogas, Biodiesel and Bioethanol as Multifunctional Renewable Fuels and Raw Materials** by Venko Beschkov
- Chapter 11 **Potential of Cellulosic Ethanol to Overcome Energy Crisis in Pakistan** by Saima Mirza, Habib ur Rehman, Waqar Mahmood and Javed Iqbal Qazi
- Chapter 12 **Jatropha Biofuel Industry: The Challenges** by M. Moniruzzaman, Zahira Yaakob, M. Shahinuzzaman, Rahima Khatun and A.K.M. Aminul Islam

- Chapter 13 **Review of Continuous Fermentative Hydrogen-Producing Bioreactors from Complex Wastewater** by Paula Rúbia Ferreira Rosa and Edson Luiz Silva
- Chapter 14 **Bifunctional Heterogeneous Catalysts for Biodiesel Production using Low Cost Feedstocks: A Future Perspective** by Anita Ramli, Muhammad Farooq, Abdul Naeem, Saleem Khan, Muhammad Hummayun, Azhar Iqbal, Sohail Ahmed and Liaqat Ali Shah
- Chapter 15 **Role of Mass-Transfer Interfacial Area in the Biodiesel Production Performance of Acid-Catalyzed Esterification** by Devjyoti Nath, Adisorn Aroonwilas and Amornvadee Veawab
- Chapter 16 **Biodiesel Compatibility with Elastomers and Steel** by Salete Martins Alves, Valdicleide Silva e Mello and Franklin Kaic Dutra-Pereira
- Chapter 17 **Biofuel Additives: Conversion of Glycerol with Benzyl Alcohol over SBA-15 with Sulfonic Acid Groups** by Pedro Canhão and Jose E. Castanheiro
- Chapter 18 **Thermodynamic Properties of Propanol and Butanol as Oxygenate Additives to Biofuels** by Eduardo A. Montero, Fernando Aguilar, Natalia Muñoz-Rujas and Fatima E. M. Alaoui
- Chapter 19 **Photocatalytic Reforming of Lignocelluloses, Glycerol, and Chlorella to Hydrogen** by Masahide Yasuda
- Chapter 20 **Renewable Hydrocarbons from Triglyceride's Thermal Cracking** by Vinicyus R. Wiggers, Ramon F. Beims, Laércio Ender, Edésio L. Simionatto and Henry F. Meier
- Chapter 21 **Biogasification of Horse Dung Using a Cylindrical Surface Batch Biodigester** by Patrick Mukumba, Golden Makaka and Sampson Mamphweli
- Chapter 22 **Refractory Materials for Biofuel Boilers** by Valentin Antonovič, Jacek Szczerba, Jadvyga Keriene, Rimvydas Stonys and Renata Boris
- Chapter 23 **Power Form Agripellets** by Claudia Santibáñez Varnero and Marcela Vargas Urrutia
- Chapter 24 **SWOT Analysis Applied to Wheat Straw Utilization as a Biofuel in Mexico** by Gisela Montero, Conrado García, Marcos A. Coronado, Lydia Toscano, Margarita Stoytcheva, Ricardo Torres, Ana M. Vázquez and Daniela G. Montes

- Chapter 25 **Use of Corn Dried Distillers Grains (DDGS) in Feeding of Ruminants** by Ewa Pecka-Kiełb, Andrzej Zachwieja, Dorota Miśta, Wojciech Zawadzki and Anna Zielak-Steciwko

Biofuel Additives: Conversion of Glycerol with Benzyl Alcohol over SBA-15 with Sulfonic Acid Groups

Pedro Canhão and Jose E. Castanheiro*

[Show details](#)

^[1] Evora Chemistry Centre, Chemistry Department, Evora University, Évora, Portugal

*Corresponding author(s) email: jefc@uevora.pt

DOI: 10.5772/65800

Abstract

The etherification of glycerol with benzyl alcohol was carried out over mesostructured silica, SBA-15, with sulfonic acid groups. The products of glycerol etherification are ethers (glycerol mono-ether, glycerol di-ether and tri-glycerol ether). It was prepared with different catalysts, consisting of SBA-15 with different amounts of sulfonic groups (SBA-15, [SO₃H]1-SBA-15, [SO₃H]2-SBA-15, and [SO₃H]3-SBA-15). It was observed that the activity increased with the amount of sulfonic acid groups on SBA-15 until a maximum ([SO₃H]2-SBA-15). However, with high amount of acid groups, a decrease in catalytic activity was observed. The effect of different parameters, such as catalysts loading, temperature, and initial concentration of glycerol, was studied in order to optimize the reaction conditions. Catalyst [SO₃H]2-SBA-15 showed good activity after four uses.

Keywords: biodiesel, glycerol, benzyl alcohol, SBA-15-SO₃H, etherification