

# **Forest and Plant Bioproducts Division 2018**

Core Programming Area at the 2018 AIChE Annual Meeting

Pittsburgh, Pennsylvania, USA  
28 October - 2 November 2018

ISBN: 978-1-5108-7618-7

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2018) by AIChE  
All rights reserved.

Printed by Curran Associates, Inc. (2019)

For permission requests, please contact AIChE  
at the address below.

AIChE  
120 Wall Street, FL 23  
New York, NY 10005-4020

Phone: (800) 242-4363  
Fax: (203) 775-5177

[www.aiche.org](http://www.aiche.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>(20a) Ultrapure Lignin Via the ALPHA Process for Materials Applications: From Carbon Fibers to Coatings</b> .....	1
<i>Mark C. Thies, Junhuan Ding, Jing Jin, Amod Ogale</i>	
<b>(20b) Mixture-Process Variable Experimental Design to Optimize Sugar Mixture (glucose, xylose and arabinose) Conversion to Polyhydroxybutyrate By Burkholderia Saccharia</b> .....	2
<i>Mengxing Li, Mark R. Wilkins, Kent Eskridge</i>	
<b>(20c) Integrating Sustainable Biocarbon in Lightweight and Durable Biocomposite Solutions for Automotive Applications</b> .....	3
<i>Amar K. Mohanty, Andrew Anstey, Amandine Codou, Manju Misra</i>	
<b>(20d) Nano-Engineered Cement Combining Biomass Ash with Nanoparticles</b> .....	4
<i>Joan G. Lynam, Narendra Kumar, Kunal Kupwade-Patil, Rayna Higuchi, David P. Ferrell, Vanya A. Luttrull, Oral Buyukozturk</i>	
<b>(20e) A Study on the Gelation Kinetics and Chain Relaxation of Polybutylene Succinate (PBS) By Reactive Extrusion</b> .....	5
<i>Feng Wu, Manju Misra, Amar K. Mohanty</i>	
<b>(20f) Chicken Feather Biocarbon Based Novel Biodegradable Composites</b> .....	6
<i>Zonglin Li, Christoff Reimer, Amar K. Mohanty, Manju Misra</i>	
<b>(70a) Reducing Energy Consumption in Thermomechanical Pulp Production Using Chlorine Dioxide</b> .....	7
<i>Jayg Dimayacyac, Rodger Beatson, Zhaoyang Yuan</i>	
<b>(548h) Understandings of Thermal Transformation of Cellulose Surface and Crystalline Core By in-Situ Nonlinear Vibrational Spectroscopy</b> .....	21
<i>Zhangyang Xu, Libing Zhang, Hongfei Wang, Zheming Zhang, Bin Yang</i>	
<b>(191s) Fabrication and Characterization of Novel Cellulose Acetate Hollow Fiber Nanoporous Membranes Prepared Via Thermally Induced Phase Separation</b> .....	22
<i>Bo Pang, Xiaolin Wang, Junyi Mao</i>	
<b>(70e) Hairy Cellulose Nanocrystals-Colloidal Starch Nanocomposite Coatings with Nanoengineered Viscosity Improve the Mechanical Properties of Papers: One Stone, Two Birds</b> .....	23
<i>Amir Sheikhi, Theo G. M. Van De Ven</i>	
<b>(120b) 2018 Outlook for Energy: A View to 2040</b> .....	24
<i>Theodore J. Wojnar Jr.</i>	
<b>(120c) Energy Decarbonisation Scenarios</b> .....	25
<i>Kamel Ben Naceur</i>	
<b>(120a) Fundamental Research Needs to Advance Energy Technologies</b> .....	26
<i>Bruce Garrett</i>	
<b>(137a) Towards Economical and Sustainable Production of Wood Based Nanomaterials</b> .....	27
<i>J. Y. Zhu</i>	
<b>(137b) High Shear Capillary Rheometry of Cellulose Nanomaterials for Industrial Relevant Processing</b> .....	28
<i>Bradley Sutliff, Jeffrey Youngblood, Michael J. Bortner</i>	
<b>(137c) Towards Standardization of Laboratory Preparation Procedure for Uniform Cellulose Nanopapers</b> .....	29
<i>Mahesh Parit, Burak Aksoy, Zhihua Jiang</i>	
<b>(137d) Emerging Cellulose Nanocrystals for Threshold Scale Inhibition: A Step Forward in Universal Biomass-Based Crystal Engineering</b> .....	30
<i>Amir Sheikhi, Ashok Kakkar, Theo G. M. Van De Ven</i>	
<b>(144a) Solid-State Depolymerization and Isolation of Lignin from Lignocellulosic Biomass</b> .....	31
<i>Ning Li, Yanding Li, Chang Geun Yoo, Xiaohui Yang, Xuliang Lin, John Ralph, Xuejun Pan</i>	
<b>(144b) Catalytic Depolymerization and Liquefaction of Lignin in Ionic Liquid By SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub> in a Flow through System</b> .....	32
<i>Xiuhui Wang, Eika W Qian</i>	
<b>(144c) The Impact of Acid Site Concentration and Pore Diameter on the Cracking of Lignin Derived Monomers in Zeolites</b> .....	33
<i>Michael Stellato, Carsten Sievers, Andreas S. Bommarius</i>	
<b>(144d) High Energy Density Fuels Produced from Lignin-Derived Intermediates and Refinery Waste Gas Streams</b> .....	34
<i>Maoqi Feng, Bin Yang</i>	

<b>(144e) Towards Valorization of Biorefinery Waste to Polyhydroxyalkanoate: Structural Characterization and Mechanisms</b> .....	35
<i>Naijia Hao, Somnath Shinde, Zhihua Liu, Joshua Yuan, Arthur J. Ragauskas</i>	
<b>(144f) Characterization of Deep Eutectic Solvent Extracted Lignin Streams from Endocarp Biomass</b> .....	36
<i>Wenqi Li, Kirtley Amos, Mi Li, Yunqiao Pu, Arthur J. Ragauskas, Seth Debolt, Yang-Tse Cheng, Jian Shi</i>	
<b>(144h) Reactivity-Based Fractionation of Lignins Via Reversible Conjunction to Polymeric Amines</b> .....	37
<i>Zhenglun Li</i>	
<b>(144i) Understanding and Modeling Effects of Nitrogen Source on Biosynthesis of Polyhydroxyalkanoates from Benzoate By Pseudomonas Putida KT2440</b> .....	38
<i>Zhangyang Xu, Bin Yang</i>	
<b>(199a) Synthesis and Potential Antiproliferative Activity of Dehydroabietylamine Imidazole Derivatives</b> .....	39
<i>Fengyi Zhao, Li Xu, Wen Lu, Dong Jiang, Xu Sun, Shilong Yang, Feng Lin, Mengyi Zhou, Fuliang Cao</i>	
<b>(199b) Protein Content and Amino Acids Profile in Ten Cultivars of Ginkgo (Ginkgo bilona L.) Nut from China</b> .....	40
<i>Mengyi Zhou, Li Xu</i>	
<b>(199c) Hydrothermal Treatment of Paper Mill Sludge: Nutrient Characterization</b> .....	41
<i>Nepu Saha, M. Toufiq Reza</i>	
<b>(199d) Inhibitory Effect of Biomass Hydrolysates on Glucose Transport in Microbial Fermentation</b> .....	42
<i>Xin Tan, Maobing Tu</i>	
<b>(199e) Effects of P-Hydroxybenzoic Acid and 2-Naphthol on Dilute Acid Pretreatment of Aspen</b> .....	43
<i>Yequan Sheng, Maobing Tu</i>	
<b>(199f) Investigating the Sorption Capacity of Hydrochar for Organic Pollutants and Comparing with That of Powdered Activated Carbon (PAC) As a Method of Treating Contaminated Water</b> .....	44
<i>Huy Nguyen, Jeremy Taylor, Justinus A. Satrio</i>	
<b>(199g) Synthesis of Hardwood Lignin Model Polymer and Its Effect on Enzymatic Hydrolysis of Cellulose</b> .....	45
<i>Conghui Yue, Maobing Tu, Hairong Guan</i>	
<b>(199h) Extraction and Recovery of Sinapic Acid from Oleaginous Biomass (Mustard Bran): A Sustainable Access to a Valuable Phenolic Platform Chemical</b> .....	46
<i>Ezjinne Achinivu, Erika Clavijo Rivera, Amandine Flourat, Florent Allais</i>	
<b>(199i) Process Design for Conversion of Coconut Coir Pith to Bioplastic and Byproducts</b> .....	47
<i>Erin Haug, Felipe Reyes Gaibor, Alex Papadakis, Patricia Popescu, Huajiang Huang, Rengasamy Kasinathan, Bandaru V. Ramarao, Shri Ramaswamy</i>	
<b>(199k) Selecting Solvents for Lignin Value Prior to Pulping</b> .....	48
<i>Thomas T. Kwok, Christopher O. Luetgen, Matthew Realf, Andreas S. Bommarius</i>	
<b>(199l) A Study on Extent of Chain Crosslink on HDT Improvement of Poly (lactic acid)</b> .....	49
<i>Feng Wu, Amar K. Mohanty, Manju Misra</i>	
<b>(70c) Effect of Lignin on Nanofibrillated Cellulose Production</b> .....	50
<i>Qiang Yang</i>	
<b>(266a) Cellulose Nanocrystal: Synthesis, Characterization, Dispersion in Organic Media and Surface Modification</b> .....	51
<i>Mohammad J. Hasan, Ashley Johnson, Esteban E. Urena-Benavides</i>	
<b>(266b) Liquid-Liquid Lignin-Solvent Systems: Phase Behavior, Characterization and Applications</b> .....	52
<i>Junhuan Ding, Spencer Temples, Sallye Gathmann, Mark C. Thies</i>	
<b>(266c) Preparation of pH-Responsive Latex Films from Glycerol Based Dendritic Precursors for Food Packaging</b> .....	53
<i>Karyn Moses, Hanxi Bao, William Pelletier, Melanie Correll, Zhaohui Tong</i>	
<b>(266d) Hydrothermal Carbonization of Biomass: Examination of Post Synthesis Treatment and Characterization Techniques</b> .....	54
<i>Avery Brown, Michael T. Timko, Geoffrey Tompsett</i>	
<b>(266e) Development of Bioplasticizers from Soybean Oil</b> .....	55
<i>Lucas Stolp, Dharm Kodali</i>	
<b>(311a) The Impact of Shale Gas and Oil on the Chemical Industry</b> .....	56
<i>Jeffrey J. Sirola</i>	
<b>(311b) Sustainable Energy and Chemicals: Past, Present, and Future</b> .....	57
<i>Joseph B. Powell</i>	
<b>(311c) Disruptions: What the Future May Hold</b> .....	58
<i>Scott F. Mitchell</i>	
<b>(311d) Geopolitical Factors Influencing the Evolution of the Chemical Industry</b> .....	59
<i>David West</i>	

<b>(311e) Agility &amp; Resilience: How to Maintain Career Competitiveness in the Changing Chemical Industry</b> .....	60
<i>Antonis Papadourakis</i>	
<b>(347a) Experimental and Computational Studies of Interfacial Interactions of Lignin Dimers with Lipid Bilayers</b> .....	61
<i>Mahsa Moradipour, Xinjie Tong, Poorya Kamali, Shadrack O. Asare, Bert C. Lynn, Dorel Moldovan, Stephen E. Rankin, Barbara L. Knutson</i>	
<b>(347f) Understanding Barrier Properties of Plastics for Packaging Applications: A Comprehensive Approach to Polymer Performance</b> .....	62
<i>Arturo Rodriguez-Uribe, Manju Misra, Amar K. Mohanty</i>	
<b>(347g) Itaconated Epoxidized Corn Oil: a Fully Biobased and Non-Volatile Alternative of Acrylated Epoxidized Soybean Oil</b> .....	63
<i>Suman Thakur, Jean-Mathieu Pin, Manju Misra, Amar K. Mohanty</i>	
<b>(347d) 3D Printing of Modified PA11 and Biocomposites: Processing and Performance Evaluation</b> .....	64
<i>Manju Misra, Andrew Anstey, Claire Benwood, Amar K. Mohanty</i>	
<b>(347e) Biodiesel As a Green Solvent to Improve the Dilute Acid Pretreatment of Lignocellulosic Biomass</b> .....	65
<i>M. Ajaz Ahmad, Ayyaz Ahmad, Mahboob Ahmed Aadil, Teran Hilares Ruly</i>	
<b>(347b) Exploring Antimicrobial Properties of Lignin Derived Compounds and Materials</b> .....	66
<i>Ryan Kalinoski</i>	
<b>(384a) 25 by 25: Chemical Engineering in the Next 25 Years</b> .....	67
<i>Clare McCabe, Phillip R. Westmoreland</i>	
<b>(384b) The Future of Chemical Engineering Itself</b> .....	68
<i>Phillip R. Westmoreland</i>	
<b>(384e) Accelerating Innovation through Academic-Industrial Partnerships</b> .....	69
<i>William Liechty, Shawn D. Feist</i>	
<b>(384c) Maximizing Uptime, Efficiency, and Safety of Industrial Operations through Early Risk Detection</b> .....	70
<i>Ankur Pariyani</i>	
<b>(384d) Gaussian Processes for Hybridizing Analytical &amp; Data-Driven Decision-Making</b> .....	71
<i>Simon Olofsson, Johannes Wiebe, Marc Peter Deisenroth, Ruth Misener</i>	
<b>(411a) Furan Production from Biomass Hydrolysates: Scale-up of a Novel, High-Yield "Sire" Process</b> .....	74
<i>Ravikumar Gogar, Sridhar Viamajala, Patricia Relue, Sasidhar Varanasi</i>	
<b>(411b) A Novel and Green Approach in Engineering Transparent and Homogenous Cellulose Nanocrystal-Lignin UV Protection Films</b> .....	75
<i>Mahesh Parit, Partha Saha, Virginia Davis, Zhihua Jiang</i>	
<b>(411c) Effect of Activation Temperature on Oxygen Functional Groups and Corresponding Electron Exchange Capacities on Hydrochar</b> .....	76
<i>M. Toufiq Reza, Nepu Saha, Akbar Saba</i>	
<b>(411d) Sustainable Food Industry Wastes for Biocomposite Applications</b> .....	77
<i>Alison C. Gowman, Maisyn C. Picard, Arturo Rodriguez-Uribe, Manju Misra, Hamdy Khalil, Amar K. Mohanty</i>	
<b>(411g) Sustainable Biomass Derived Fluorescent Carbon Dots for the Selective Detection of Fe<sup>3+</sup> Ions</b> .....	78
<i>Maisyn C. Picard, Suman Thakur, Manju Misra, Amar K. Mohanty</i>	
<b>(411f) Oxidative Pretreatment Process of Sugarcane Bagasse Assisted By Hydrodynamic Cavitation</b> .....	79
<i>Terājn Hilares Ruly, M. Ajaz Ahmad, Ayyaz Ahmad</i>	
<b>(655a) Catalytic Etherification of Glycerol to Glycerol Oligomers in the Presence of Alumina Supported Ca/Sr Mixed Oxides</b> .....	80
<i>Yi-Chen Shih, Bing-Hung Chen</i>	
<b>(655b) The Role of Copper Stability in Selectively Condensation of Ethanol to Higher Alcohols</b> .....	81
<i>Mond Guo, Karthikeyan K. Ramasamy</i>	
<b>(655c) Effects of Alloying Pd and Cu on Tandem Dehydrogenation-Aldol Condensation Reactions</b> .....	82
<i>Konstantinos A. Goulas, Yuying Song, Lars C. Grabow, Dean Toste</i>	
<b>(655d) Lubricant Base Oils Production from Biomass</b> .....	83
<i>Sibao Liu, Basudeb Saha, Dionisios G. Vlachos</i>	
<b>(655e) Selectivity Control during the One-Pot Conversion of Aliphatic Carboxylic Acids to Linear Olefins through Tandem Hydrogenation/Dehydration</b> .....	84
<i>Jher Hau Yeap, Bartosz Rozmyslowicz, Jeremy S. Luterbacher</i>	
<b>(655f) Mechanism and Kinetics of Isobutene Production over Zirconia-Supported Zinc Oxides</b> .....	85
<i>Julie Rorrer, Alexis T. Bell, Dean Toste</i>	
<b>(655g) Catalytic Upgrading of Sugar-Derived Polyols to Glycols in Absence of Externally Added Hydrogen</b> .....	86
<i>Bin Yin, Xin Jin, Guangyu Zhang, Hao Yan, Chaohe Yang</i>	

<b>(655h) Selective C-C Bond Scission of Primary Alcohols Using Cerium Oxide-Supported Palladium Catalyst</b> .....	87
<i>Tomoo Mizugaki, Kodai Nitta, Takato Mitsudome, Koichiro Jitsukawa</i>	
<b>(695a) Gas Phase Catalytic Oxidation of Lignin to Produce Phenolic Compounds over Vanadia Catalysts</b> .....	88
<i>Matthew M. Yung, Calvin Mukarakate, Mark Nimlos, Michael B. Griffin, Seonah Kim, Eric C. D. Tan</i>	
<b>(695b) Mechanistic Study of the Hydrogenolysis of Diaryl Ethers Catalyzed By Heterogeneous Metal Catalysts</b> .....	89
<i>Meng Wang, Oliver Gutierrez, Donald M. Camaioni, Johannes A. Lercher</i>	
<b>(695c) Palladium-Iron Bimetallic Catalyst: High Activity and Stability for Aqueous Phase Hydrogenations</b> .....	90
<i>Yan Cheng, Hien N. Pham, Robert L. Johnson, Brent H. Shanks, Abhaya K. Datye</i>	
<b>(695d) Hydrodeoxygenation of Guaiacol over Ni and Mo Nanoparticles Supported on SBA-15 and <math>\gamma</math>-<math>\text{Al}_2\text{O}_3</math></b> .....	91
<i>Thiago L. R. Hower, Rubens W. S. Lima, Reinaldo Giudici, Martin Schmal, Rita M. B. Alves</i>	
<b>(695e) Hydroprocessing of Biomass-Derived Oxygenates on Metal-Exchanged Zeolites Using Light Alkanes As the Source of Hydrogen</b> .....	94
<i>Dante Simonetti, Eric Lin</i>	
<b>(695f) Flowthrough Reductive Catalytic Fractionation of Biomass</b> .....	95
<i>Eric Anderson, Michael Stone, Rui Katahira, Michelle Reed, Gregg T. Beckham, Yuriy Roman-Leshkov</i>	
<b>(695h) Hydrodeoxygenation of Sorbitol to Monofunctional Fuel Precursors over Co/TiO<sub>2</sub></b> .....	96
<i>Nathaniel Eagan, Joseph P. Chada, Ashley Wittrig, J. Scott Buchanan, George W. Huber, James A. Dumesic</i>	
<b>(730a) Catalytic Hydrogenation of Furfural over Rumop: Probing Bimetallic and Compositional Effects on Catalyst Performance</b> .....	97
<i>Yolanda Bonita, Timothy O'Connell, Jason C. Hicks</i>	
<b>(730c) Etherification of 5-Hydroxymethylfurfural Using Zeolite Catalysts</b> .....	98
<i>Meredith Allen, Spencer Martell, Akbar Mahdavi Shakib, William M. Gramlich, Brian G. Frederick, Thomas J. Schwartz</i>	
<b>(730d) Mechanistic Insights into the Hydrogenolysis of Levoglucosan over Bifunctional Platinum Silica-Alumina Catalysts in Tetrahydrofuran Solvent</b> .....	99
<i>Siddarth H. Krishna, Rajeev Assary, Quinn A. Rashke, Zachary R. Schmidt, Larry Curtiss, James A. Dumesic, George W. Huber</i>	
<b>(730e) Hydrothermal Stability of Chloromethyl Polystyrene Based Solid Acid Catalysts and Mechanism of Cellulose Hydrolysis</b> .....	100
<i>Maksim Tyufekchiev, Jordan Finzel, Pu Duan, Klaus Schmidt-Rohr, Sergio Granados-Focil, Marion Emmert, Michael T. Timko</i>	
<b>(730f) Glycerol Transfer-Hydrogenation of Levulinic Acid Using Ru and Ir Carbene Organometallics Immobilized on Active Hydrotalcites</b> .....	101
<i>Jacob Heltzel, Kai Wang, Matthew Finn, Evan Sandefur, Adelina Voutchkova-Kostal</i>	
<b>(730g) Paired Electrocatalytic Hydrogenation and Oxidation of 5-Hydroxymethylfurfural for Efficient Production of Biorenewable Monomers</b> .....	102
<i>Xiaotong Chadderdon, David Chadderdon, Wenzhen Li</i>	
<b>(730h) A Full Furfural Utilization over Ni/SiO<sub>2</sub> Catalysts</b> .....	103
<i>Sheng-Chiang Yang, Shawn D. Lin</i>	
<b>Author Index</b>	