

Environmental Division 2014

Core Programming Area at the 2014 AIChE Annual Meeting

Atlanta, Georgia, USA
16-21 November 2014

ISBN: 978-1-5108-1258-1

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© (2014) by AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2015)

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

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

(9a) A Marco-Level Impact Assessment Tool for Emerging Technologies in Chemical Industry	1
<i>Yuan Yao, Diane J. Graziano, Mathew Riddle, Eric Masanet</i>	
(9b) Environmental Life Cycle Assessment of OEM Automotive Paint Shop Technologies	2
<i>Rebecca M. Glaspie, Jason Pierce</i>	
(9c) Evaluation of the Environmental Impacts of Ethanol Production from Eastern Red Cedar	14
<i>Ife Olukoya, Mark R. Wilkins, Karthikeyan Ramachandriya, Clint P. Aichele</i>	
(9d) Life Cycle Assessment of Underground Coal Gasification	15
<i>Sayara Saliyeva, Joseph Anthony Menicucci Jr., Paola Lettieri, Stefaan J. R. Simons</i>	
(9e) Life Cycle Analysis for Urban Waste Treatment Optimization	16
<i>Dimosthenis Sarigiannis, Evangelos Handakas, Spyros Karakitsios, Mariela Antonakopoulou, Alberto Gotti</i>	
(9f) Life Cycle Assessment of Green Transportation Fuels Produced from Algal Biomass Via Hydrothermal Liquefaction	24
<i>Sundaravadivelnathan Ponnusamy, Harvind Kumar Reddy, Tapaswy Muppaneni, Peter Lammers, Cara Meghan Downes, Shuguang Deng</i>	
(9g) A Life-Cycle Assessment of Greenhouse Gas Emissions for Transportation Fuels from North American Conventional Crudes.....	25
<i>Amit Kumar, Md. Mustafizur Rahman, Christina Canter</i>	
(11b) Specific Energy Consumption in Spiral Wound Reverse Osmosis Water Desalination.....	26
<i>Mingheng Li</i>	
(11c) Enhancement of Oil-Water Separation By Dissolved Air Flotation	38
<i>M. R. Aliff Mohamad Radzi, M. A. Abia-Biteo Belope, R. B. Thorpe</i>	
(11d) Direct Integration of RO Desalination and UF Pre-Treatment with RO Concentrate Backwash.....	48
<i>Larry Gao, Anditya Rahardianto, Han Gu, Panagiotis D. Christofides, Yoram Cohen</i>	
(11a) Removal of Organic and Nitrogenous Contaminants of Wastewater By Polyelectrolyte Multilayer Membranes.....	49
<i>Oishi Sanyal, Anna Sommerfeld, Zhiqiu Liu, Rui Chen, Wei Liao, Ilsoon Lee</i>	
(42a) Photoactivated SOA Formation: Mechanistic Insight from Modeling and Experiments	50
<i>V. Faye McNeill</i>	
(42b) Effect of Humidity and Particle Acidity SOA Derived from Reaction of Beta-Pinene with Nitrate Radical	51
<i>Christopher Boyd, Lu Xu, Javier Sanchez, Xiaoxi Liu, Wing-Yin Tuet, Greg Huey, Nga Lee Ng</i>	
(42c) Composition and Oxidative Properties of Particulate Matter Mixtures	52
<i>Wing-Yin Tuet, Vishal Verma, Julie A. Champion, Nga Lee Ng</i>	
(42d) Quantify the Impact of Biomass Burning Aerosols on Regional Climate over the Southeastern USA	53
<i>Peng Liu, Yongtao Hu, Armistead Russell, Athanasios Nenes</i>	
(42e) Evaluating the Role of Natural Variability in Assessments of Climate Change Impacts on Air Quality	54
<i>Fernando Garcia Menendez, Erwan Monier, Noelle Selin</i>	
(42f) Sector-Based Analysis of Deposited BC in the Arctic and Its Impact on Snow Albedo	55
<i>Negin Sobhani, Sarika Kulkarni, Gregory Carmichael</i>	
(42g) The Contribution of Different Surfactants within Corexit in Ejection of Oil/Dispersant Material to the Atmosphere	56
<i>Paria Avij, He Huang, Zenghui Zhang, Francisco R. Hung, Kalliat T. Valsaraj</i>	
60a) Impacts of CO, H₂ and C₃H₆ on the SCR Reactions over a Cu-Chabazite SCR Catalyst	57
<i>Yang Zheng, Benjamin A Wilhite, Dan Luss</i>	
(60b) Development of SSZ-13 Based Sulfur Resistant NH₃-SCR Catalysts.....	58
<i>Chao Wang, Erdem Sasmaz, Benjamin Galloway, Biltier Padak, Jochen Lauterbach</i>	
(60c) Understanding of the Transition Metal Ion Properties and Their Impact on Various Catalytic Functions of Zeolite-Based SCR Catalysts.....	59
<i>Ashok Kumar, Krishna Kamasudram, Neal W. Currier, Aleksey Yezerski, Hai-Ying Chen</i>	
(60d) Controlled Synthesis of Novel Interweaved Titanium Oxide Nanotubes Confined Metal Oxide Catalytic Formulations: Effect of Morphology on Selective Catalytic Reduction (SCR) of NOx By NH₃	60
<i>Thirupathi Boningari, Dimitrios Pappas, Panagiotis Smirniotis</i>	
(60e) Bimetallic Pt-Pd Catalyst Kinetics for CO and C₃H₆ Oxidation in Diesel Oxidation Catalysts (DOC).....	61
<i>Melanie Hazlett, William Epling</i>	
(60f) Characteristics of Pt-BaO/MgAl Mixed Oxides for NO_x Storage-Reduction Catalysis	63
<i>Soyeon Jeong, Seunghee Youn, Do Heui Kim</i>	
(60g) Hydrogen Purification for Fuel Cells: Preferential CO Oxidation in Excess of Hydrogen.....	64
<i>Oscar E. Amador Sr., Luis F. Cordoba Sr., Julio C. Vargas</i>	
Reverse Electrodialysis: Sustainable Energy from Hydraulic Fracturing Water Recycle	70
<i>Hailey Dunswoth</i>	
Modeling of the Aerobic Cometabolic Transformation of Chlorinated Ethenes By the Mycobacterium Elw-1.....	71
<i>Stephanie Rich</i>	
The Enzymatic Hydrolysis of Alfalfa Stalks for Use As a Biofuel Resource	72
<i>Elijah Wade</i>	

Synthesis and Characterization of Thin Film Fealcr for High Temperature Corrosion Applications.....	73
<i>Randy Fang</i>	
Crossing Borders and Communities for Healthy Water	82
<i>Joshua Gomez, Meng Zhou, Shuguang Deng</i>	
Ferroelectric BTO on Si (001) for High-Efficiency Solar Cell Heterostructures	91
<i>Emma Kaeli</i>	
Natural Gas, the Bridge Fuel	92
<i>Sravya Khasnavees</i>	
The Federal Role in Fostering an Innovative U.S. Energy Ecosystem	93
<i>Erin Alderink</i>	
A Biowall for Improving Indoor Air Quality	94
<i>Caroline Kelemen</i>	
(87a) Optimal Performance Management of Clean Water Treatment Processes	95
<i>Eva Sorensen, Folashade Akinmolayan, Nina F. Thornhill</i>	
(87b) Using Integrated Controls and Real-Time Weather Forecasting to Drive Zero Discharge.....	96
<i>Brian Petty, Melissa Fagan</i>	
(87c) Water Footprint of Rio Grande River Basin	97
<i>Jonathan Dubinsky, Arunprakash T. Karunanithi</i>	
(87d) Water Scarcity Assessment As Part of a Complete Product Life Cycle Assessment, LCA.....	98
<i>Sergio Galeano</i>	
(87f) Choose Appropriate Scenario in Order to Improve Water Quality at EL-Rahawy Drain and the Rosetta Branch, Egypt	105
<i>Mohamed Mostafa, Robert W. Peters</i>	
(87g) Dynamic Optimization Strategies for Control of Algae Growth in Eutrophic LAKES with Nonpoint Nutrient Sources	113
<i>Jimena A. Di Maggio, Vanina Estrada, María Soledad Diaz</i>	
(87h) Environmental Risk Analysis of Application of Electro-Disinfection on Ballast Water Treatment.....	114
<i>Yue Ma, Shah Thayil, J. Paul Chen</i>	
(104a) Multi-Objective Optimization for Solid Waste Management Systems.....	115
<i>José Ezequiel Santibáñez-Aguilar, Juan Martínez-Gómez, José María Ponce-Ortega, Fabricio Nápoles-Rivera, Meadardo Serna-González, Mahmoud El-Halwagi</i>	
(104b) Global Optimization for Sustainable Design and Synthesis of Algae Processing Network for CO₂ Mitigation and Biofuel Production Using Life Cycle Optimization.....	117
<i>Jian Gong, Fengqi You</i>	
(104c) Towards Integration of Life Cycle Assessment within a Multi Objective Supply Chain Optimization Modeling Framework.....	120
<i>Bahador Mousavi, Arunprakash T. Karunanithi</i>	
(104d) Optimal Design of Microgrids with Innovative CHP Systems: Integration of Process Optimisation and Life Cycle Assessment	121
<i>Di Zhang, Sara Evangelisti, Lazaros G. Papageorgiou, Paola Lettieri</i>	
(104e) Application of Sustainability Footprint and Multicriteria Optimization for the Choice of Sustainable Chemical Processes.....	122
<i>Rajib Mukherjee, Debalina Sengupta, Subhas Sikdar</i>	
(104f) Sustainable Biorefinery Supply Network Using a Concept of Eco- and Total Profit – Case Study of the European Union.....	123
<i>Lidija Cucek, Mariano Martín, Ignacio E. Grossmann, Zdravko Kravanja</i>	
(104g) Planning and Scheduling Industrial Waste Management Using Knowledge Based Lagrangean Decomposition.....	125
<i>Elisabet Capón-García, Edrisi Muñoz, José Miguel Lainez, Antonio Espuña, Konrad Hungerbühler, Luis Puigjaner</i>	
(104h) Identifying the Preferred Subset of Alternatives for Environmental Improvements Via an MILP Approach Based on the Analytic Hierarchy Process	127
<i>Gonzalo Guillén-Gosálbez, Rubén Ruiz-Femenia, José Antonio Caballero, Laureano Jiménez</i>	
(106a) Micro-Kinetics of NO_x Storage and Reduction with H₂/CO/C₃H₆ on Pt/BaO/Al₂O₃ Monolith Catalysts.....	128
<i>Arun Kota, Dan Luss, Venuri Balakotaiah</i>	
(106b) Deep SO₂ Adsorption at Parts per Billion Level By Alumina-Based Mn/Ce Mixed Oxides for SOFC Cathode Protection.....	131
<i>Peng Cheng, Bruce Tatarchuk</i>	
(106c) A First-Principles Study of the Catalytic Hydrodechlorination of 1,2-Dichloroethane.....	132
<i>Lang Xu, Eric Stangland, Manos Mavrikakis</i>	
(106d) Ultra-Low Loading, Highly Active and Stable Ru/γ-Al₂O₃ Catalyst for Low Temperature Solar Steam Reforming of Methane	133
<i>David Simakov, Yuriy Román-Leshkov</i>	
(106e) Spatio-Temporal Features of NO_x Reduction on LNT+SCR System: Effect of Hydrocarbon Reductant and Space Velocity	134
<i>Mengmeng Li, Vencon Easterling, Michael P. Harold</i>	
(106f) H₂SO₄ Catalysis: Perspective and Opportunities for Reducing SO₂ Emissions Using Particulate and Monolith Catalysts.....	139
<i>Anuradha Nagaraj, Patrick L. Mills</i>	

(106g) Synthesis, Characterization of Vanadia/Titania-Based Catalysts and Their Performance in Ammonia Remediation	143
<i>Hao Chen, Raquel Portela, Wei Han, Pedro Avila, Miguel A. Bañares, King Lun Yeung</i>	
(123a) Probing the Active Site Requirements and Mechanistic Details of NO_x Selective Catalytic Reduction with NH₃ on Cu-SZS-13	148
<i>Rajamani Gounder, Fabio H. Ribeiro, W. Nicholas Delgass, William F. Schneider, Jeffrey T. Miller, Aleksey Yezersets, Trunojoyo Anggara, Christopher Paolucci, Shane A. Bates, Anuj Verma, Atish Parekh</i>	
(123b) A New Method for Exhaust Aftertreatment Design - Integrated Engine and Aftertreatment Analysis	149
<i>Yong Miao, Steve Felix</i>	
(123c) Analysis of Ash-Loaded DPF Performance during Drop-to-Idle Test.....	150
<i>Yi Liu, Changsheng Su, Arvind Harinath</i>	
(123d) Transient Kinetic Study of Sulfur Oxide Adsorption/Desorption over Al₂O₃ and Pt/Al₂O₃ Catalysts.....	151
<i>Tayebeh Hamzehlouyan, Chaitanya S. Sampara, William S. Epling</i>	
(123e) Effect of Degredation on NO_x Storage over Novel Lean NO_x Trap Catalysts	154
<i>Travis Wentworth, Susan M. Stagg-Williams, Christopher D. Depcik</i>	
(123f) Low Temperature Oxidation of Carbon Monoxide Produced By Diesel-Ignited Methane Dual Fuel Low Temperature Combustion in a Single-Cylinder Diesel Engine	155
<i>Navid Zanganeh, Hossein Toghiani, Kalyan K Srinivasan, Sundar Rajan Krishnan, Taryn Bayles, Mostafa S. Raihan, Jason M. Keith</i>	
(163a) The IMPACT of Roofing Material on Building Energy Performance	174
<i>Ali Badiee</i>	
(163b) Biowall's Impact on Indoor Air Quality and Energy	175
<i>Dan Newkirk, Bill Hutzel</i>	
(163c) Sustainable Buildings: Targets and Measurements	176
<i>Godfried Augenbroe, Jason Brown</i>	
(163d) Sustainable Buildings	191
<i>Theresa Weston, Cory Jensen, Yudong Chen, Bhima Sastri</i>	
(163e) Avoided GHG Emissions Achieved By Using Architectural Window Film: An LCA Compliant with New WBCSD Avoided Emissions Guidelines.....	192
<i>Terrie Boguski, Lauren Johnson</i>	
(163f) Design of Robust Renewable Energy Supply Systems By Providing Visibility Based upon Improved Neural Network	202
<i>Soo Bin Lee, Jun-Hyung Ryu, In-Beum Lee</i>	
(163g) Experimental Investigations on Brick Specimens Made from Deinking Sludge	203
<i>Shilpa Kulkarni, Vivek Kumar, Sanjeev K. Singh, Mukesh C. Bansal</i>	
(163h) Multi-Objective Optimization of CHP Systems for Housing Complexes.....	210
<i>Luis Fabian Fuentes-Cortes, José María Ponce-Ortega, Medardo Serna-González, Carlos Rubio-Maya</i>	
(180a) Multi-Layer Monolith Catalysts for Lean NO_x Reduction.....	211
<i>Michael P Harold, Venuri Balakotaiah, Dan Luss, Sachi Shrestha, Yang Zheng, Bijesh M. Shakya, Pranit S. Metkar, Yi Liu, Krishna Kamasamudram, Aleksey Yezersets</i>	
(180b) A Discussion on the Fundamental Aspects of Urea SCR Control for Transient Applications	212
<i>Devesh Upadhyay, M. Van Nieuwstadt</i>	
(180c) Investigation of Burning Mode for Diesel Particulate Oxidation: Contrasting O₂ and NO₂	221
<i>Andrea Strzelec</i>	
(180d) TWC Formulation Effects on NH₃ Generation for Passive SCR Applications in Lean Gasoline Engine Exhaust	222
<i>Josh A. Pihl, Vitaly Y. Prikhodko, Todd J. Toops, James E. Parks</i>	
(180e) Experimental Investigation and Kinetic Modeling of Diesel Oxidation Catalysts for Emissions Aftertreatment from Diesel Engine Exhaust	223
<i>Hom Sharma</i>	
(180f) A New Catalyst for the Selective Catalytic Reduction of NO_x by NH₃ over Olivine	224
<i>Yun Shi, Su-Jing Li</i>	
(215a) Renewable H₂/CO Fuels for FTS and SOFC Applications Via Electrochemical Conversion.....	226
<i>Wenhua H. Zhu, Bruce J. Tatarchuk</i>	
(215c) Maximizing the Recovery of Bio-Commodities from Algal Biomass	227
<i>Ali Teymour, Edith Martinez-Guerra, Sandeep Kumar, Veera Ganeswar Gude</i>	
(215d) Green Chemical Conversion of Cellulose into Soluble Sugars and 5-Hydroxymethylfurfural (HMF) Using Ionic Liquids	228
<i>Sapna Jain, Alexis Rogers, Kelvin Jones, Jessica Abron</i>	
(215e) Liquid-Liquid Extraction of Bio-Oil Components	229
<i>Kyoung Eun Park, Sotira Yiacoumi, Costas Tsouris, Abhijeet P. Borole</i>	
Exploiting Polymer-Nanoparticle Interactions to Create a Hydrogel with Biomedical Applications	230
<i>Jessica Greer</i>	
Validation of High Throughput Electrochemical Gas Sensing Screening System.....	231
<i>Zixuan Wang</i>	
Long-Range Correlations in Liquid Water	241
<i>Nancy Figueroa</i>	
Frictional Study of Polyethylene Glycol Monolayers on Silica Substrate	242
<i>Nadiyah Nordin</i>	

A Machine-Learning Model to Predict Activation Energies of Hydrogenation Reactions	243
<i>Jack McCullough</i>	
Microscopic Modeling of the Self Assembly of Poly(ethylene oxide)-Poly(propylene oxide)- Poly(ethylene oxide) (PEO-PPO-PEO) Block Copolymers: Critical Micelle Concentrations	244
<i>Alexander Colville</i>	
(221a) Recommendations for Legislative Actions to Reduce Carbon Emissions in the Electricity Production Sector	245
<i>Sam White</i>	
(224a) Life Cycle Assessment of Vaccine Supply Chain in Developing Countries	273
<i>Bahador Mousavi, Joshua Martens, Chris Thai, Arunprakash T. Karunanithi</i>	
(224aa) The Study of Metal Oxide Modified Limestone As CO₂ Sequestration Materials	274
<i>Jiang-Feng Li, Hui Li, Wen-Bin Yang, Lele Zhang, Binglu Meng, Youhai Yu, Yong Min</i>	
(224b) Simple Method of Deposition of CuO Nanoparticles on a Cellulose Paper and Its Antibacterial Activity	275
<i>Amin Yoosefi Booshehri, Rong Xu</i>	
(224c) Use of a Commercial-Scale Reverse Osmosis Laboratory Module to Illustrate Interception Technology Applications in Water Pinch Network Design	276
<i>Russell F. Dunn, Jarrid Ristau</i>	
(224d) Influence of Stabilizer Size and Chelation Strength on Iron Nanoparticle Oxidation	277
<i>Nikki S. Rentz, Lauren F. Greenlee</i>	
(224e) Immobilization Carbonic Anhydrase on Magnetic Polymer Microsphere for Accelerating CO₂ Absorption into a Carbonate Solution	278
<i>Zuoming Zhou, Fujun Pan, Guohua Jing</i>	
(224g) Optimal Design of Domestic Water-Heating Systems through Solar Collectors	280
<i>Aurora De Fatima Sanchez-Bautista, José Ezequiel Santibañez-Aguilar, José María Ponce-Ortega, Fabricio Nápoles-Rivera, Medardo Serna-González, Mahmoud El-Halwagi</i>	
(224h) Simultaneous Design of Water Reusing and Rainwater Harvesting Systems in a Residential Complex	283
<i>Mariana García-Montoya, Andrea Bocanegra-Martínez, José María Ponce-Ortega, Fabricio Nápoles-Rivera, Medardo Serna-González, Mahmoud El-Halwagi</i>	
(224i) Mineralization of CO₂ with Industrial Solid Waste and Natural Ore	284
<i>Bin Liang, Jiahua Zhu, Chun Li, Hairong Yue, Houfang Lu, Longpo Ye, Chao Wang, Yufei Wang, Heping Xie</i>	
(224j) Optimization of Electrode Design for Electrodialysis Reversal	287
<i>Masoume Jaberi, Fattaneh Naderi Behdani, Abbas Ghassemi, Jim Loya</i>	
(224k) A Study on Effect of Temperature, COD and Influent Tds on Microbial Desalination Cells' Performance with an Approach to a Unique Predictive Model	288
<i>Mohammad Tanhaemani</i>	
(224l) Controlled-Release Antimicrobial for Air Disinfection	289
<i>Yue Tak Lai, Hao Chen, Yan Li, Wei Han, King Lun Yeung</i>	
(224m) Impact of Fugitive Emissions on the Greenhouse Gas Emissions of Conventional Crudes	290
<i>Amit Kumar, Christina Canter, Md. Mustafizur Rahman</i>	
(224n) Mini Pulsed Electric Field Device for Drinking Water Disinfection	291
<i>Ka Wo Lam, Hao Chen, Pik Shuen Hung, Oi Wa Lee, Siu Ming Kwan, Joseph Kai Cho Kwan, King Lun Yeung</i>	
(224o) Antimicrobial and Anti-Adhesion Coating for Water Filtration Membrane	292
<i>Hiu Pang Yu, Hao Chen, King Lun Yeung</i>	
(224p) Well to Wheel Life Cycle Assessment of Greenhouse Gas Emissions of Transportation Fuels from Canadian Oil Sands	293
<i>Amit Kumar, Balwinder Nimana, Christina Canter, Md. Mustafizur Rahman</i>	
(224q) Advanced Ozone Membrane Reactor for Treatment of Endocrine Disrupting Compounds in Water	294
<i>Tiphaine Corbet, Yakub Fam, Liping Li, Ying Li, Rafael Serra Cuesta, Wei Han, King Lun Yeung</i>	
(224r) Greenhouse Gas Calculator for Tracking Combustion and Process Upset Emissions: Methodology and Visual Representation for Simple Ethylene Process Base Case	296
<i>Fahd M. Mohammed, Monzure-Khoda Kazi, Fadwa T. Eljack</i>	
(224t) Tower Gardens and Solar Technology	297
<i>Willy Giron Matute</i>	
(224u) Investigation of the Influence of Pulsed Corona Discharges on Benzotriazole Degradation	298
<i>Oluwatosin Owoseni</i>	
(224v) Modeling of Physical-Chemical Variables Behavior in Rivers Using the Streeter-Phelps Model	299
<i>Lady Andrea Fuentes, Mario Andres Noriega</i>	
(224w) Dynamic Model of Stabilization Pond Systems	300
<i>Maria P. Ochoa, Vanina Estrada, Patricia M. Hoch</i>	
(224x) Design and Optimization of the Distillation and Dehydration Steps for Bio-Ethanol Production	301
<i>Mauricio Colombo, Michel Kahwaji Janho, Jorge E. Gatica, Fernando Daniel Mele, María Rosa Hernández</i>	
(224y) The Morphology Modification of Limestone By Different Forms of Carbon Additives for CO₂ Sequestration	302
<i>Binglu Meng, Hui Li, Wen-Bin Yang, Lele Zhang, Jiang-Feng Li, Youhai Yu, Yong Min</i>	
(224z) The Enhancement of CO₂ Sequestration of Limestone in Cement Industry By Carbon Black Modification	303
<i>Binglu Meng, Hui Li, Wen-Bin Yang, Lele Zhang, Jiang-Feng Li, Youhai Yu, Yong Min</i>	
(710b) Primarily Investigation of Mixed Adsorbents for the Removal of Copper and Methylene Blue from Aqueous Solutions	304
<i>Ahmad Albadarin, Chiranganu Mangwandi, Gavin Walker</i>	
(256a) Biodegradation of Contaminants in Karst Groundwater, a Dual Continuum Model	310
<i>Roger Painter, Tom Byl, Lonnie Sharpe, Justin Harris</i>	

(256b) CFD and Response Surface Modeling of Flare Performance: DRE/CE Vs. Soot	311
<i>Daniel H. Chen, Peyton C. Richmond, Helen H. Lou, Xianchang Li, Matthew Johnson</i>	
(256c) Development of Detailed Kinetic Mechanisms for Olefins Pyrolysis	312
<i>Kun Wang, Stephanie M. Villano, Anthony M. Dean</i>	
(256d) Development of a New Low-GWP Refrigerant Composed of HFO-1123 (trifluoroethylene)	314
<i>Toshiyuki Tanaka, Hidekazu Okamoto, Katsuya Ueno, Jun Irisawa, Tetsuo Otsuka, Tatsuhiko Nogami, Ritsu Dobashi</i>	
(256e) Nitric Oxide Removal By Aqueous Persulfate and Ferrous-EDTA Systems: Effects of Persulfate and EDTA Concentrations and pH	322
<i>Yusuf G (Debo) Adewuyi</i>	
(256f) Modeling and Analysis of Light-Off Behavior of DOC	323
<i>Richa Raj, Michael P Harold, Venuri Balakotaiah</i>	
(256g) Kinetic Study of Anaerobic Digestion of Sewage Sludge	325
<i>Pooja Sharma, U K Ghosh, Amiya Kumar Ray</i>	
(256h) Impact of Hydrocarbon Fuel Structure on Anaerobic Biodegradation Via the Fumarate Addition Reaction: An Ab-Inito and Kinetic Modelling Study	329
<i>Vivek Bharadwaj, C. Mark Maupin, Anthony M. Dean</i>	
(288a) Biodiesel Production Via Transesterification in a Mixed Carbon Dioxide-Methanol System with a Heterogeneous Catalyst	330
<i>Lindsay Soh, Chun-Chi Chen, Thomas Kwan, Eric J. Beckman, Julie Zimmerman</i>	
(288b) Production of Biochar and Combustible Gas from Co-Pyrolysis of Agricultural Plastic Wastes and Animal Manures	331
<i>Kyoung S. Ro</i>	
(288c) Hydrothermal Liquefaction of Wet Algal Biomass with/without Catalysts	332
<i>Tapaswi Muppaneni, Harvind Reddy, Sundaravadivelvathan PonnuSamy, Nagamany Nirmalakhandan, Tanner Schaub, Barry Dungan, Francisco Holguin, Pete Lammers, Wayne Voorhies, Shuguang Deng</i>	
(288d) Biorefinery on Biocathodes of Microbial Desalination Cells	333
<i>Bahareh Kokabian, Veera Gnaneswar Gude</i>	
(288e) Life-Cycle Energy Use and Greenhouse Gas Emissions of Biofuels Production from Sweet Sorghum	334
<i>Jihong Li, Shizhong Li</i>	
(324a) Improving a Process Site Sustainability Through Waste Heat Recovery	335
<i>G. Oluleye, Megan Jobson, Robin Smith</i>	
(324b) Multiscale Connectivity for Chemical Mixture Toxicity Assessment	358
<i>Dimosthenis Sarigiannis</i>	
(324c) Double Containment Piping Systems: A Fail-Safe, Leak-Proof and Environmentally Friendly Solution	366
<i>Darin Johnson</i>	
(324d) Humic Substances in Treatment of Water Contaminated with Hydrocarbons	373
<i>Yair Cruz-Narváez, Hever Honorato-Cervantes, Enrique Rico-Arzate, Jose J. Castro-Arellano, Vanessa Silva-Castro</i>	
(324e) Sustainability Assessment and Performance Improvement of Electroplating Systems	374
<i>Hao Song, Navdeep Bhadbade, Yulin Huang</i>	
(324f) Uncertainties of Ozone Increments Caused By Industrial Startup Flaring	375
<i>Jian Zhang, Ziyuan Wang, Qiang Xu, Thomas C. Ho</i>	
(335a) Protecting our Environment with Catalysis and Reaction Engineering	376
<i>Panagiotis Smirniotis</i>	
(352a) Using Soybean Derived Crude Glycerol As Co-Digestate in Sewage Sludge Anaerobic Digester to Increase Biogas Production	377
<i>Steven Nartker, Michelle Ammerman, Michael Stogsdill, Jennifer Aurandt, Olivia Hayden, Chad Antle</i>	
(352b) Kinetic Modeling of Hydrothermal Liquefaction of Algal Biomass	378
<i>Harvind Kumar Reddy, Tapaswi Muppaneni, Sundaravadivelvathan PonnuSamy, Thinesh Selvaratnam, Barry Dungan, Nagamany Nirmalakhandan, Tanner Schaub, Francisco Holguin, Peter Lammers, Wayne Voorhies, Shuguang Deng</i>	
(352c) Utilization of Solid Residual Wastes Arising from Woody Biomass Gasification	379
<i>Thawatchai Maneerung, Zhanyu Yang, Sibudjing Kawi, Chi-Hwa Wang</i>	
(352d) Toxicity Assessment of Bottom Ash from Biomass and Sewage Sludge Co-Gasification	380
<i>Le Rong, Koon Gee Neoh, Yen Wah Tong, Chi-Hwa Wang</i>	
(352e) Single-Step Synthesis of Biodiesel from Crude Jatropha curcas Oil Using Chlorosulfonic Acid Catalyst	381
<i>Hanif A Choudhury, Pulkit Srivastava, Vijay Moholkar, Sai Gu</i>	
(381a) The Chemistry of the "Herycnite Cycle" Solarthermal Water Splitting Reactions	382
<i>Christopher L. Muhich, Kayla Weston, Darwin Arifin, Anthony H. McDaniel, Eric N. Coker, Charles B. Musgrave, Alan W. Weimer</i>	
(381b) Hydrogen Production from Biomass Via Microbial Electrolysis	383
<i>Alex Lewis, Abhijeet P. Borole</i>	
(381c) The Power of Electricity & Chemicals Co-Production	384
<i>Abdulrahman Albassam, Vasilios Manousiouthakis</i>	
(381d) Low Temperature H₂ Generation from Thermochemical Water-splitting Reaction Using Complex Redox Materials	385
<i>Rajesh V. Shende, Vinod S. Amar, J. Puzsynski</i>	
(409a) Uncertainty and Sensitivity Analysis in Sustainable Process Design – Environmental Indicators	386
<i>Carina Gargalo, Gürkan Sin</i>	
(409b) A Techno-Economic, Life-Cycle Modeling Framework for Emerging Technology Assessments in the U.S. Chemical Industry	388
<i>Yuan Yao, Diane J. Graziano, Mathew Riddle, Eric Masanet</i>	

(409c) Rare Earth Oxide Production: Quantification of Life Cycle Environmental Impacts	389
George G. Zaines, Vikas Khanna, Berlyn Hubler	
(409d) Life Cycle Analysis of Oil Shale Production Using Greet	390
Ghana Paudel, Daniel Steiner, Joseph D. Smith	
(409e) Dimethyl Ether Chemical Storage Cycle for Uninterrupted Renewable Power	391
Emre Genger, Easa I. Al-Musleh, Dharik S. Mallapragada, Rakesh Agrawal	
(423a) Plasma-Based Advanced Oxidation: Effects of Reactor Design on the Degradation of Organic Contaminants	392
Selma Mededovic, Gunnar Stratton, Fei Dai, Christopher Bellona, Thomas Holsen	
(423b) Effects of the Addition of Catalysts on the Decomposition of Amido Black 10B By Pulsed Corona Discharge	393
Negin Koutahzadeh, Pedro E. Arce	
(423c) Novel Spatially and Temporally Confined Microplasmas for Advanced Oxidation	394
Justin Pommerenck, Jordan Pommerenck, Peter Kreider, Yousef Alanazi, Jacob Lum, Alexandre F. T. Yokochi	
(423e) Photocatalytic Degradation of Methamphetamine Using UV/TiO₂	395
Chin-Sheng Kuo, Cheng-Fang Lin, Pui-Kwan Andy Hong	
(423f) Visible Light Mediated Heterogeneous Photo-Fenton Oxidation of Endocrine Disrupting Compounds in Wastewater and Water Using CdS/Carbon Nanotube-Iron Oxide Composite Photocatalyst	396
Jihyun R. Kim, Eunsung Kan	
(433a) Technical, Economic and Environmental Viability of Offshore CO₂ Reuse from Natural Gas By Dry Reforming	397
Bruna Lima, Ofélia Araújo, José L. Medeiros, Cláudia Morgado	
(433b) Improved CO₂ Capture Process : Rich Vapor Recompression with Split Flow	408
Jaeheum Jung, Yeong Su Jeong, Chonghun Han	
(433c) Development of CO₂ Capture and Utilization Technologies for Alkaline Wastes for Building Waste-to-Resource Supply Chain: Theoretical Consideration	409
Shu-Yuan Pan, Pen-Chi Chiang, Elisa G. Eleazar, Andrew Chiang, E-E Chang, Yi-Hung Chen	
(433d) CO₂ Fixation through Carbonation of Waste Cement and Concrete	410
Atsushi Izuka, Akihiro Yamasaki, Motoki Inoue, Miyuki Noguchi	
(433e) Technological Trends in CO₂ Capture, Transport and Utilization	411
Rita M. B. Alves, Fernanda M. Fontes, José L. Medeiros, Ofélia Q. F. Araújo	
(433f) Effects of Contaminants to Physical Solvents for Pre-Combustion CO₂ Capture	426
Fan Shi, Brian Kail, Hunaid Nulwala, Nicholas Siebert, David Luebke	
(464a) Self-Emulsification of Alkaline-Dissolved Clove Bud Oil By Whey Protein, Gum Arabic, Lecithin, and Their Combinations	427
Yangchao Luo, Yue Zhang, Kang Pan, Faith Critzer, P. Michael Davidson, Qixin Zhong	
(464b) Oil Extraction from Spent Coffee Grounds Using Advanced Techniques	428
Javier Davila Sr., Moshe Rosenberg, Gonzalo Taborda Sr., Carlos A. Cardona	
(464c) Microencapsulation of Blackberry Antioxidants. Modeling and Simulation	437
Miguel Rojas, Javier Davila Sr., Moshe Rosenberg, Carlos A. Cardona	
(464d) Liquid-Phase Electrical Discharge Plasmas Rapidly Inactivate Pathogenic and Spoilage Microorganisms in Water	449
Tomislava Vukusic, Zoran Herceg, Shane Rogers, Selma Mededovic	
(464e) Modeling the Drying Kinetics of Carrot Particles in a Closed Chamber Following Forced Convection and Electric Field Treatment	450
Abdelbasset Bessadok Jemai, L. Khezami, M. Hadjali, E. Vorobiev	
(464f) Antimicrobial Peptide Segments from Soy Protein for Use in Food Safety	451
Ning Xiang, Yuan Lyu, Ganesh Narasimhan	
(464g) Making Food Safe in Light of New Demands	452
James Van Wyk	
(464h) Low Temperature Batch Conversion of Cellulosic Biomass	457
Mohit Nahata, Galen B Fisher, Johannes W. Schwank	
(479a) Influence of the Synthesis Method on Cr Leaching during the Liquid Phase Photocatalysis of Cr-TiO₂	458
Siva Nagi Reddy Inturi, Makram Suidan, Panagiotis Smirniotis	
(479b) Electrochemical Wastewater Treatment for Industrial Applications	459
Dieter Woisetschläger, Matthias Siebenhofer	
(479c) Mathematical Model of a Thin Film Slurry Reactor for the Degradation of an Azo-Reactive Dye By Solar Photo-Fenton Process	470
Abdón Parra, Lidia Yokoyama, Fabiana Valéria Da Fonseca	
(479d) Performance of Activated Carbon Supported Catalyst during Wet Oxidation of Pulping Effluent	472
Bholu Ram Yadav, Anurag Garg	
(479f) Catalytic Wet Oxidation of Phenolic Compounds at Moderate Temperature and Pressure	478
Rajendra Mohite, Anurag Garg	
(499a) Establishing Analytical Adsorption Methods for Pore Characteristic Evaluations in Gas Shales	483
Erik C. Rupp, Jennifer Wilcox	
(499b) A Generalized Model for Gas-Solid Adsorption Equilibria	484
Austin Ladshaw, Sotira Yiacoumi, Costas Tsouris, David Depaoli, Ronghong Lin, Lawrence L. Taylarides	
(499c) Binding of SO₃ to Fly Ash Components: CaO, MgO, Na₂O and K₂O	485
Benjamin Galloway, Erdem Sasman, Bihter Padak	
(499d) Metal Organic Frameworks for Selective Adsorption of t-Butyl Mercaptan from Natural Gas	486
Grace Chen, Christopher W. Jones, William J. Koros	

(499e) Atomic Layer Deposition Assisted Layer-By-Layer Growth of Metal Organic Frameworks on Polymer Fiber Mats for Hazardous Gas Adsorption.....	495
Junjie Zhao, Bo Gong, Paul C. Lemaire, William T. Nunn, Eric C. Stevens, Fahim I. Sidi, Matthew A. Browne, Gregory W. Peterson, Mark D. Losego, Gregory N. Parsons	
(499f) Amino-Pillared Nanosheet (APN) for High Performance Carbon Dioxide Capture.....	496
Christopher Cogswell	
(499g) Carbon Dioxide Capture Using Elastic Layered Metal-Organic Frameworks: Experimental and Computational Evaluation.....	497
Francisco Sotomayor, Tran D. Trinh, Christian Lastoskie	
(499h) Effects of Flue Gas Contaminants, Regeneration Conditions, and Amine Modification on the Adsorption of Carbon Dioxide By MIL-101(Cr)	498
Qing Liu, Junjie Shi, Shudong Zheng, Yao Shi, Yi He	
(506a) Effect of C/N Ratio on Microbial Lipid Production with the Oleaginous Yeast <i>Lipomyces Starkeyi</i>	499
Christopher Giorgio, Stephen Dufreche, William Holmes, Rafael Hernandez, Mark E. Zappi, Rakesh Bajpai, Ramalingam Subramanian	
(506b) Recovery of Polyphenol-Enriched Sugarcane Molasses Solution By Ultrafiltration.....	500
Michelle Almendrala, Gerald Aaron Ang, Edmar Bermadas, Cedrick Ong	
(506c) β -1,3-Glucan Production By Metabolically Engineered Agrobacterium Sp. from Cellulosic Sugar	501
Hyun-Dong Shin, Young-Il Park, Mi-Kyoung Kim, Rachel Ruizhen Chen	
(506d) Chemical Imaging of Cheese Microstructure Using ATR Microimaging Spectroscopy	502
Ramazan Kizil	
(506e) Study on Swine Manure Foaming to Understand Its Major Reason and Its Relations to Industrial Products.....	503
Mi Yan, Jing Gan, Yan Yang, Aravindan Rajendran, Hongjian Lin, Qiyang He, Bo Hu	
(506f) Economic Analysis of Different Stabilization Methods of Antioxidants	504
Miguel Rojas, Moshe Rosenberg, Carlos A. Cardona	
(506g) Preventing Paper Towels from Bacteria Growth Using Selenium Nanoparticles	514
Qi Wang, Thomas J. Webster	
(506h) Novel Tools in Genome-Scale Metabolic Flux Modeling to Identify Metabolic Engineering Targets and Predict Microbial Phenotypes	518
Hadi Nazem-Bokaei, Juien Yen, Ryan S. Senger	
(556a) Sustainable Winemaking – Challenges and Opportunities	519
Michael Roland	
(556b) The Challenges of Water Use Reductions and Food Safety in Dairy Processing	520
Jill Brigham	
(556c) The Challenges of Food Safety and Water Use Reductions in Dairy Processing	521
Joseph Herrud, Montgomery Bohanan	
(556d) Maximizing Water and Energy Efficiency in Food Processing While Minimizing Negative Environmental Impact	527
Christopher W. Simmons	
(562a) Carbon Footprint of Agrarian Systems.....	528
Jonathan Dubinsky, Arunprakash T. Karunanithi	
(562b) Process Sustainability Evaluation for the Recovery of Metal from Spent Batteries	529
Gerardo J. Ruiz-Mercado, Michael A. Gonzalez, Raymond L. Smith	
(562c) Sustainability Control: Theoretical Aspects and Engineering Methods	530
Hao Song, Liwei Yan, Yinlun Huang	
(562d) Statistical Analysis of Global Environmental Impact Patterns Using a World Multi-Regional Input Output Database	531
Janire Pascual-González, Gonzalo Guillén-Gosálbez, Laureano Jiménez Esteller, Josep Maria Mateo-Sanz	
(562e) Maximizing Sustainability of Ecosystem Model through Socio-Economic Policies Derived from Multivariable Optimal Control Theory	532
Rohan Doshi, Urmila Diwekar, Kirti Maheshkumar Yenkie, Heriberto Cabezas, Pahola T. Benavides	
(562f) Understanding Resilience of Metro Systems in Polycentric Megacities: A Case Study of Delhi Metro Rail System	546
Shauhrat Chopra, Vikas Khanna	
(565a) Trichloroethylene Oxidation and Hexavalent Chromium Reduction Via Redox Reactions Using KMnO ₄ and FeSO ₄ in Aqueous and Soil Systems	548
Jude Ighere, Karina Honjoya, Ramesh Chawla	
(565b) Investigation of the Extraction and Recycle Potential of CCA Treated Wood Waste	549
R. Mark Bricka, Amy M. Parker	
(565c) Development of a New Paradigm in Biochemical Engineering: Predicting the Genetic Regulation of Aromatic Pollutants Degradation	550
Argyro Tsipa, Michalis Koutinas, Athanasios Mantalaris, Efstratios N. Pistikopoulos	
(565d) Studies on Evaluation of Acute Toxicity Factor for Selected Industrial Effluents Using Zebra Fish(Danio Rerio) As a Test Organism	555
Pulipati King, Garika Sheshamma	
(565e) Integrated Solar Photocatalytic Oxidation and Biodegradation for Degradation of Antibiotics and Endocrine Disrupting Compounds in Wastewater and Water	556
Jihyun R. Kim, Eunsung Kan	

(565f) Enhanced Combustion of Rice Husk for Pollution Abatement and Regional Potential of Silica from Rice Husk Ash (RHA).....	557
<i>Muhammad Suleman Tahir</i>	
(565g) Innovative Design of an Integrated Biotrickling Filter System for Removal of Simulated Waste Gas Containing a Mixture of p-Xylene and Ethyl Mercaptan.....	563
<i>Xiang-Qian Wang, Su-Jing Li, Wei Li</i>	
(605b) Land Use Emissions and Environmental Impacts of Agricultural Systems	564
<i>Jonathan Dubinsky, Arunprakash T. Karunanithi</i>	
(608a) Development and Performance of a Novel Cu²⁺-Imprinted Membrane By Semi-Interpenetrating Polymer Network Technique for Selective Cu²⁺ Removal	565
<i>Jinsong He, J. Paul Chen</i>	
(608b) Surfactant-Free Synthesized Mesoporous Carbon Nanocomposites Towards Efficient Pollutants Removal from Water	566
<i>Long Chen, Jiahua Zhu</i>	
(608c) Evaluation of Usability of Various Real Wastewaters in Microbial Fuel Cells	567
<i>Anna Casasus, Luciana Bava, Jaime Lee</i>	
(608e) Some Aspects of Hydrodynamics of Continuous Countercurrent Liquid-Solid System	575
<i>Krishnan Nagarajan, T. Renganathan, K. Krishnaiah</i>	
(660a) Removal of Cadmium Ions from Aqueous Solution Using a New Low-Cost Biosorbent	577
<i>Alireza Saraeian, Atefe Hadi, Abbas Ghassemi</i>	
(660b) Environmental Remediation of Dense Non-Aqueous-Phase Liquids Using Multifunctional Iron-Carbon Nanocomposites	578
<i>Yang Su, Bhanukiran Sunkara, Owoseni Olasehinde, Yueheng Zhang, Jingjing Zhan, Gary McPherson, Vijay T. John</i>	
(660c) Adsorption and Oxidative Degradation of Bisphenol a on Surface Modified Iron-Amended Activated Carbon: Effects of Temperature on Adsorption and Fenton Oxidation	579
<i>Eunsung Kan, Jihyun R. Kim</i>	
(660d) Removal of Metronidazole and Dimetridazole from Aqueous Solution By Adsorption on Multiwalled and Singlewalled Carbon Nanotubes	580
<i>Roberto Leyva-Ramos, Damarys H Carrales-Alvarado, Raul Ocampo-Perez</i>	
(660e) Synthesis of Zirconium Nanoparticles Doped Activated Carbon Fiber for Optimized Adsorption for Arsenic Removal	581
<i>J. Paul Chen</i>	
(663b) Integrated Membrane Bioreactor Process for Water Reclamation and Groundwater Recharge Applications	584
<i>Woonhoe Kim, Varadarajan Ravindran, Massoud Pirbazari</i>	
(663c) Controlling Ammonia Levels with Natural Materials to Preserve Bait and Stored Fish in Fresh- and Seawater	585
<i>Wen Zhao, Daniela M. L. Stebbins, Fei Guo, Sarina Ergas, Norma Alcantar</i>	
(663d) Production Water Recovery Processing and Reuse	596
<i>Christina M. Borgese</i>	
(663e) Polyaniline Coated Ethyl Cellulose with Improved Hexavalent Chromium Removal	597
<i>Bin Qiu, Cuixia Xu, Dezhi Sun, Suying Wei, Zhanhu Guo</i>	
(663f) Study of Fluoride Adsorption Onto Nanostructured Zirconium-Manganese Based Particle	598
<i>Alam Akm Khorshed Sr., Jinsong He, Narahari Mahanta, J. Paul Chen</i>	
(663g) Removal of Chromium (VI) and Divalent Cations from Flowback Water By Graphene Oxide-Modified Natural Zeolite	599
<i>Lucy Mar Camacho, Tanyiben Pareshbhai Desai</i>	
(688a) Adsorptive Removal of Humic Acids and Microbes By Polyacrylonitrile-Chitosan Composite Membrane	600
<i>Swapna Rekha Panda, Mumun Mukherjee, Sirshendu De</i>	
(688b) Removal of Gaseous O-Xylene in the Two-Liquid Phase Biotrickling Filters and Airlift Bioreactors	608
<i>Chao Wu, Xiang-Qian Wang, Bai-Long Xu, Su-Jing Li, Wei Li</i>	
(688c) The Effect of Various Fibrous Filter Media and Newly Designed Packaging Configurations on Sea Salt Particles Loading Performance	609
<i>Pengfei Zhao, Bruce J. Tatarchuk</i>	
(688d) Removal of Heavy Metals from Wastewater Using Immobilized Biochar	618
<i>Edward Trujillo</i>	
(695a) UV-Assisted Stabilization of Modified Softwood Kraft Lignin Fibers	619
<i>Meng Zhang, Jing Jin, Amod A. Ogale</i>	
(695b) Effect of a Natural Cactus Based-Mucilage Dispersant on the Surface Tension and Droplet Size of Dispersed Crude Oil	620
<i>Fei Guo, Daniela M. L. Stebbins, Tunan Peng, Rana Falahat, Wen Zhao, Sylvia Thomas, Ryan Toomey, Norma Alcantar</i>	
(695c) Artificially Engineered Protein Gels Derived from Nucleoporins	621
<i>Minkyu Kim, Wesley Chen, Jeon Woong Kang, Matthew J. Glassman, Katharina Ribbeck, Bradley D. Olsen</i>	
(695d) Enhancing Oxygen Permeability in Hydrogel Wound Dressing By Cyanobacterial Gas Vesicles	622
<i>Napaporn Vongpanish, Uchechukwu Chamberlin Anozie, Lu-Kwang Ju</i>	
(695e) Adhesive Elastin-Based Proteins As Soft Tissue Glues	623
<i>M. Jane Brennan, Julie C. Liu, Jessica K. Roman, Julie N. Renner, Renay S.-C. Su, Jonathan J. Wilker</i>	
(695f) Simulation and Experimental Investigation of Osteogenic Activity of Hydrogel-Conjugated BMP-2 Peptide	624
<i>Seyedrina Moeinzadeh, Esmaeil Jabbari</i>	
(695g) Designing Multi-Component Nanostructured Soft Biomaterials Interacting with Charged Nanoparticles	626
<i>Fikret Aydin, Meenakshi Dutt</i>	

(710a) Novel 3D-Printed Oleophilic Absorbents.....	627
<i>Duanduan Han, Victor M. Ugaz</i>	
(710c) Fate and Removal Behaviour of Antibiotics in an Osmotic Membrane Bioreactor for Municipal Wastewater Treatment	628
<i>Guanglei Qiu, Divya Shankari Srinivasa Ragha, Yen-Peng Ting</i>	
(710d) Removal of Trihalomethanes (THMs) By Electro-Coagulation Process Using Aluminium Plate	629
<i>Cheng-Chun He, Ching-Yao Wu, Shang-Lien Lo</i>	
(710e) Applications of Sulfur-Containing Radical Treatment in for Water Reuse and Recycling	630
<i>Haizhou Liu, Lucy Li, Lamees Alkhamis</i>	
(710f) Copper (II) Removal Using Activated Neem Bark from Waste Water As a Low Cost Adsorbent: Column Studies.....	631
<i>Suresh Gupta, Utkarsh Maheshwari</i>	
(710g) Preparation Characterization and Application of an Affinity Flat Sheet Membrane	632
<i>Ling Yu, Yu Ming Zheng, J. Paul Chen</i>	
Author Index	