

# **North American Mixing Forum 2019**

Held at the 2019 AIChE Annual Meeting

Orlando, Florida, USA  
10-15 November 2019

ISBN: 978-1-7138-0530-4

**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© (2019) by AIChE  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

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>(87A) DISPERSION AND COALESCENCE IN LIQUID/LIQUID SYSTEMS STABILIZED WITH NANOPARTICLES.....</b>	1
<i>Lena Hohl, Susanne Röhl, Matthias Kraume</i>	
<b>(87B) THIXOTROPIC SUSPENSIONS IN STATIC MIXER: COMPARISON OF DIFFERENT STRUCTURE-BASED MODELS .....</b>	3
<i>Mohammadali Masoudian, Ravindra Aglave, Thomas Eppinger</i>	
<b>(87C) USING THRUST AS AN INDIRECT MEASURE FOR MIXING EFFICIENCY OF SUBMERGED PROPELLER AGITATORS IN NON-NEWTONIAN AND VISCOELASTIC MEDIA .....</b>	4
<i>Markus Kolano, Manuel Brehmer, Matthias Kraume</i>	
<b>(87D) MACROMIXING CHARACTERISTICS OF VISCOUS AND SHEAR-THINNING FLUIDS IN ROTOR-STATOR SPINNING DISC REACTORS .....</b>	6
<i>Arnab Chaudhuri, Wyatt Winkenwerder, John Van Der Schaaf</i>	
<b>(87E) COMPUTATIONAL FLUID DYNAMICS MODELING OF MIXING AND REACTION OF HIGH-VISCOSITY LIQUIDS IN A CONTINUOUS FLOW REACTOR.....</b>	10
<i>Corey Clifford, Kevin Glunt, Hari C. Mantripragada, Brandon Hlavaty, Nasser Al Azri, Cliff Kowall, Robert Enick, Götz Veser</i>	
<b>(87F) NON-INVASIVE DETECTION AND ASSESSMENT OF CORONARY STENOSIS USING MEAN AGE OF BLOOD FLOW .....</b>	11
<i>Javad Hashemi, Shahab Ghafghazi, Shesh Rai, R. Eric Berson</i>	
<b>(87G) FURTHER STUDIES ON OPTIMIZATION OF AGITATION IN SUSPENSION POLYMERIZERS.....</b>	12
<i>Richard K. Grenville, Jason J. Giacomelli, Benjamin Boyer</i>	
<b>(153A) A NOVEL APPROACH TO THE EXPERIMENTAL DETERMINATION OF NJS USING ELECTRICAL RESISTANCE TOMOGRAPHY .....</b>	13
<i>Baran Teoman, Piero M. Armenante</i>	
<b>(153B) CHARACTERIZATION OF MICROMIXING IN A ROTOR-STATOR SPINNING DISC REACTOR: EFFECTS OF GAP DISTANCE.....</b>	15
<i>Arturo N. Manzano Martinez, Melissa Assirelli, John Van Der Schaaf</i>	
<b>(153C) (MICRO-)MIXING EFFECT IN ALKYL BENZENE SULFONATION USING SPINNING DISC TECHNOLOGY.....</b>	18
<i>Roy Van Kouwen, Wyatt Winkenwerder, Sander Haase, Melissa Assirelli, Zach Brentzel, Bill Joyce, Tom Pagano, John Van Der Schaaf</i>	
<b>(153D) INTENSIFICATION OF REACTION-DIFFUSION PROCESSES BY MAGNETIC NANOMIXING.....</b>	20
<i>Aleš Zdražil, František Štěpánek, Dalimil Snita</i>	
<b>(153E) BLENDING IN ABOVE GROUND STORAGE TANKS WITH SIDE ENTERING AGITATORS: EFFECT OF SCALE AND D/T.....</b>	21
<i>Jason J. Giacomelli, Sarah J. Johnson, Richard K. Grenville</i>	
<b>(153G) CHARACTERIZATION AND ANALYSIS OF MIXING IN A SOFT-ELASTIC REACTOR (SER).....</b>	22
<i>Jie Xiao, Minghui Liu, Chao Zou, Guillaume Delaplace, Romain Jeantet, Xiao Dong Chen</i>	
<b>(218A) TOWARDS AN UNDERSTANDING OF FLUID HISTORY IN A TURBULENT MIXING TANK USING LARGE EDDY SIMULATION MODEL .....</b>	24
<i>Matthew H. Flamm, Katherine Raudenbush, Eric Sirota, Aaron Cote</i>	
<b>(218B) CFD MODELLING AND MATLAB ANALYSIS TO ASSES MIXING PERFORMANCE IN CUSTOM VESSEL CONFIGURATIONS IN THE BIOPHARMACEUTICAL INDUSTRY.....</b>	25
<i>Jamie McCarry</i>	
<b>(218C) SPIROID DESIGN OPTIMIZATION IN A ROTATING CONTINUOUS BIOREACTOR FOR ENHANCED OXYGEN MASS TRANSFER .....</b>	26
<i>Rithvija Avvari, Paul W. Todd, Thomas R. Hanley</i>	
<b>(218D) EFFECT OF GAS SPARGE TYPE ON OXYGEN MASS TRANSFER IN AN AGITATED VESSEL (COMPARING CFD VERSUS EXPERIMENTAL MODELING TECHNIQUES) .....</b>	27
<i>John A. Thomas, Richard Kehn</i>	
<b>(218E) MULTIPHASE REACTING FLOW SIMULATIONS AND OPTIMIZATION OF COMMERCIAL-SCALE AEROBIC BIOREACTORS .....</b>	28
<i>Hariswaran Sitaraman, Mohammad J. Rahimi, James J. Lischeske, Jonathan J. Stickel</i>	

<b>(218F) MODELING MIXING IN AERATED SYSTEMS: MASS TRANSPORT AND FLOODING</b> .....	29
<i>Christopher Tyler, John A. Thomas</i>	
<b>(366A) USE OF THE HIERARCHICAL PARCEL SWAPPING METHOD TO SIMULATE TURBULENT SUBGRID REACTING FLOWS WITH VARIABLE SCHMIDT NUMBERS</b> .....	30
<i>David O. Lignell, Victoria B. Stephens, Isaac Wheeler</i>	
<b>(366B) COMPUTATIONAL FLUID DYNAMICS SIMULATIONS OF MIXING IN THE TRANSITION REGION</b> .....	31
<i>David G. Foster, Zachary J. Oliver, Paul W. Steve, Riley D. Flower, William T. Funkenbusch</i>	
<b>(366C) USING GPUS TO RUN LARGE EDDY SIMULATIONS OF BLENDING IN OIL STORAGE TANKS</b> .....	32
<i>Brian Devincentis, John A. Thomas, Kevin Smith</i>	
<b>(366D) THE EFFECT OF GRID CELL TYPE IN MIXING TIME SIMULATIONS IN NON-TURBULENT STIRRED VESSELS</b> .....	33
<i>Harry E. A. Van Den Akker</i>	
<b>(366E) ANALYZING REACTIVE MIXING PROCESSES USING COMPUTATIONAL FLUID DYNAMICS AND Z-TRANSFORM</b> .....	34
<i>De-Wei Yin</i>	
<b>(366F) MODELING POLYMER FLUID FLOW AND REACTION WITH COMPUTATIONAL FLUID DYNAMICS (CFD)</b> .....	35
<i>Lu Zhu, Jie Jiang, Li Xi</i>	
<b>(366G) CFD-BASED MULTI-OBJECTIVE OPTIMIZATION OF DUAL-IMPELLER CONFIGURATIONS IN A GAS-LIQUID STIRRED TANK</b> .....	36
<i>Miao-Na Chen, Jia-Jun Wang, Xue-Ping Gu, Lian-Fang Feng</i>	
<b>(431A) ASSESSMENT OF 3D-PTV TO MEASURE LAGRANGIAN FLOW FIELDS IN STIRRED TANKS</b> .....	38
<i>Manuele Romano, Federico Alberini, Mark Simmons, E. Hugh Stitt, Giuseppe Raso, Li Liu</i>	
<b>(431B) CHARACTERIZATION OF VORTEX FORMATION AND BLEND TIME IN UNBAFFLED TANKS</b> .....	41
<i>Robert P. Hesketh, Arthur W. Etchells, Christopher O'Connell, Nicholas Tiwari, Anthony Salemo</i>	
<b>(431C) SUSPENSION OF LARGE AND DENSE PARTICLES IN STIRRED VESSELS: FURTHER APPLICATION AND VALIDATION OF GRENVILLE-MAK-BROWN (GMB) 2015 APPROACH</b> .....	42
<i>Jason J. Giacomelli, Richard K. Grenville, Harry E. A. Van Den Akker</i>	
<b>(431D) AN IMPROVED KINETIC MODEL FOR MICROMIXING CHARACTERIZATION USING THE VILLERMAUX-DUSHMAN METHOD</b> .....	44
<i>Arturo N. Manzano Martinez, Sander Haase, Melissa Assirelli, John Van Der Schaaf</i>	
<b>(431E) COMPARISON OF CFD SIMULATIONS TO EXPERIMENTAL RESULTS FOR BLEND TIME OF TURBULENT NEWTONIAN FLUIDS IN STIRRED TANKS</b> .....	47
<i>Aaron Strand, John A. Thomas</i>	
<b>(431F) COMPARISON OF BLEND TIME MEASUREMENTS: AN EXPERIMENTAL AND COMPUTATIONAL STUDY</b> .....	48
<i>Eric E. Janz, Kevin Myers, Nicholas A. Brown</i>	
<b>(431G) CONTROLLED DROPLET SIZE FOR OIL-IN-WATER EMULSIONS: EXPERIMENTAL AND MODELING APPROACH TO CHARACTERIZE WORK HISTORY APPLIED BY MIXING DEVICES</b> .....	49
<i>Margaret Y. Hwang, Chang Kai Wu, Sarat Chandra Kuchibhatla</i>	
<b>(470A) DEFINING A SCALE-UP STRATEGY FOR AN OIL IN WATER COSMETIC EMULSION</b> .....	50
<i>Andrea Suaza, Alvaro Orjuela</i>	
<b>(470B) EFFECTIVE SCALE-UP OF AERATED FERMENTATION PROCESSES WITH COMPLEX RHEOLOGY TO INDUSTRIAL SCALE</b> .....	51
<i>Sören Bernauer, Mathias Schöpf, Christian Witz, Philipp Eibl, Johannes G. Khinast, Timo Hardiman</i>	
<b>(470C) DIRECT NUMERICAL SIMULATION OF BIOREACTORS USING GPUS</b> .....	52
<i>John A. Thomas</i>	
<b>(470E) USE OF ACOUSTIC EMISSION FOR IDENTIFYING GAS-LIQUID MIXING REGIME IN AGITATED VESSELS AT DIFFERENT SCALES APPLYING MACHINE LEARNING</b> .....	53
<i>Giuseppe Forte, Federico Alberini, Mark Simmons, Hugh Stitt</i>	
<b>(470F) HYDRODYNAMICS INVESTIGATION OF USP DISSOLUTION TESTING APPARATUS I (BASKET APPARATUS) AND EFFECT OF THE BASKET MESH SIZE ON HYDRODYNAMIC CHARACTERISTICS</b> .....	56
<i>Chadakarn Sirasitthichoke, Piero M. Armenante</i>	
<b>(470G) EFFICIENTLY CHARACTERIZE PROCESS SCALABILITY IN THE MICROMIXING-MESOMIXING SPACE USING THE BOURNE PROTOCOL</b> .....	57
<i>Aaron Sarafinas</i>	

<b>(491B) COMPLEXITIES IN SIMPLE MIXING</b> .....	58
<i>Christopher Tyler</i>	
<b>(178F) STEAM STRIPPING OF AROMA FROM COFFEE: MULTI SCALE MODELLING OF EXTRACTION BEHAVIOUR</b> .....	59
<i>David Beverly, Peter J. Fryer, Serafim Bakalis, Estefania Lopez-Quiroga, Robert Farr</i>	
<b>(491E) QUANTIFYING THE EXTENT AND RATE OF CAKING IN FOOD POWDERS</b> .....	60
<i>Tim Freeman, John Yin, Laura Monington, Katrina Brockbank</i>	
<b>(554B) OPTIMIZATION OF CLEANING IN PROCESS EQUIPMENT VIA CFD STUDIES</b> .....	61
<i>Evgenii Burlutskii, Harry E. A. Van Den Akker, Orest Shardt</i>	
<b>(554C) DEVELOPMENT OF A CFD-DEM MODEL IN NON-INERTIAL FRAME FOR SOLID-LIQUID MIXING APPLICATIONS</b> .....	63
<i>Bastien Delacroix, Bruno Blais, Louis Fradette, Francois Bertrand</i>	
<b>(554D) DESIGN OPTIMIZATION OF CONTRA-ROTATING, BAFFLE-FREE IMPELLERS FOR MAXIMIZING SOLID-LIQUID MIXING EFFICIENCY</b> .....	64
<i>Pongsarun Satjaritanun, John A. Regalbuto, John R. Regalbuto, Sirivatch Shimpalee, John W. Weidner</i>	
<b>(554E) IMMISCIBLE LIQUID-LIQUID MIXING STRATEGY IN AN AGITATED CHEMICAL REACTOR – A COMPUTATIONAL FLUID DYNAMICS STUDY</b> .....	65
<i>Rui C. Silva, Maria Inês Lopes, Filipe Neves</i>	
<b>(554H) THE EFFECT OF THE PRESENCE OF INTERNALS ON THE FLOW REGIME IN INDUSTRIAL-SCALE BUBBLE COLUMN REACTOR</b> .....	66
<i>Muthanna H. Al-Dahhan, Joshua P. Schlegel, Hayder Al-Naseri, Sebastián Uribe</i>	
<b>(597A) ON THE JOINT USE OF SIMULATION AND EXPERIMENTATION TO CLARIFY SOLID-LIQUID MIXING BEHAVIOR</b> .....	67
<i>François Bertrand</i>	
<b>Author Index</b>	