

## REBECCA GARLOCK ONG

CHEMICAL SCIENCES AND CHEMICAL ENGINEERING 2021

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### RESEARCH INTERESTS

- Understanding how field environmental/agronomic conditions, lignocellulosic feedstock characteristics, and processing methods interact to affect biofuel and product yields.
- Development of fuel and products from lignocellulosic materials and upcycled waste plastics.
- Sustainability of the bioenergy and bio-based product industries.

### EDUCATION

<b>Ph.D. Chemical Engineering</b> , Michigan State University	<b>December 2011</b>
Dissertation Title: <i>Interactions between Biomass Feedstock Characteristics and Bioenergy Production: From the Landscape to the Molecular Scale</i>	
Thesis Advisor: Dr. Bruce E. Dale	
<b>B.S. Chemical Engineering</b> , Michigan Technological University	<b>April 2005</b>
<b>B.S. Biological Sciences, Concentration in Plant Biology</b> , Michigan Technological University	<b>April 2005</b>

### WORK EXPERIENCE

Aug 2016 – Present	<b>Assistant Professor</b> , Department of Chemical Engineering, Michigan Technological University
Jan 2016 – May 2016	<b>Research Assistant Professor</b> , Department of Chemical Engineering, Michigan Technological University, Houghton, MI
Aug 2015 – Dec 2015	<b>Instructor</b> , Department of Chemical Engineering, Michigan Technological University, Houghton, MI
Dec 2013 – Aug 2016	<b>Research Assistant Professor</b> , Biomass Conversion Research Laboratory (BCRL) and Great Lakes Bioenergy Research Center (GLBRC), Michigan State University, East Lansing, MI
Feb 2012 – Dec 2013	<b>Research Technician III/S</b> , Biomass Conversion Research Laboratory (BCRL) and Great Lakes Bioenergy Research Center (GLBRC), Michigan State University, East Lansing, MI
Sept 2010 – Apr 2011	<b>Visiting Scholar</b> , Hong Kong University of Science and Technology, Kowloon, Hong Kong <i>Dow Chemical Hong Kong – Michigan Scholarship</i>
Aug 2006 – Dec 2011	<b>Graduate Research Assistant</b> , Biomass Conversion Research Laboratory (BCRL) and Great Lakes Bioenergy Research Center (GLBRC), East Lansing, MI

### RESEARCH

#### Research Funding

2020 - 2024	<i>BioPROTEIN - Biological Plastic Reuse by Olefin and Ester Transforming Engineered Isolates and Natural Consortia</i> , DARPA – Department of Defense.
2019 – 2024	<i>Convergence Proposal: Michigan Community and Anishinaabe Renewable Energy Sovereignty</i> , National Science Foundation.
2019 – 2020	<i>Bringing Engineering to Rural, Low Income, Native American Early Elementary Children, Families in the U.P. via Teacher-Training and Outreach Events</i> , Michigan Space Grant Consortium

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2017 – 2022	<i>Great Lakes Bioenergy Research Center</i> , U.S. Department of Energy via University of Wisconsin-Madison.
2012 – 2015	<i>Applying Engineering Principles to Increase the Impact of GLBRC Basic Research</i> . <u>Project Leads: Rebecca Garlock Ong and Bruce Dale/Mingjie Jin</u> . DOE, GLBRC, BER DE-FC02-07ER64494
2012 – 2015	<i>Pretreatment Service Facility</i> . <u>Project Leads: Steve Slater/David Cavalier and Rebecca Garlock Ong</u> . DOE, Great Lakes Bioenergy Research Center, BER DE-FC02-07ER64494
2009 – 2012	Assisted in development of various Great Lakes Bioenergy Research Center funded project proposals.

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## PUBLICATIONS

### PEER-REVIEWED ARTICLES

1. Andeme Ela RC, Tajiri M, Newberry NK, Heiden PA, **Ong RG**. Double-Shell Lignin Nanocapsules Are a Stable Vehicle for Fungicide Encapsulation and Release. *ACS Sustain. Chem. Eng.* (2020). <https://doi.org/10.1021/acssuschemeng.0c06686>.
2. Dale BE, Bozzetto S, Couturier C, Fabbri C, Hilbert JA, **Ong R**, Richard T, Rossi L, Thelen KD, Woods J. The potential for expanding sustainable biogas production and some possible impacts in specific countries. *BioFPR* (2020). <https://doi.org/10.1002/bbb.2134>.
3. Andeme Ela RC, Spahn L, Safaie N, Ferrier RC, and **Ong RG**. Understanding the Effect of Precipitation Process Variables on Hardwood Lignin Characteristics and Recovery from Black Liquor. *ACS Sustain. Chem. Eng.* (2020). 10.1021/acssuschemeng.0c03692.
4. Chundawat SPS, Pal RK, Zhao C, Campbell T, Teymouri F, Videto J, Nielson C, Wieferich B, Sousa L, Dale BE, Balan V, Chipkar S, Aguado J, Burke E, and **Ong RG**. Ammonia Fiber Expansion (AFEX) Pretreatment of Lignocellulosic Biomass. *JoVE* (2020). 10.3791/57488(158):e57488.
5. Williams DL, **Ong RG**, Mullett JE, and Hodge DB. Integration of Pretreatment With Simultaneous Counter-Current Extraction of Energy Sorghum for High-Titer Mixed Sugar Production. *Front. Energ. Res.* (2019) **6**(133).
6. Zhang Y, Oates LG, ... and **Ong RG**. Diverse lignocellulosic feedstocks can achieve high field-scale ethanol yields while providing flexibility for the biorefinery and landscape-level environmental benefits. *Glob. Change Biol. Bioenergy*. 2018. **10**(1):825-840.
7. **Ong RG**, Shinde S, da Costa Sousa L, et al. Pre-senescence harvest of switchgrass inhibits xylose utilization by engineered yeast. *Front. Energ. Res.* 2018. **6**(52).
8. Kumar R, Bhagia S, Smith MD, Petridis L, **Ong RG**, et al. Cellulose-hemicellulose interactions at elevated temperatures increase cellulose recalcitrance to biological conversion. *Green Chem.* 2018. **20**(4):921-934.
9. Williams DL, Crowe JD, **Ong RG**, et al. Water sorption in pretreated grasses as a predictor of enzymatic hydrolysis yields. *Bioresource Technol.* 2017; 245:242-249.
10. Crowe JD, Feringa N, Pattathil S, Merritt B, Foster C, Dines D, **Ong RG**, Hodge DB. Identification of developmental stage and anatomical fraction contributions to cell wall recalcitrance in switchgrass. *Biotechnol. Biofuels* 2017; **10**:184.
11. Valli L, Rossi L, Fabbri C, Sibilla F, Gattoni P, Dale BE, **Ong RG**, Bozzetto S, et al. Greenhouse gas emissions of electricity and biomethane produced using the Biogasdoneright™ system: four case studies from Italy. *BioFPR* 2017; <http://dx.doi.org/10.1002/bbb.1789>.
12. **Ong RG**, et al. Inhibition of microbial biofuel production in drought-stressed switchgrass hydrolysate. *Biotechnol. Biofuels* 2016; **9**:237.
13. Park S-H, **Ong RG**, & Sticklen M. Strategies for the production of cell wall-deconstructing enzymes in lignocellulosic biomass and their utilization for biofuel production. *Plant Biotechnol. J.* 2016; **14**:1329-1344.

14. Serate J, Xie D, ...**Ong RG**, and Zhang YP. Controlling microbial contamination during hydrolysis of AFEX-pretreated corn stover and switchgrass: effects on hydrolysate composition, microbial response and fermentation. *Biotechnol. Biofuels* 2015; 8(1):1-17.
15. Karlen DL, Beeler LW, **Ong RG**, Dale BE. Balancing energy, conservation, and soil health requirements for plant biomass. *J. Soil Water Conserv.* 2015; (70); 5:279-287.
16. Park, S-H, Mei C, **Ong RG**, Sticklen M. Lignin Down-regulation of *Zea mays* via dsRNAi and Klason Lignin Analysis. *J. Vis. Exp.* 2014; (89):e51340, doi:10.3791/51340.
17. Dale BE, **Ong RG**. Design, implementation, and evaluation of sustainable bioenergy production systems. *BioFPR*. 2014; 8:487-503.
18. Dale BE, Anderson JE, ...**Ong RG**, et al. Take a closer look: Biofuels can support environmental, economic and social goals. *Environ. Sci. & Technol.* 2014; 48:7200-7203.
19. Shao Q, Cheng C, **Ong RG**, Zhu L, Zhao C. Hydrogen peroxide presoaking of bamboo prior to AFEX pretreatment and impact on enzymatic conversion to fermentable sugars. *Bioresour. Technol.* 2013; 142:26-31.
20. Dale BE, **Ong RG**. Energy, wealth, and human development: Why and how biomass pretreatment research must improve. *Biotechnol. Progr.* 2012; 28:893-898.
21. Park S-H, Mei C, Pauly M, **Ong RG**, Dale BE, Sabzikar R, Fotoh H, et al. Down-regulation of maize cinnamoyl-CoA reductase via RNAi technology causes brown midrib and improves AFEX-pretreated conversion into fermentable sugars for biofuels. *Crop Sci.* 2012; 52:2687-2701.
22. Kim S, Dale BE, **Ong RG**. An alternative approach to indirect land use change: Allocating greenhouse gas effects among different uses of land. *Biomass Bioenerg.* 2012; 46:447-452.
23. **Garlock RJ**, Bals B, Jasrotia P, Balan V, Dale BE. Influence of variable species composition on the saccharification of AFEX™ pretreated biomass from unmanaged fields in comparison to corn stover. *Biomass Bioenerg.* 2012; 37:49-59.
24. **Garlock RJ**, Balan V, Dale BE. Optimization of AFEX™ pretreatment conditions and enzyme mixtures to maximize sugar release from upland and lowland switchgrass. *Bioresour. Technol.* 2012; 104:757-768.
25. **Garlock RJ**, Wong YS, Balan V, Dale BE. AFEX pretreatment and enzymatic conversion of black locust (*Robinia pseudoacacia* L.) to soluble sugars. *Bioenergy Res.* 2012; 5:306-318.
26. **Garlock RJ**, Balan V, Dale BE, Ramesh Pallapolu V, Lee YY, Kim Y, Mosier NS, et al. Comparative material balances around pretreatment technologies for the conversion of switchgrass to soluble sugars. *Bioresour. Technol.* 2011; 102:11063-11071.
27. Falls M, Shi J, Ebrik MA, Redmond T, Yang B, Wyman CE, **Garlock R**, et al. Investigation of enzyme formulation on pretreated switchgrass. *Bioresour. Technol.* 2011; 102:11072-11079.
28. Shi J, Ebrik MA, Yang B, **Garlock RJ**, Balan V, Dale BE, Ramesh Pallapolu V, et al. Application of cellulase and hemicellulase to pure xylan, pure cellulose, and switchgrass solids from leading pretreatments. *Bioresour. Technol.* 2011; 102:11080-11088.
29. Kim Y, Mosier NS, Ladisch MR, Ramesh Pallapolu V, Lee YY, **Garlock R**, Balan V, et al. Comparative study on enzymatic digestibility of switchgrass varieties and harvests processed by leading pretreatment technologies. *Bioresour. Technol.* 2011; 102:11089-11096.
30. Donohoe BS, Vinzant TB, Elander RT, Pallapolu VR, Lee YY, **Garlock RJ**, Balan V, et al. Surface and ultrastructural characterization of raw and pretreated switchgrass. *Bioresour. Technol.* 2011; 102:11097-11104.
31. Tao L, Aden A, Elander RT, Pallapolu VR, Lee YY, **Garlock RJ**, Balan V, et al. Process and technoeconomic analysis of leading pretreatment technologies for lignocellulosic ethanol production using switchgrass. *Bioresour. Technol.* 2011; 102:11105-11114.

32. Pallapolu VR, Lee YY, **Garlock RJ**, Balan V, Dale BE, Kim Y, Mosier NS, et al. Effects of enzyme loading and  $\beta$ -glucosidase supplementation on enzymatic hydrolysis of switchgrass processed by leading pretreatment technologies. *Bioresour. Technol.* 2011; 102:11115-11120.
33. **Garlock RJ**, Chundawat SPS, Balan V, Dale BE. Optimizing harvest of corn stover fractions based on overall sugar yields following ammonia fiber expansion pretreatment and enzymatic hydrolysis. *Biotechnol. Biofuels* 2009; 2:29.

**BOOK CHAPTERS**

1. **Ong RG**, Chundawat SPS, Hodge DB, Keskar S, Dale BE. Linking Plant Biology and Pretreatment – Understanding the Structure and Organization of the Plant Cell Wall and Interactions with Cellulosic Biofuel Production. In: McCann MC, Buckeridge MS, Carpita NC, eds. *Plants and BioEnergy*: Springer New York; 2014, p. 231-253.
2. Chundawat SPS, Bals B, Campbell T, Sousa L, Gao D, Jin M, Eranki P, **Garlock R**, et al. Primer on Ammonia Fiber Expansion Pretreatment. In: Wyman CE, ed. *Aqueous Pretreatment of Plant Biomass for Biological and Chemical Conversion to Fuels and Chemicals*. John Wiley and Sons, Ltd., 2013, p. 169-200.
3. Balan V, Bals B, da Costa Sousa L, **Garlock R**, and Dale BE, A Short Review on Ammonia-based Lignocellulosic Biomass Pretreatment, in *Chemical and Biochemical Catalysis for Next Generation Biofuels*. 2011, The Royal Society of Chemistry. p. 89-114.

**EMPLOYEES AND STUDENTS SUPERVISED**

<u>Employee</u>	<u>Job Title</u>	<u>Time Period</u>
Leela Joshi	Assitant Research Scientist	2019
Pete Donald	AFEX Technician	2012-2016
Margaret Kreuger	Research Technician	2015-2016
Mahboubeh Shabani Samghabadi	Research Technologist	2013-2015

**Graduate Student Researchers Advised**

<u>Student</u>	<u>Major &amp; Degree</u>	<u>Time Period</u>
Aiden Truettner	M.S. Chemical Engineering	Fall 2020 - Current
Marissa Gallmeyer	M.S. Chemical Engineering	Fall 2019 – Current
Karleigh Krieg	M.S. Environmental Engineering	Summer 2019 – Current
Rasia Carmen Andame Ela	Ph.D. Chemical Engineering	Fall 2018 – Current
Sarvada Chipkar	Ph.D. Chemical Engineering	Fall 2017 – Current
Meenaa Chadrashekar	Ph.D. Chemical Engineering	Spring 2017 – Current

**Undergraduate Student Researchers Advised**

<u>Student</u>	<u>Major &amp; Degree</u>	<u>Time Period</u>
Larkin Hooker-Moericke	B.S. Chemical Engineering	Spring 2020 - Current
Katlyn Jeffries	B.S. Chemical Engineering	Spring 2020
Jailynn Johnson	B.S. Chemistry	Fall 2019 - Current
Briana Cronk	B.S. Medical Laboratory Science	Summer 2019 – Fall 2020
Hazen Keinath	B.S. Biochemistry and Molecular Biology	Summer 2019 – Fall 2020
Jasmine Cassidy	B.S. Chemical Engineering	Summer 2019 – Current
Jacob Aguado	B.S. Chemical Engineering	Summer 2019
Lauren Spahn	B.S. Chemical Engineering	Fall 2018 – Current
Adam Schmidt	B.S. Chemical Engineering	Spring 2019
William Otto	B.S. Chemical Engineering	Fall 2018 - Spring 2019
Marissa Gallmeyer	B.S. Chemical Engineering	Fall 2018 - Spring 2019

Emily Burke	B.S. Chemical Engineering	Spring 2018 – Current
Meredith Grusnick	B.S. Chemical Engineering	Spring 2018 – Spring 2020
Jacob LeBarre	B.S. Chemical Engineering	Spring 2018 – Fall 2018
Drew Applegath	B.S. Electrical Engineering	Spring 2018 – Fall 2018
Samual Lakninen	B.S. Mech. & Electrical Eng.	Spring 2018 – Spring 2019
Will Dion	B.S. Biochemistry	Fall 2013 – Spring 2014
Brennan Furman	B.S. Chemical Engineering	Spring 2012 – Fall 2014
Aaron Vigil	B.S. Chemical Engineering	Spring 2012 – Spring 2014
Yi Siang (Isaac) Wong	B.S. Biological Sciences	Spring – Summer 2009

### High School Student Researchers Advised

<u>Student</u>	<u>Period</u>
Alondra Llerena	Summer 2019
Macarena Peralta	Summer 2019
Tanvi Joshi	Fall 2013 – Summer 2014

### TEACHING

<u>Courses Taught</u>	<u>University</u>	<u>Year</u>
CM4125: Bioprocess Engineering Laboratory	MTU	2020
CM2110: Fundamentals of Chemical Engineering I	MTU	2019
CM5300: Advanced Transport Phenomena (Graduate Course)	MTU	2015, 2017-2020
CM4310: Chemical Process Safety & Environment (Co-Taught)	MTU	2017-2018
CM3979/ENT3979: Alternative Energy Technology	MTU	2017-2020
CM1000: Introduction to Chemical Engineering	MTU	2015

<u>Guest Lectures</u>	<u>University</u>	<u>Year</u>
Botany	MTU	2018-2019
Environmental Plant Biology	Bethel University	2017
Biomass Conversion Engineering	MSU	2014

<u>Teaching Assistantships</u>	<u>University</u>	<u>Year</u>
Material and Energy Balances	MSU	2007
Fluids (Momentum and Heat Transfer)	MSU	2006

### OUTREACH AND SERVICE

- Grant Panel Reviewer: U.S. Department of Agriculture and National Science Foundation
- Poster Session Chair: Symposium on Biotechnology for Fuels and Chemicals (SBFC) Meeting. 2019-2021.
- Session Chair: American Institute of Chemical Engineers (AIChE) Annual Meeting. 2018-2019.
- Session Chair: Multiple times for various GLBRC retreat sessions. 2012 – Present.
- Session Chair: “Session for Young Scientists” – 1<sup>st</sup> Annual World Congress of Bioenergy. Dalian, China, **April 25-28, 2011**.
- Faculty Advisor: Omega Chi Epsilon (OXE) Chemical Engineering Honor Society. 2016 and 2018.
- Panel Moderator and Participant: “Unlimited Potential: A Roundtable Discussion with Renewable Energy and Energy Efficiency Experts” – Sponsored by the U.S. Consulate in Guangzhou, Guangdong, China, **April 21, 2011**.

- Ad hoc Reviewer: Applied Biochemistry and Biotechnology, BioEnergy Research, BioFPR, Bioresource Technology, Biotechnology for Biofuels, etc.

#### HONORS AND SOCIETY MEMBERSHIPS

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- 2020 Dean's Teaching Showcase – Michigan Technological University
- American Institute of Chemical Engineers (AIChE) Member
- Society of Industrial Microbiology and Biotechnology (SIMB) Member
- 2<sup>nd</sup> Annual Dow Chemical Hong Kong – Michigan Scholarship
- Tau Beta Pi Engineering Honor Society Member
- Omega Chi Epsilon (OXE) Chemical Engineering Honor Society Member
- Phi Kappa Phi Honor Society Member
- Dean's List, MTU Board of Control Scholarship, National Merit Scholarship and Michigan Merit Award