REBECCA GARLOCK ONG

CHEMICAL SCIENCES AND CHEMICAL ENGINEERING 202I
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RESEARCH INTERESTS

- Developing a comprehensive understanding of the biomass conversion process – how variability in upstream parameters (agronomic decisions, weather patterns, etc.) influences biomass characteristics, alters optimal processing variables, and affects process yields, economic viability, and environmental impacts.
- Investigating the variability in plant microstructure, cell wall components (lignin, ferulates, hemicelluloses, minerals, etc.) and their properties, and their impact on lignocellulosic biomass conversion processes.
- Development of lignocellulose-based co-products.

EDUCATION

Ph.D. Chemical Engineering, Michigan State University **December 2011**
Dissertation Title: *Interactions between Biomass Feedstock Characteristics and Bioenergy Production: From the Landscape to the Molecular Scale*
Thesis Advisor: Dr. Bruce E. Dale

B.S. Chemical Engineering, Michigan Technological University **April 2005**

B.S. Biological Sciences, Concentration in Plant Biology, Michigan Technological University **April 2005**

WORK EXPERIENCE

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

RESEARCH

Research Funding

2020 - 2024	*BioPROTEIN - Biological Plastic Reuse by Olefin and Ester Transforming Engineered Isolates and Natural Consortia*, DARPA – Department of Defense.
2019 – 2024	*Convergence Proposal: Michigan Community and Anishinaabe Renewable Energy Sovereignty*, National Science Foundation.

2019 – 2020 *Bringing Engineering to Rural, Low Income, Native American Early Elementary Children, Families in the U.P. via Teacher-Training and Outreach Events*, Michigan Space Grant Consortium

2017 – 2022 *Great Lakes Bioenergy Research Center*, U.S. Department of Energy via University of Wisconsin-Madison.

2012 – 2015 *Applying Engineering Principles to Increase the Impact of GLBRC Basic Research.* Project Leads: Rebecca Garlock Ong and Bruce Dale/Mingjie Jin. DOE, GLBRC, BER DE-FC02-07ER64494

2012 – 2015 *Pretreatment Service Facility*. Project Leads: Steve Slater/David Cavalier and Rebecca Garlock Ong. 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.

Employees Supervised

Employee	*Job Title*	*Time Period*
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

Student	*Major & Degree*	*Time Period*
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

Student	*Major & Degree*	*Time Period*
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 Laknenen	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

Student	*Period*
Alondra Llerena	Summer 2019
Macarena Peralta	Summer 2019
Tanvi Joshi	Fall 2013 – Summer 2014

TEACHING

Courses Taught	**University**	**Year**
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

Guest Lectures	**University**	**Year**
Botany	MTU	2018-2019
Environmental Plant Biology	Bethel University	2017
Biomass Conversion Engineering	MSU	2014

Teaching Assistantships	**University**	**Year**
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" *–1st Annual World Congress of Bioenergy.* Dalian, China, **April 25-28, 2011.**
- Faculty Advisor: Omega Chi Epsilon (ΟΧΕ) 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

- 2020 Dean's Teaching Showcase – Michigan Technological University
- American Institute of Chemical Engineers (AIChE) Member
- Society of Industrial Microbiology and Biotechnology (SIMB) Member
- 2nd Annual Dow Chemical Hong Kong – Michigan Scholarship
- Tau Beta Pi Engineering Honor Society Member

- Omega Chi Epsilon (ΟΧΕ) 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

PUBLICATIONS

PEER-REVIEWED ARTICLES

1. 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.
2. 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.
3. Williams DL, **Ong RG**, Mullet 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).
4. 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.
5. **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).
6. 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.
7. 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.
8. 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.
9. 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.
10. **Ong RG**, et al. Inhibition of microbial biofuel production in drought-stressed switchgrass hydrolysate. *Biotechnol. Biofuels* 2016; 9:237.
11. 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.
12. 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.
13. 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.
14. 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.
15. Dale BE, **Ong RG**. Design, implementation, and evaluation of sustainable bioenergy production systems. *BioFPR.* 2014; 8:487-503.

16. 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.

17. 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.

18. Dale BE, **Ong RG.** Energy, wealth, and human development: Why and how biomass pretreatment research must improve. *Biotechnol. Progr.* 2012; 28:893-898.

19. 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.

20. 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.

21. **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.

22. **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.

23. **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.

24. **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.

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. Pallapolu VR, Lee YY, **Garlock RJ**, Balan V, Dale BE, Kim Y, Mosier NS, et al. Effects of enzyme loading and β-glucosidase supplementation on enzymatic hydrolysis of switchgrass processed by leading pretreatment technologies. *Bioresour. Technol.* 2011; 102:11115-11120.

31. **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.