

## WEI LIAO, Ph.D., P.E.

### Education and Training

- Ph.D., Biological Systems Engineering, December 2005, Washington State University
- M.S., Biotechnology, December 1996, Jiangnan University, China
- B.S., Fermentation Engineering & Technology, July 1994, Jiangnan University, China
- Registered Professional Engineer, Washington State No. 42913

### Research and Professional Experience

- Professor and Director, Anaerobic Digestion Research and Education Center (ADREC), Dept. of Biosystems and Agricultural Engineering, Michigan State University, July 2019 – Present
  - Manage the MSU Anaerobic Digestion Research and Education Center (ADREC)
  - Develop on-farm biogas powered charging stations for off-road electric vehicles
  - Study the combination of biological and electrochemical processes to treat high-strength wastewater
  - Integrate solar, biological and nano technologies to create novel food, energy, and water (FEW) systems
  - Develop a one-carbon platform to convert CO<sub>2</sub> and CH<sub>4</sub> into fuel and chemicals
  - Conduct techno-economic analysis (TEA) and life-cycle assessment (LCA) for FEW systems
- Assistant/Associate Professor, Dept. of Biosystems and Agricultural Engineering, Michigan State University (East Lansing, MI), August 2007 – June 2019
  - Studied effects of environmental factors and process conditions on anaerobic microbes and digestion performance
  - Developed a new process to use anaerobic digestion as a pretreatment step to generate amendable lignocellulosic feedstock for biofuel and chemical production
  - Integrated anaerobic digestion and algae cultivation to treat animal wastes and generate value-added chemicals
- Research Associate, Dept. of Biological Systems Engineering, January 2006 – June 2007
  - Developed a biomass inventory and bioenergy assessment for Washington State
  - Developed a novel process of fungal fermentation using *Aspergillus terreus* to produce lovastatin and chitosan
  - Designed a fiber reactor to treat dairy manure to produce high-quality fiber for the plant nursery industry
- Research Assistant, Dept. of Biological Systems Engineering, August 2001 – December 2005
  - Developed a new state-of-the-art anaerobic digestion system for co-digestion with municipal and food wastes
  - Was a research Associate in NSF (National Science Foundation) IGERT (Integrative Graduate Education and Research Training) program
- Project Manager, Brewing Department, Suntory Co. January 1997 – July 2000
  - Conducted a TEA of a new beer production line
  - Participated in the project team to construct the new plant for 200,000 metric ton/year of beer production
  - Managed the installation of equipment and process control systems for the new brewing house
  - Designed a process to shorten the fermentation time by 20% and saved \$ 3 million/yr
  - Researched and developed on scaling up fermentation processes from bench top, through the pilot test, to plant production

### Honors and Awards

- Camden Endowed Teacher/Scholar Award, Michigan State University College of Agriculture and Natural Resources (CANR), 2020
- Withrow Global Leadership Award, Michigan State University College of Engineering, 2019.
- Team member for the partnership award for innovative program models, USDA CSREES, 2009.

### **Synergistic Activities**

- Developed new cross-disciplinary initiatives on wastes-to-resource research and development, and responding to major grant opportunities
- Established pilot facilities and conducted pilot-scale research in the U.S. and overseas, including the MSU anaerobic digestion/algal cultivation system, the container-based solar-bio-nano wastewater utilization system, the pilot-scale photobioreactor system at the MSU power plant, and the pilot solar-biopower system in Costa Rica
- Editorial board member of Journal of Bioresources and Bioprocessing, 2020 – present
- Member of the scientific committee of the 2021 university Scholar Conference: Engineering and Innovation (USC), Kathmandu University, Nepal, 2020-2021
- Co-chair of the executive committee for the 2022 Sustainable Energy for a Sustainable Future – An ASABE global engagement conference, 2019 – present
- Associate editor of Journal of Biotechnology for Biofuels and Bioproducts, 2019 – present
- Editorial board member of Journal of Biomass and Bioenergy, 2019 – present
- Member of the scientific advisory committee for BDT-TERI Center of Excellence on integrated production of advanced biofuels and biocommodities, The Energy Resources Institute (TERI), India. 2019 – present
- Member of the advisory board of Agricultural and Food Sciences (DISTAL) of University of Bologna, Italy. 2019 – present
- Organizer for the session of Water for Food Processing: Waste Reduction, Optimization and Reuse in Development Topic A at the 8<sup>th</sup> World Water Forum, Brasilia, Brazil, March 18 – 23, 2018
- Co-organizer for the session of challenges and opportunities for microalgal technologies at the 66<sup>th</sup> Canadian Chemical Engineering (CSCHE) Conference and Exhibition, Quebec City, Canada. October/17-20/2016
- Member of the working group to develop “Science-Based Methods and Technical Guidelines for Quantifying Greenhouse Gas Sources and Sinks in the Forest and Agriculture Sectors” for USDA Climate Change Program Office, 2011 – 2022

### **Peer-reviewed Publications** (during the past 4 years)

- Murillo-Roos, M., Uribe-Lorio, L., Fuentes-Schweizer, P., Vidaurre-Barahona, D., Brenes-Guillen, L., Jimenez, I., Arguedas, T., Liao, W., Uribe, L. 2022. Biogas production and microbial communities of mesophilic and thermophilic anaerobic co-digestion of animal manure and food wastes in Costa Rica. *Energies* 15, 3252.
- Valenti, F., Rojas-Sossa, J. P., Porto, S.M.C., Toscano, A., Marsh, T., Dale, B., Liu, Y., Liao, W. 2022. Effects of Mediterranean agricultural residues on microbial community and digestion performance. *Journal of Biofuels Bioproducts and Biorefining* 16(2), 523-536.
- Daiek, C., Liao, W., Liu, Y. 2022. Effects of water recirculation on microalgae and corresponding sustainability of the photobioreactor cultivation system. *Biomass and Bioenergy* 157, 106326.
- Thomas, B. D., Uludag-Demirer, S., Frost, H., Liu, Y., Dusenbury, J.S., Liao, W. 2022. Decentralized high-strength wastewater treatment using a compact aerobic baffled bioreactor. *Environmental Management* 305, 114281.

- Xiao, Z., Zheng, Y., Gudi, C. R., Liu, Y., Liao, W., Tang, Y. J. 2021. Development of a kinetic model to describe six types of symbiotic interactions in a formate utilizing microalgae-bacteria cultivation system. *Algal Research* 58, 102372
- Bustamante, M., Engeda, A., Liao, W. 2021. Small-scale solar-bio-hybrid power generation using Brayton and Rankine cycles. *Energies* 14, 472
- Xu, M., Uludag-Demirer, S., Fang, D., Zhou, L., Liu, Y., Liao, W. 2021. Effects of pyrogenic carbonaceous materials on anaerobic digestion of a nitrogen-rich organic waste – Swine manure. *Energy and Fuels* 35(3), 2282-2292
- Cutshaw, A., Daiek, C., Zheng, Y., Frost, H., Marks A., Clements, D., Uludag-Demirer S., Verhanovitz, N., Pavlik, D., Clary, W., Liu, Y., Liao, W. 2020. A long-term pilot-scale algal cultivation on power plant flue gas – Cultivation stability and biomass accumulation. *Algal Research* 52, 102115
- Francesca, V., Liao, W., Simona, P. 2020. Life cycle assessment of agro-industrial by-products reuse: a comparison between anaerobic digestion and conventional disposal treatments. *Green Chemistry* 22(20) 7729-7139.
- Hussain, J., Wang, X., Sousa, L., Ali, R., Rittmann, B. E., Liao, W. 2020. Using non-metric multi-dimensional scaling analysis and multi-objective optimization to evaluate green algae for production of proteins, carbohydrates, lipids, and simultaneously fix carbon dioxide. *Biomass and Bioenergy* 141, 105711.
- Uludag-Demirer, S., Olson, N., Ives, R., Nshimyimana, J. P., Rusinek, C.A., Rose, J. B., Liao, W. 2020. Techno-economic analysis of electrocoagulation on water reclamation and bacterial/viral indicator reductions of a high-strength organic wastewater – Anaerobic digestion effluent. *Sustainability* 12, 2697.
- Zhong, Y., Frost, H., Bustamante, M., Li, S., Liu, Y., Liao, W. 2020. A mechano-biocatalytic one-pot approach to release sugars from lignocellulosic materials. *Renewable and Sustainable Energy Reviews* 121, 109675.
- Wang, L., Long, F., Liao, W., Hong, L. 2020. Prediction of anaerobic digestion performance and identification of critical operational parameters using machine learning algorithms. *Bioresource Technology* 298, 122495.
- Zhong, Y., Chen, R., Rojas-Sossa, J., Isaguirre, C., Mashburn, A., Marsh, T., Liu, Y., Liao, W. 2020. Anaerobic co-digestion of energy crop and agricultural wastes to prepare uniform-format cellulosic feedstock for biorefining. *Renewable Energy* 147, 1358-1370.
- Rojas-Sossa, J., Zhong, Y., Valenti, F., Blackhurst, J., Marsh, T., Kirk, D., Fang, D., Dale, B., Liao, W. 2019. Effect of ammonia fiber expansion (AFEX) treated corn stover on anaerobic microbes and corresponding digestion performance. *Biomass and Bioenergy* 127, 105263.
- Valenti, F., Porto, S.M.C., Dale, B.E., Liao, W. 2018. Spatial analysis of feedstock supply and logistics to establish regional biogas power generation: A case study in Sicilian region. *Renewable and Sustainable Energy Reviews* 97, 50-63.
- Paritosh, K., Yadav, M., Mathur, S., Balan, V., Liao, W., Pareek, N., Vivekanand, V. 2018. Organic fraction of municipal solid waste: overview of treatment methodologies to enhance anaerobic biodegradability. *Frontiers in Energy Research* 6, 75.
- Valenti, F., Zhong, Y., Sun, M., Porto, S. M. C., Toscano, A., Dale, B.E., Sibilla, F., Liao, W. 2018. Anaerobic co-digestion of multiple agricultural residues to enhance biogas production in Southern Italy. *Journal of Waste Management* 78, 151-157.
- Valenti, F., Liao, W., Porto, S.M.C. 2018. A GIS-based spatial index of feedstock-mixture availability for anaerobic co-digestion of Mediterranean by-products and agricultural residues. *Journal of Biofuels Bioproducts and Biorefining* 12(3), 362-378.