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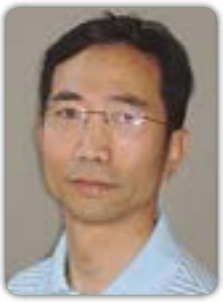

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Intermittent vacuum assisted thermophilic AD and biorefining technologies for liquid and solid waste utilization and treatment

Organic solid and liquid wastes, such as animal manure and food wastes, contain large amounts of energy, nutrients, and water, and should not be perceived as merely waste. Treatment and disposal have been the primary management strategy for wastewater; while recycling, composting, and combustion of non-recyclables have been practiced for decades to capture the energy and values from municipal solid wastes. As new technologies are emerging, alternative options for utilization of both wastewater and solid wastes have become available. Considering the complexity of chemical, physical, and biological properties of these wastes, multiple technologies may be required to maximize the energy and value recovery from the wastes. For this purpose, biorefining tends to be an appropriate approach to completely utilize and therefore treat them. Research has demonstrated that the liquid waste streams have the potential to support crop and algae growth and provide other energy recovery and food production options, while the non-recyclable waste materials and bio-solids can be converted into useable heat, electricity, or fuel and chemical through a variety of processes. In this presentation, new biorefining schemes especially for organic solid and liquid wastes from municipal sources, food and biological processing plants, and animal production facilities have been proposed. Four new breakthrough technologies, namely intermittent vacuum-assisted thermophilic anaerobic digestion (AD), extended aquaponics, oily wastes to biodiesel via glycerolysis, and microwave assisted thermochemical conversion, can be incorporated into the biorefining schemes, enabling complete utilization and therefore treatment of those wastes for the production of chemicals, fertilizer, energy (biogas, syngas, biodiesel, and bio-oil), foods, and feeds, resulting in clean water and a significant reduction in pollutant emissions.

Recent Publications

1. Erik Anderson, Min Addy, Paul Chen and Roger Ruan (2017) Development and operation of innovative scum to biodiesel pilot-system for the treatment of floatable wastewater scum. Bioresource Technology. 249:1066-1068. Doi:10.1016/j.biortech.2017.10.075.
2. Dengle Duan et al. (2018) Microwave-assisted acid pretreatment of alkali lignin: effect on characteristics and pyrolysis behavior. Bioresource Technology. 251:57-62.
3. Leilei Dai et al. (2018) Hydrothermal pretreatment of bamboo sawdust using microwave irradiation. Bioresource Technology. 247:234-241.
4. Yunfeng Zhao (2018) Fast microwave-assisted ex-catalytic co-pyrolysis of bamboo and polypropylene for bio-oil production. Bioresource Technology. 249:69-75.
5. Xiangyuan Deng et al. (2018) Cultivation of *Chlorella vulgaris* on anaerobically digested swine manure with daily recycling of the post-harvest culture broth. Bioresource Technology. 247:716-723.

Biography

Roger Ruan is the Director of Center for Biorefining and Professor of Bioproducts and Biosystems Engineering Department at the University of Minnesota, USA and Fellow of American Society of Agricultural and Biological Engineers. He has published over 400 papers in refereed journals, books, and book chapters, and over 300 meeting papers and other reports, and holds 18 US patents. He is also a top cited author in the area of agricultural and biological sciences. He has supervised over 65 graduate students, 110 Postdoctors, Research Fellows, and other Engineers and Scientists, and 12 of his PhD students and 8 other Postdoctors hold university faculty positions. He has received over 160 projects totaling over $40 million in various funding for research, including major funding from USDA, DOE, DOT, DOD, and industries. He has served as Guest Editor and/or Editorial Board Member of Bioresource Technology, etc. and Editor-in-Chief and Chairman of the board for *International Journal of Agricultural and Biological Engineering*.

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