Research Statement

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Summary (More details can be provided upon request)

Increasing wet organic waste production has become an unavoidable issue in the US. Although often considered as environmental pollutants, these wet organic feedstocks contain large amounts of unharnessed energy and nutrients. My research aims to recover the energy and nutrients from the wet organic waste with appropriate waste remediation systems (**Figure 1**). Hydrothermal treatments, including catalytic hydrothermal gasification (CHG) and hydrothermal liquefaction (HTL), is a new energy efficient thermochemical process that can generate high-energy content biogas/biocrude and simultaneously reduce total organic carbon in wastewater. In contrast, anaerobic digestion (AD) is a widely utilized biochemical process that similarly produces renewable biogas. Application of different catalysts and adsorbents in each scenario can increase energy yields and nutrient recovery. Running both systems in parallel on identical wet organic wastes can compare energy returns and pollutant reduction through techno-economic analysis. In addition, effluent waters from each process containing high concentrations of nitrogen and phosphorous, amongst other dilute nutrients, can be further recycled as a desirable substrate for production of crops (e.g. algal biomass or crops grown in hydroponic systems). Secondary algal treatment of wastewaters from CHG/HTL and AD will clean water for environmental discharge meeting EPA standards and also generate renewable resources for further application. Simultaneously, using isotopes with representative model compounds in CHG/HTL process can further elucidate the reaction kinetics, network, and mechanism in this biomass conversion system. Successful completion of these objectives will provide clearer understanding of how advanced thermochemical and biochemical waste remediation technologies can alleviate the ***food-water-energy nexus***.

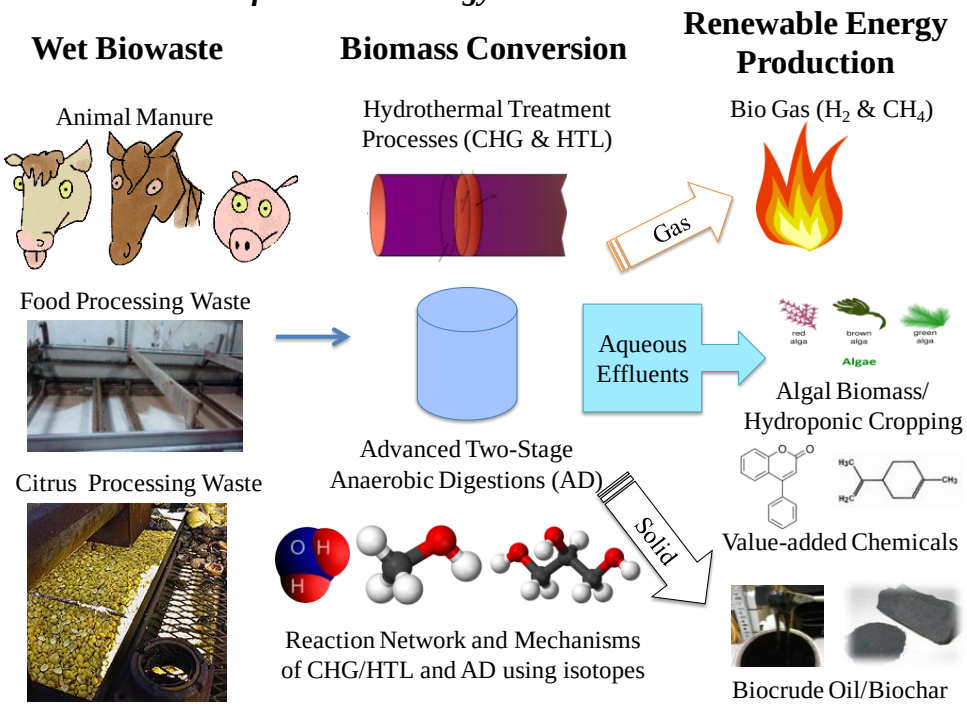

Figure 1. Hydrothermal treatments (CHG & HTL) and advanced two-stage anaerobic digestions for enhanced conversion of wet biowastes to renewable fuels

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