Integrating Anaerobic and Hydrothermal Treatment of Dairy and Food Biowastes: A Sustainable Systems Approach for Biofuel and Animal Feed Production and Nutrient Recovery

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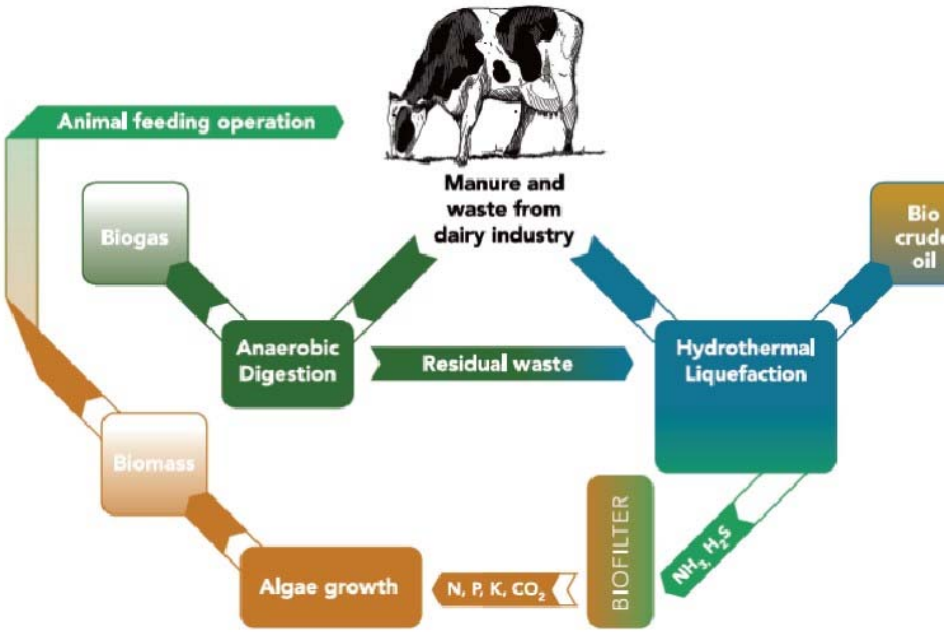
My project focuses on developing a new technology that directly addresses two critical sustainability challenges -- the management of dairy and food production wastes to recover renewable energy and agricultural nutrients while minimizing effluents to the environment. We propose to couple anaerobic digestion and biofiltration with hydrothermal liquefaction and gasification in supercritical water in a unique hybrid system to maximize the recovery of renewable energy (biogas, liquid biofuels and thermal energy), and facilitate the capture and recycle of nitrogen, phosphorous, and potassium (N-P-K) nutrients. The proposed technology will recover these nutrients in elemental form and will minimize the discharge of N-P-K compounds to the environment. Simultaneously, the process will substantially reduce other emissions to water and air sheds, such as bio toxins, organic micro-pollutants, anthropogenic carbon, and SOx, NOx, and particulates. A key element of our work is centered on evaluating the technical feasibility of this hybrid approach in a set of carefully designed experiments on model waste streams. In addition, we intend to quantify impacts using sfull life cycle analysis and evaluate the economic feasibility of scaled up applications for deployment on dairy farms ranging in size from about 250 to 2000 cows or larger and industrial level food production on a scale from 100 to 1000 tons per day.



Schematic of the integrated biorefinery for dairy manure and food waste reduction, biofuel production and nutrient recovery.