Conversion of lignocellulose including biosolids and green waste to Biogas

Conly Hansen
Utah State University, USA

Lignocellulosic biomass is the most abundantly available raw material on the Earth for the production of biofuels. The conversion of lignocellulose into renewable energy and more valuable chemicals has been limited. Several methods for increasing the conversion of lignocellulose into energy by pretreating the feedstock have been developed, but all of the existing methods have large economic penalties, e.g. disposal of toxic wastes and greatly increased capital and operating costs. The discovery and characterization of Caldicellulosiruptor microbes; extremophilic organisms capable of solubilizing lignocellulose, suggested a possible solution to the economic problem of pretreatment. Beginning in 2014, recognizing the potential for anaerobic digestion of lignocellulose for biogas production, a multidisciplinary team including a biochemist, chemist, microbiologist and agricultural engineer, from Brigham Young and Utah State Universities has been conducting experiments to determine if we could break down lignocellulose feedstocks for later anaerobic digestion. The definition of breakdown in this case means conversion of organic solids in a high temperature vessel (175°C) containing Caldicellulosiruptor bescii into a type of tea that contains mostly acetate and lactate in water. Results to date indicate nearly 90% breakdown in 18 – 24 hrs. of certain plant materials including grass and leaves collected at municipal sanitary landfills. Perhaps the most significant results were that brewery waste that is somewhat refractory to anaerobic treatment could be partially broken down (50%) and even aerobic sludge from a wastewater treatment plant that was previously anaerobically digested in a mesophilic process and sun dried could be further broken down (additional nearly 40% destruction). This presentation will report the results of work we have done to take the process from the lab to the market; the hurdles to scaling and commercializing the anaerobic digestion of lignocellulose in an economically viable way.