Optimizing Thermal Hydrolysis for Increased Biogas Generation in Wastewater Treatment

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New York City process approximately 1.3 billion gallons of wastewater daily and with such quantities, wastewater treatment has become increasingly energy intensive and costly (DEP, 2016). In addition to these environmental and economic issues in the sanitation industry, wastewater treatment poses significant humanitarian concerns. Across the United States, the vast majority of wastewater treatment plants are housed in close proximity to residential areas which results in the foul odors and chemicals disrupting the living conditions of residents. This research seeks to develop a pre-treatment process, known as thermal hydrolysis, that extracts greater amounts of biogas from wastewater while simultaneously reducing odors in wastewater treatment. The engineering objectives were to optimize this process by finding the ideal location for thermal hydrolysis in the wastewater treatment process as well as determining the time and temperature that would yield the greatest net energy gain. The samples of waste activated sludge, thickened underflow, digested sludge, and primary sludge at four different sampling points throughout the wastewater treatment process. A group of samples were thermally hydrolyzed for a time range of 10 to 60 minutes at a temperature range of 20 to 200°C. Both the hydrolyzed samples and the control group (non-hydrolyzed samples) were tested for COD and TSS/VSS followed by the placement of the samples in a homemade benchscale anaerobic digester for quantification of biogas generation. This research shows that the waste activated sludge yielded the greatest net energy gain of 8.8 kWh when heated to 160°C for a contact time of 30 minutes.

Awards Won:
Second Award of $1,500