Enhanced Biomethane Recovery and Volume Reduction of Pulp Mill Biosolids

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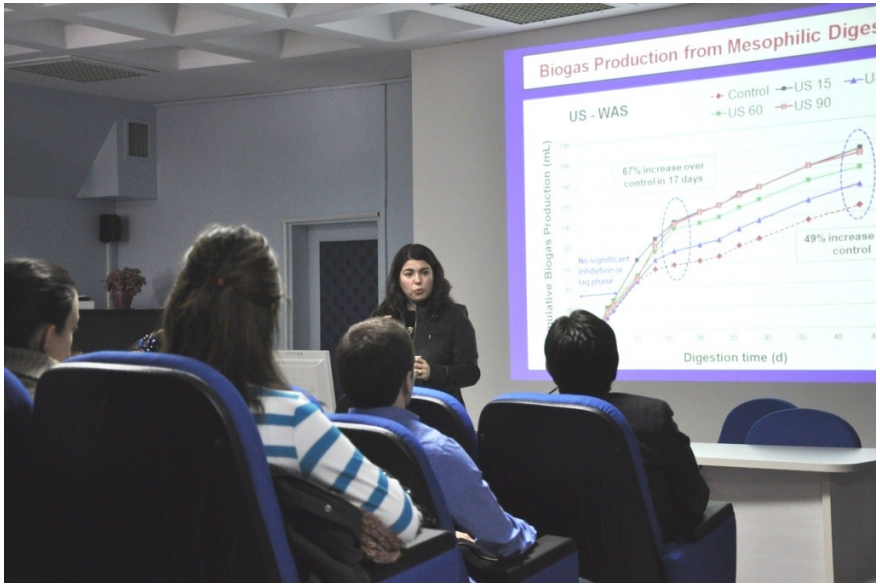
This research addresses the needs of one of the major BC industries (pulp/paper sector) for efficient biowaste to bioenergy production. The community of Quesnel (BC) was used as a test case for technology development. Under an extensive Bio-Energy/Bio-Products Strategy, Quesnel River Pulp (QRP) mill is investigating the technical and economic feasibility of producing methane from QRP mill biosolids in an advanced anaerobic digester. Therefore, in this study, thermal (Microwave Accelerated Reaction System, 1250 W, 2450 MHz, temperature range 25-260^{o}C), and ultrasonic (20 kHz, 400 W) pretreatments were applied to QRP waste sludge to enhance methane production and reduce sludge retention time (SRT) requirements in the subsequent anaerobic digesters. At laboratory scale, effects of four different variables [microwave temperature (50-175^{o}C at 25^{o}C increments) and sonication time (15-90 min at 15 min intervals), waste sludge type [waste activated sludge (WAS) and mixed (WAS/primary) sludge] and digester temperature [mesophilic (35 ± 2^{o}C) and thermophilic (55 ± 2^{o}C)] were investigated on waste disintegration as well as methane yields from the QRP waste sludges. This experimental design resulted in a total of 96 batch digesters including controls (no pretreatment) and duplicates.

Microwave pretreatment was found most effective, increasing methane yield more than 100% compared to control digesters. Sonication solubilized the sludge samples best, but resulted in the formation of soluble non-biodegradable compounds. However, methane potential improvements over controls were higher for mesophilic digesters since thermophilic controls were benefitting from elevated digester temperatures after pretreatments.


Why Pretreatment before Digestion?
Difficult to digest, complex
polymeric network of sludge


Electromagnetic Spectrum
Microwave Oven
Cellular Telephone
2450 Mhz = 2.45 Ghz
915 Mhz
12.24
37.24 (deep penetration)


Biogas Production from Mesophilic Diges
US - WAS
Control
US 15
US 60
US 90
67% increase over
control in 17 days
49% increase
control
No significant
inhibition of
lag phase
Cumulative Biogas Production (mL)
Digestion time (d)