A Study of

Ultrasonic Pretreatment of Feedstock Before Anaerobic Digestion

M. Moisan - A. Dutta (3) - B. Van Heyst

Statement of the Problem

Biogas production can be enhanced to deal with the future realities of waste management and energy requirement:

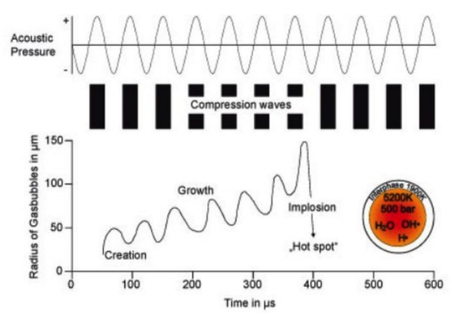
- Commun AD digest OM from 25% to 60% (1);
- Some feedstock requires an HRT more than 30 days (2).

Potential Solution:

Pre-treating some specific feedstock with ultrasonic wave to short the HRT

Theory and Hypothesis

Ultrasonic wave induce cavitation in water phase which blow the cell membrane and thus release the intracellulaire matter to aqueous phase:



Digestion is thus improved since nutrients is more easily available and that C:N ratio is increased.

Experimentation

Laying hen manure -3 % TS

COD, TOC and TN determination

Control | 10 sec 45 μm_{p-p} | 10 sec 90 μm_{p-p} | 20 sec 45 μm_{p-p} | 20 sec 90 μm_{p-p}

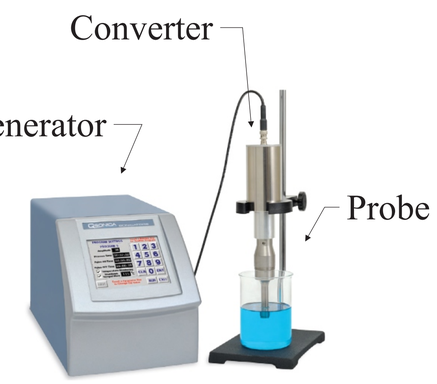
$COD, TOC, TN and DD_{COD}$ determination

BMP test: incubation at 35ºC for 30 days

$COD, TOC, TN and DD_{COD}$ determination

Biogas yield + Energy Balance

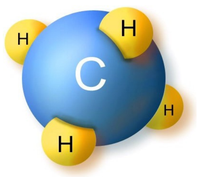
What variable impact more the digestion; **time** or **power** ?

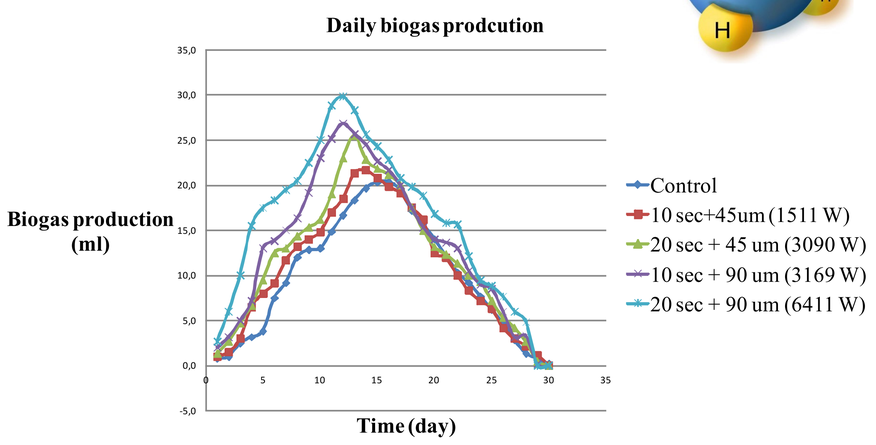


Expected Results and Impact

Population, industries and government could take advantage of an improved digestion through:

- Biogas production increased by 10% to 20 %
- Accelerate biogas production
- Positive net energy balance





- Technology readily transposable to existing biogas facility
- Batch experimentation exportable to continuous flow ultrasonication field application.

(1) Grönroos A, Kyllönen H, Korpijärvi K, Pirkonen P, Paavola T, Jokela J, Rintala J. 2005. Ultrasound assisted method to increase soluble chemical oxygen demand (SCOD) of sewage sludge for digestion. Ultrasonics Sonochemistry. 12: 115-120.
(2) Metcalf and Eddy. 2003. Wastewater Engineering: Treatment and Reuse. NewYork: 4th ed. McGraw-Hill
(3) Dr. Animesh Dutta: adutta@uoguelph.ca

School of Engineering

Mitacs

The BetterPlanet Project

University of Guelph

Changing Lives Improving Life