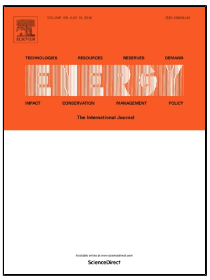
Accepted Manuscript



Enhancement of biogas production from sewage sludge in a wastewater treatment plant: evaluation of pretreatment techniques and co-digestion under mesophilic and thermophilic conditions

Siamak Mirmasoumi, Sirous Ebrahimi, Rahim Khoshbakhti Saray

PII:	S0360-5442(18)31056-9
DOI:	10.1016/j.energy.2018.06.003
Reference:	EGY 13045
To appear in:	*Energy*
Received Date:	24 August 2017
Accepted Date:	01 June 2018

Please cite this article as: Siamak Mirmasoumi, Sirous Ebrahimi, Rahim Khoshbakhti Saray, Enhancement of biogas production from sewage sludge in a wastewater treatment plant: evaluation of pretreatment techniques and co-digestion under mesophilic and thermophilic conditions, *Energy* (2018), doi: 10.1016/j.energy.2018.06.003

Enhancement of biogas production from sewage sludge in a wastewater treatment plant: evaluation of pretreatment techniques and co-digestion under mesophilic and thermophilic conditions

Siamak Mirmasoumi[a], Sirous Ebrahimi[b,*], Rahim Khoshbakhti Saray[a]

[a] Faculty of Mechanical Engineering, Sahand University of Technology, Sahand New Town, Tabriz, Iran

[b] Biotechnology Research Centre, Faculty of Chemical Engineering, Sahand University of Technology, Sahand New Town, Tabriz, Iran

Abstract:

Boosting biomethane production makes it possible to offset the required energy in a wastewater treatment plant. In this research, using batch biomethane potential assays, various techniques including pretreatment, co-digestion, and digestion temperature rise were evaluated to increase the methane productivity of municipal sewage sludge (SS). Between thermal and sonication pretreatment methods, thermal pretreatment was shown to be more efficient and there was no need to pretreat SS for more than 0.5h. Thermophilic digestion of SS led to 160.8% rise in the methane productivity, compared to mesophilic digestion. The most suitable co-substrate for co-digestion with SS was food waste (FW). FW and SS had little negative synergistic effect, however higher FW concentration caused to higher specific methane yield. Thermal pretreatment was not effective on FW. To evaluate the techniques, a combined cooling, heat and power plant was suggested. The energy recovery balance was positive for all the techniques, but co-digestion was not successful to reduce the levelized cost of energy (LCOE). Unlike co-

* Corresponding author: Email: sirous.ebrahimi@epfl.ch

Abbreviations: AD: Anaerobic Digestion; An.Bd: Anaerobic Biodegradability; CM: Cow Manure; EC: Electrocoagulation; FW: Food Waste; FWSL: Food Waste Slush; HEx: Heat Exchanger; HRT: Hydraulic Retention Time; IBR: Initial Biodegradation Rate; ISR: Inoculum to Substrate Ratio; LFL: Landfill Leachate; LCOE: Levelized Cost of Energy; OBMPR: Overall Biomethane Production Rate; OLR: Organic Loading Rate; SBMY: Specific Biomethane Yield; SD: Standard Deviation; SS: Sewage Sludge