TREATMENT AND ENERGY RECOVERY OF TOMATO INDUSTRY WASTE BY BIOMETHANATION

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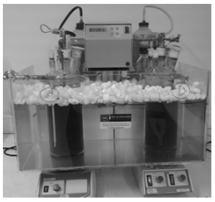
INTRODUCTION

Extremadura is located in the southwest of Spain where the tomato processing industry plays a vital role in its economic development and generates high pollutant waste.

Biomethanation is the best technique for the treatment of tomato industry waste because it reduces greenhouse gas emissions, produces renewable energy and the digested effluent can be used as fertilizers (IDAE, BESEL, 2007).

Although tomato industry waste has been previously treated by biomethanation, very few studies have been performed using solid and liquid waste in the same proportions as it was originally produced.
This study also performes essays at laboratory and pilot scale and demonstrates the economic viability of an industrial scale project.

MATERIALS & METHODS



Semicontinuous anaerobic digester.

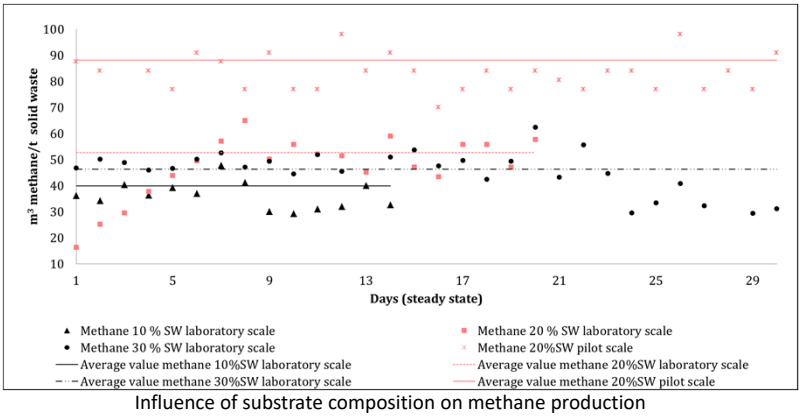
Biogas pilot plant.

Both anaerobic reactors were monitored by determining: VFA, alkalinity, pH, VSS, VDS using industry standard methods (APHA et al., 1992) and COD using Nanocolor® (Macherey-Nagel) kits and a PF-12 portable spectrophotometer (Macherey-Nagel).

RESULTS & DISCUSSION

Results obtained in laboratory essays.

PARAMETERS	90% PW/10%SW	80% PW/20%SW	70% PW/30%SW	Pilot plant: 80% PW/20%SW
Organic load (kg COD/m³ reactor and day)	4.98	7.08	5.47	7.08
HRT (days)	13	20	40	20
pH	7.05±0.14	7.23±0.18	7.19±0.33	7.39±0.26
VFA (g CH_3COOH/L)	0.42±0.39	0.60±0.12	0.76±0.27	0.38±0.08
Alkalinity (g $CaCO_3$/L)	1.33±0.21	2.27±0.38	2.26±0.21	2.88±0.28
Nm³ biogas/t solid waste	72.09±22.47	84.17±9.43	78.86±20.19	120.32±11.10
Nm³ methane/t solid waste	39.86±12.43	52.69±5.90	46.29±11.85	88.13±14.27
BIOGAS COMPOSITION				
CH_4 (%)	55.3	62.6	58.7	70.14
CO_2 (%)	38.7	31.8	36.0	24.6
O_2 (%)	0.5	0.3	0.3	0.2
SH_4 (ppm)	30.0	182.0	72.0	80.0



Influence of substrate composition on methane production

DESCRIPTION OF BIOGAS PLAN EQUIPMENT	
Crusher tank	510 m³
Mixing tank	880 m³
Anaerobic reactor	11,000 m³
Effluent tank	440 m³
Gasometer	2,900 m³
Cogeneration engine	977 kWe 1,127 kWt
ECONOMIC RATIOS	
Payback time PBT(years)	10
Internal rate of return IRR (%)	8
Net present value NPV (€)	582,750

Desing and economic viability of implementation at industrial scale

CONCLUSIONS

1. It has been shown that substrate composed of 80% pretreated water and 20% solid waste maximizes the energy yields from the biomethanization of tomato industry waste, producing almost 53m³ of methane per ton of solid waste treated.
2. The pilot plant scale increased methane production to 67% over that obtained in the laboratory.
3. Biomethanation of tomato industry waste is economically viable at industrial scale.

Acknowledgments

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