

DRY THERMOPHILIC ANAEROBIC DIGESTION OF ORGANIC FRACTION OF THE MUNICIPAL SOLID WASTE: FOCUSING ON THE INOCULUM SOURCES

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INTRODUCTION

Anaerobic digestion is an attractive treatment strategy for organic fraction of municipal solid waste (OFMSW) and has been considered the main commercially option for treatment and recycling of biomass wastes (Polanco and Encina, 2000). The growth of full-scale applications and the low cost is due to the high energy recovery linked to the process in Europe.

The anaerobic digestion in semidry (Pavan et al., 1994) and dry conditions (solids totals content of 20-35%) is considered capable of producing an inert biosolid product with higher methane productivity (Mata-Alvarez et al., 2000).

The objective of this work was to evaluate the performance of six lab-scale reactors during start-up and steady-state phases using different inoculum sources.

MATERIAL AND METHODS

Substrate preparation

The organic fraction from the campus restaurant (University of Cádiz) was selected, dried, and homogenized to obtain a representative sample of sorted source of organic fraction of municipal solid waste (SS-OFMSW). The initial SS-OFMSW (78.6% ST) was adjusted to 35.0% total solid (TS) with water.

In this experiment, the six different organic solids: Corn silage, rice hulls mixed with OFMSW digest (RH-OFMSW), swine digest waste (SDW), sludge digest (SD), manure waste, SDW mixed with SD (SDW-SD). The inoculum source were added (25.0% of inoculum) to digesters with SS-OFMSW. In previous works, the MDS from digester Treatment Plant has shown to be an excellent stabilized organic waste and inoculum source (De la Rubia et al., 2002).

The thermophilic temperature was controlled and monitored at 55°C.

Analytical methods

The operational parameters evaluated were pH, alkalinity, ammonia nitrogen (AN), solids, and also based in the production and composition of biogas.

RESULTS AND DISCUSSION

The dry thermophilic anaerobic digestion showed promising results in laboratory scale studies for municipal solid waste treatment. The initial characteristics of SS-OFMSW and the SS-OFMSW mixed with inoculum sources are presented in table 1.

Studies conducted at laboratory-scale shows that dry thermophilic anaerobic digestion in

agitated reactors is suitable for degradation of SS-OFMSW.

Table 1 - Initial characteristics of SS-OFMSW and SS-OFMSW diluted pre-digestion sources inoculum.

Parameter	SS-OFMSW	SS-OFMSW + CORN SILAGE	SS- OFMSW + OFMSW7 RH	SS-OFMSW + SDW	SS-OFMSW + SLUDGE	SS-OFMSW + MANURE	SS-OFMSW + SDW/ SLUDGE
TS (g/kg waste)	786.8	318.2	330.43	321.74	285.71	367.7	315.79
VS (g/kg waste)	684.2	272.73	282.61	265.22	257.14	280.0	247.37
TSS (%)	15.1	3.0	3.5	2.0	3.5	5.0	6.0
Alkalinity (mg CaCO ₃ /g waste)	4.6	208.0	82.5	101.5	82.25	93.0	81.75
Density (kg/m ³)	490	1010	1020	1010	1005	1100	1010
AN (mg NH ₃ -N/L)	112.0	0	1120.0	1120.0	280.0	280.0	1120.0
COD (mg O ₂ /g waste)	193 04	94 94	175 68	116 78	62 85	223 410	9 81

The six sources of inoculum were found to be significantly different from each other regarding the analytical response parameters studied. All inoculum sources being an attractive treatment strategy, the initial start up phase occurred between 2 and 4 days and the initial production of methane began in the day 10 after the initial of experimentation.

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REFERENCES

- De la Rubia, M.A., Perez, M., Romero, L.I., Sales, D. 2002. Anaerobic mesophilic and thermophilic municipal sludge digestion. *Chem. Biochem. Eng. Q.*, 16: 119-124.
- Mata-Álvarez, J., Macé, S., Llabrés, P. 2000. Anaerobic of organic solid wastes. An overview of research achievements and perspectives. *Biores. Technol.*, 74: 3-16.
- Pavan, P., Musacco, A., Cecchi F., Bassetti A., Mata-Alvarez J. 1994. Thermophilic semi-dry anaerobic digestion process of the organic fraction of municipal solid waste during transient conditions. *Environ. Technol.*, 15: 1173-1182.
- Polanco, F.F., Encina, A.G. 2000. *Jorn. Tratm. Bio. de Res. Org. Acta*, 1.