ANAEROBIC CO-DIGESTIÓN OF SOLID AGRO- WASTES TO PRODUCE BIOGAS FOR USE AS A GREEN FUEL.

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Introduction. Anaerobic digestion (AD) provides an entirely new alternative for treating organic waste (OW), recovering renewable energy (biogas), and converting OW to a product that can be used as a soil amendment. This is important, because of the growing impact that OW has on the environment: odor, leachates, global warming (CH_4),and the need for clean energy. Co-digestion is an important improvement to AD technology. It combines different organic substrates with complementary characteristics, improves the nutrient balance, and increases biogas yield (1). Biogas is the flammable mixture of gases (CH_4, CO_2) that is generated by AD. It has good calorific value and can be used directly as a fuel or indirectly to generate electricity(2).
The goal of this work is to examine and improve an anaerobic co-digestion system (manure/agro-wastes) for generation of biogas that can be used directly.

Methods. Agro-wastes were selected according to their abundance and availability in the study's geographical area. Raw materials were collected including: Swine Manure (SM), DairyManure (DM), Fruit and Vegetable Waste (FVW), Whey (W), and Sewage Sludge (SS). After shredding toreduce size and homogenizing, the raw materials were stored at 4°C. Total Solids (TS), Total Volatile Solids (TVS), and pH were determined (3).The test mixture ratios were 1:1. 1 L Laboratory-scale batch reactors (LBR) were used. Samples were incubated for 28 days at (35 ± 1)°C at pH 6.5-8.5. The LBR were manually mixed daily for 3–4 min. Biogas production was measured using a liquid displacement system. The criteria for judging the success of the co-digestion were: process stability, TVS reduction, and biogas production rate.

Results. The characterizations of the co-digestion substrates are shown in Table 1. All the mixtures were analyzed for their properties before and after digestion, and the final analyses are shown in Table 2. Since the pH was maintained within an optimal range in LBRs A, B and D during digestion, these LBRs were the most stable. The highest reductions of TVS were for LBRs A and C, followed by D and E, and the lowest was B. The highest total biogas production and biogas production level peaks were LBRs A and B. In contrast, LBRs C, D and E produced smaller amounts of biogas.

Table 1. Characterizations of co-digestion substrates

ITEM	SM	DM	SS	W	FVW
C/N	13	25	10	0.9	34
pH	5.5	7.5	7.1	5	3.8
TS(%)	26	20	0.9	7.9	11
TVS/TS(%)	53	57	25	76	90

Table 2. Characterizations of co-digestion mixtures

ITEM	(A) SM: SS	(B) DM: SS	(C) SM: FV W: SS	(D) DM: FV W: SS	(E) DM: W: SS
C/N_{mix}	10	16	15	18	12
pH_{final}	7.5	7.5	6.7	5.5	7.2
$TVS_{reduction}$ (%)	78	13	59	39	39
Biogas m^3/Kg TVS	0.13	0.16	0.03	0.04	8e-3
Biogas Lt/Kg TVS day	9.5	12.5	5.6	9.9	0.5

Conclusions. In co-digestion of the studied manure mixtures, Dairy Manure had the highest biogas production potential because it maintained well-balanced conditions and high buffer capacity resulting in improved digester performance. In contrast, Swine Manure had the worst performance,due to its low buffer capacity and stability.

Acknowledgements.CONACYT

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