ANAEROBIC CO-DIGESTION OF ORGANIC WASTES

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ABSTRACT

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities. It may be categorised according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). Current global MSW generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next fifteen years. Waste generation rate in Indian cities ranges between 200 - 870 grams/day, depending upon the region's lifestyle and the size of the city. The per capita waste generation is increasing by about 1.3% per year in India they are disposed in open dumping and landfill. The disadvantage of landfill are health-hazard - insects, rodents etc., damage due to air pollution , ground water and run-off pollution so this research was conducted to find out the amount of gas produced during the research by water displacement method. The experiment is done in lab scale ,using 2000 ml reactor is and the experimental were carried out as follows case A(vegetable waste, fruit waste and water hyacinth),case B(vegetable waste and fruit waste), case C (vegetable waste and water hyacinth),case D(fruit waste and water hyacinth),case D (vegetable waste),Case E(Fruit waste),case F(water hyacinth)are chosen due to their degradability nature and moisture content. These substrates were mixed with different proportion. From the result it has been observed that case B (vegetable waste and fruit waste)liberated more quantity of gas compared to other combination.

1. INTRODUCTION

Biogas typically refers to a mixture of different gases Produced by the breakdown of organic matter, in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. It is a renewable energy source and in many cases exerts a very small carbon footprint. Biogas is produced by anaerobic digestion with anaerobic micro-organism, which digests material inside a closed system or by fermentation of biodegradable materials. Biogas comprises of methane (CH_4) and carbon dioxide (CO_2)(*Patil V.S et al 2015*).. It may have some traces of hydrogen sulphide (H_2S), moisture, and siloxanes. Biogas to be used as a fuel, and can be used for any heating purpose, such as cooking. It can also used in a gas engine to covert the energy in the gas into electricity and heat.

Fruit and vegetable wastes are produced in large quantities in markets and constitute a source of nuisance in municipal landfills because of their high biodegradability. In this study production of biogas using cow dung, fruit waste, vegetable waste and water hyacinth were carried out.

OBJECTIVES:

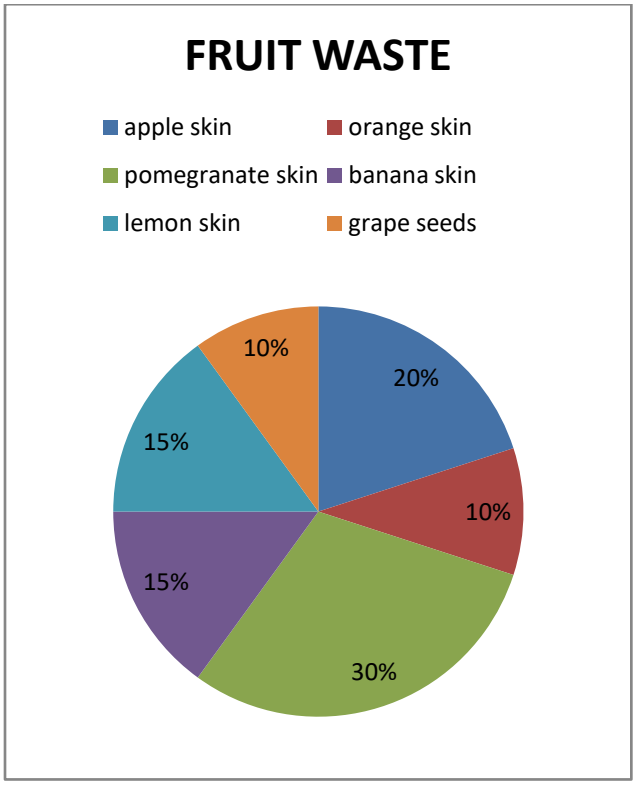
To determine the gas production by varying the composition of substrates.

To compare the gas production under various cases.

2. MATERIAS AND METHODS

WASTE COLLECTION AND PROCESSING

FRUIT WASTE , VEGETABLE WASTE , WATER HYACINTH



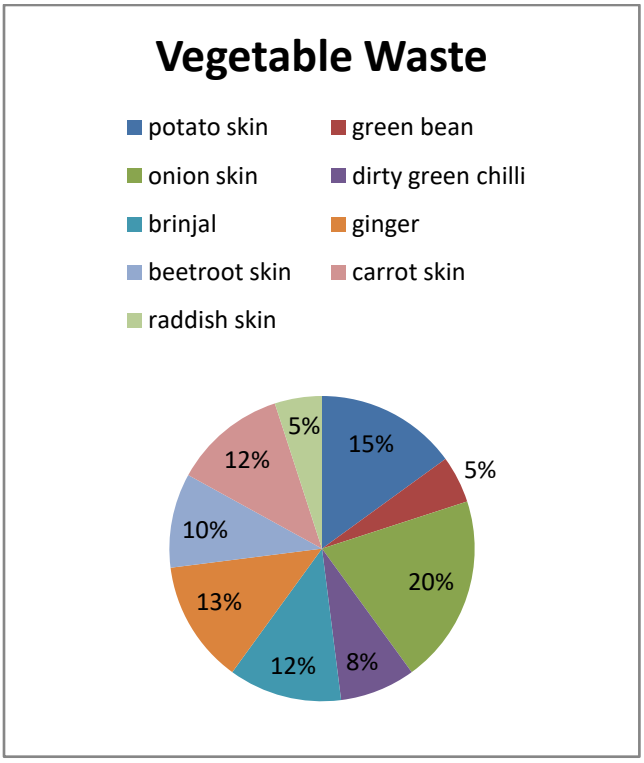


Fig .1Water Hyacinth

The waste used in this study were collected from our house. The water hyacinth collected from vadavaru rive. Waste contains the fruits, vegetables and non-used vegetables waste. This waste is drying use sunlight crushed by mixer grinder and cow dung was prepared mixing with water in 1:1.

Fig 2 fruit waste in powder form

Fig 3vegetable waste in powder form

Fig 4 water hyacinth in powder form

REACTOR SETUP

A simple lab-scale reactor was setup for the experimental work. The volume of digester was 2 L and working volume was 1.5 L. In this study the volume of gas was measured by water displacement method considering the volume of the generated gas equal to that of expelled water in the water collector. Digester was connected to water chamber (plastic bottles) by a plastic pipe (gas pipe) which was used to pass the produced gas into water chamber. Glass pipe (water pipe) was used to take the displaced water from the water chamber to the water collector which was fitted air sealed by china clay. Both the ends of the gas pipe were inserted just at the top of the digester and the water chamber. The water pipe was inserted just bottom of the water chamber and top of water collector.*(Salma A. Iqbal et al 2013*)

Fig 5 Reactor setup

3. RESULT AND DISCUSSION

Case A (vegetable waste and fruit waste and water hyacinth)

Case B (vegetable waste and fruit waste), Case C (vegetable waste and water hyacinth)

Case D (fruit waste and water hyacinth)

Case E (fruit waste)

Case F (vegetable waste)

Case G(water hyacinth)

Determination of pH Values

Table 1 pH values for case A

Days	Substrate Weight	Case A pH
1	20g +20 g +20g	6.81
3	20g +20 g +20g	6.86
5	20g +20 g +20g	7.25

Table 2 pH values for case B, case C, case D

Days	substrates Weight	Case B pH	Case C pH	Case D pH
1	30 g+30g	5.81	5.92	5.81
3	30 g+30g	5.90	6.51	5.92
5	30 g+30g	5.87	6.32	6.50

Table 3 pH values for case E, case F, case G

Days	substrates Weight	Case E pH	Case F pH	Case G pH
1	60 g	6.25	6.30	7.5
3	60 g	6.10	6.29	7.25
5	60 g	5.98	6.49	7.32

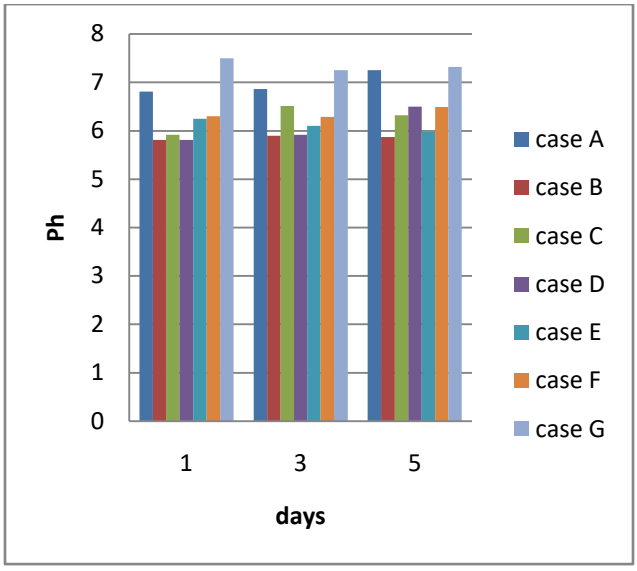


Figure 1 show pH Vs Digestion period

The substrate value ranges between 5.5 to 7.3.the minimum of pH value is case E ,the maximum of pH value is case G . the bio gas production is higher for the range between 5.81 to 6.0 (case B)

Determination of Total Solids &Volatile Solids

Table 4 T.S and V.S values for case A, case B, case C, case D, case E, case F, case G

Detail	substrates Weight	T. S %	V.S %
Case A	20g+20g+20g	7.5	6.8
Case B	30g + 30 g	8.6	7.5
Case C	30g + 30 g	8.9	7.8
Case D	30g + 30 g	7.9	6.8
Case E	60g	8.1	7.2
Case F	60g	7.5	6.5
Case G	60g	8.5	7.6

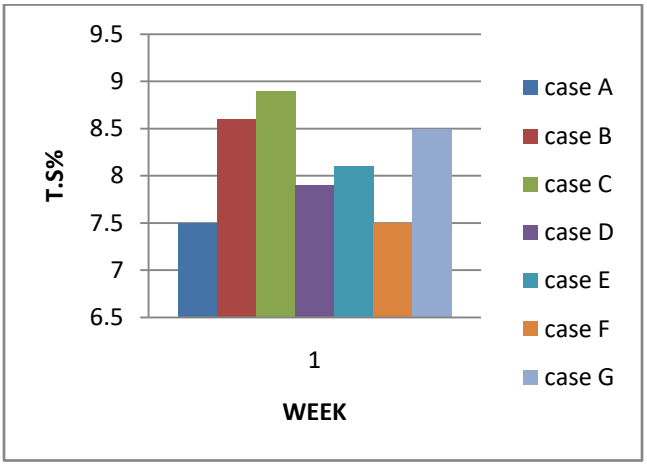


Figure 2 show T.S % Vs Digestion period

The substrate T.S value ranges between 7.5% to 8.9%.the bio gas production is higher for the range 8.6 % (case B)

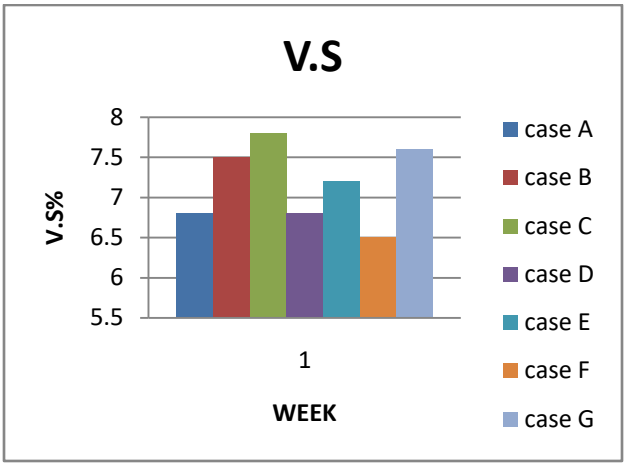


Figure 3 show V.S % Vs Digestion period

The substrate V.S value ranges between 6.5% to 7.8%.the bio gas production is higher for the range 7.5 % (case B)

Determination of Chemical Oxygen Demand

Table 5 COD values for case A, case B, case C, case D, case E, case F, case G

Details	substrate Weight	COD mg/l
Case A	20g+20g+20g	1180
Case B	30g +30g	1450
Case C	30g +30g	1350
Case D	30g +30g	1390
Case E	60g	1375
Case F	60g	1400
Case G	60 g	1300

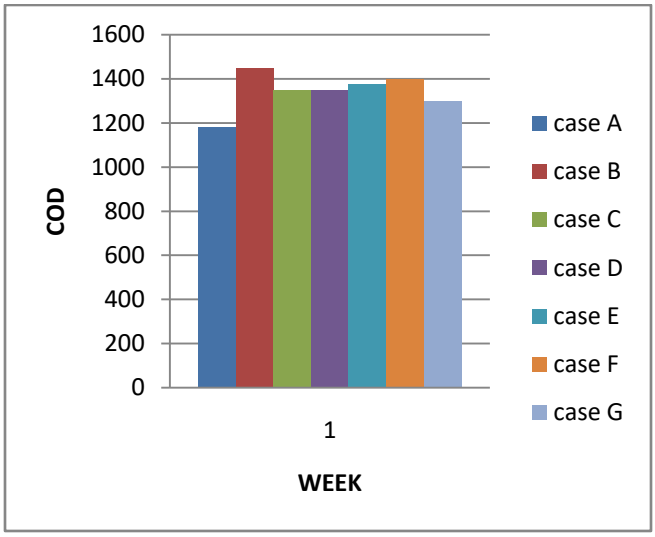


Figure 4 show COD Vs Digestion period

The substrate COD value ranges between 1180 mg/l to 1450mg/l. the bio gas production is higher for the range 1450mg/l (case B)

Determination of Bio-Gas Production

Table 6 gas production for case A, case B, case C, case D, case E, case F, case G

Details	substrate Weight	Bio gas production in ml
Case A	20g+20g+20g	750
Case B	30g +30g	1800
Case C	30g + 30g	1600
Case D	30g + 30g	1556
Case E	60g	1700
Case F	60 g	1755
Case G	60 g	1140

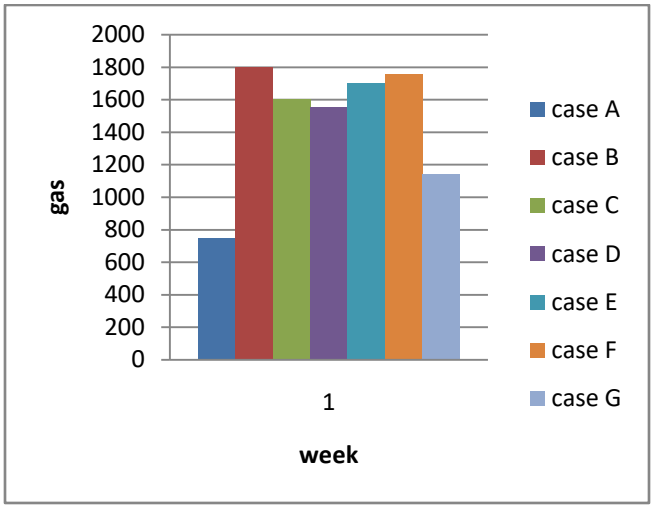


Figure 5 show Gas production Vs Digestion period

The substrate gas production ranges between 750ml to 1800ml . the bio gas production is higher for the range 1800 mg/l (case B).

Three set of substrates are used in this project from the result it has been seen that case B(vegetable waste and fruit waste) combination produce more gas compare to other combination. In case A (vegetable waste, fruit waste and water hyacinth) combination the gas production is 750 ml. case C (fruit waste and water hyacinth) combination the gas production is 1600 ml. case D(vegetable waste and water hyacinth)combination the gas production is 1556 ml. case E (fruit waste) combination the gas production is 1700ml.case F(vegetable waste) the gas production is 1755 ml case G(water hyacinth)the gas production is 1140 ml. case B (fruit waste and vegetable waste) produce more gas .so use of case B(vegetable waste and fruit waste) combination produce more efficient method of biogas production

4. CONCLUSION

Three set of substrates were used in this project. From the experimental work case B (fruit waste and vegetable waste) produced more gas when compared to other combinations 1800ml. Hence the project justified the potential of gas production further the study focuses towards to the pretreatment of substrates in order to enhance the gas production.

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