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MODE OF FERMENTATION TECHNOLOGY AND BIOGAS YIELD-FROM HUMUS

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Abstract-

Dead and partially decomposed plants under condition of excess moisture and lack of air and mixed with Inorganic matter can be used for production of Bio-gas by the process of fermentation.

The composition of humus is determined by the condition under which it was formed. They are also determined by the constituent of plant residues. The agronomical classification of humus is based on its botanical composition, degree of decomposition, content of nutrients, acidity and moisture capacity. Humus containing residues of grasses and woody plants are richer in elemental composition. Humus are richer in nitrogen if contains roots of nodulous plants.

Industrial fermentation produce large scale microbes. Batch fermentation used for small production of Biogas and fed batch fermentation gives greater yield. Anaerobic digestion of humus with the use of latest technology reported to give high yield of biogas under continuous culture, Chemostatically and terbidostatically where preventing bacteria never reach to stationary phase. 'Fe' is excluded to check Krebs cycle.

Keywords-

Humus, Nutrients, Bacteria, Fermentation, air composition

Digester, yield, moisture, anerobes.

Introduction

Humus containing 5 to 25% of cellulosic substances are slightly decomposed or young and if contains 25 to 40% are moderate and if cellulosic content exceeds 40% it will be highly decomposed. Woody humus contains highest 70% of cellulose. Humus contains all three basic nutrients (N,P,K). P content varies from 0.05 to 0.60 percent.

The highest moisture content of humus gives low decomposition rate. Photoelectric device used to monitor the cell density. At constant dilution cell density remains constant. Bacteria grow in log phase. Fermenter or bio-reactors are closed vessel for bio-chemical reactions by microbial cells used to produce microbial product and bio-gas. In Bio-reactors all type of cells are cultivated.

Sterilization carried out to prevent unwanted microbial growth under proper concentration of O_2 and CO_2. Inoculum must be healthy and pure and free from contamination. Microbial cell when started dividing fast, it is called as 'Log Phase'. Airlift fermentors, submerged fermentors support growth of micro fermentors. Small or laboratory fermenters is of 1 - 50 litres capacity, larger one is of more than 1000 litres and Pilot fermentors is of 50 - 1000 litres. Osmotic pressure also affects the growth of bacteria. High osmotic pressure tolerant microbes called as Halophites. Obligate and facultative microbes works in low O_2 concentration.

$$2O_2\text{-} + 2O_2^- + 8H^+ \rightarrow 4H_2O_2$$

('O' Radicals)

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

$$\text{Bacteria} + H_2O_2 \rightarrow \text{bubbles (catalase test)}$$

Thyoglycollate binds molecular O_2 thus reducing and removing it.

$$RSH + O_2 \rightarrow RSO_2 + H^+$$

Experimental procedure-

Fermenters are fitted with thermometer, controlled aeration, pH and other sensors are also applied to it. It is used for bacterial culture cultivation and biogas production. Fermenters are charged with the Raw material (Humus) carbon source, energy source, Nutrients.

I. 1 kg humus sterilized by washing with EDTA and applied to Bio-reactor at pH = 7 and at temperature 25°C (20 days)

II. In another fermentor 1 kg of Humus taken at pH=8 and at temp 30^{o}C.

(30 days)

III. In third experiment 1 kg of semisolid Humus is taken and pH kept at 9 and temperature maintained at 35^{o}C. (40 days)

Result and discussion-

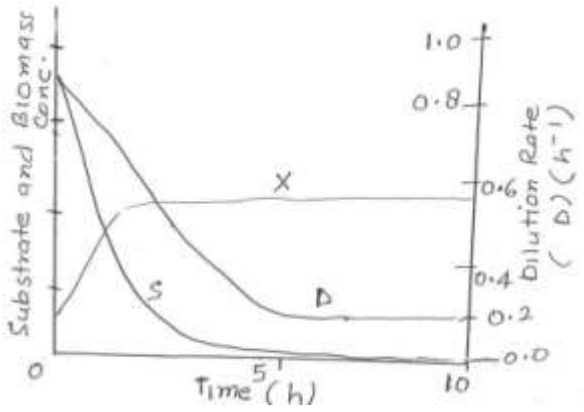
Study of table and graphs indicate that-

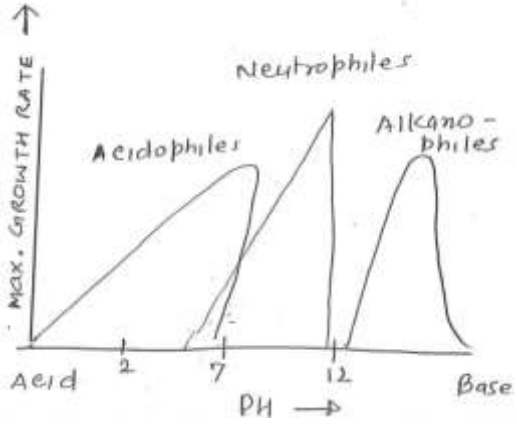
1. The highest rate of Bio-gas production at pH=8 and at 30^{o}C where microbe density was also highest.
2. In third Bio-reactors the microbes cellular division was reduces leading to low yield of Bio-gas.
3. In second set of experiment density of fermenting bacteria was high and the Bio-gas yield was lowest due to incomplete digestion of charge.

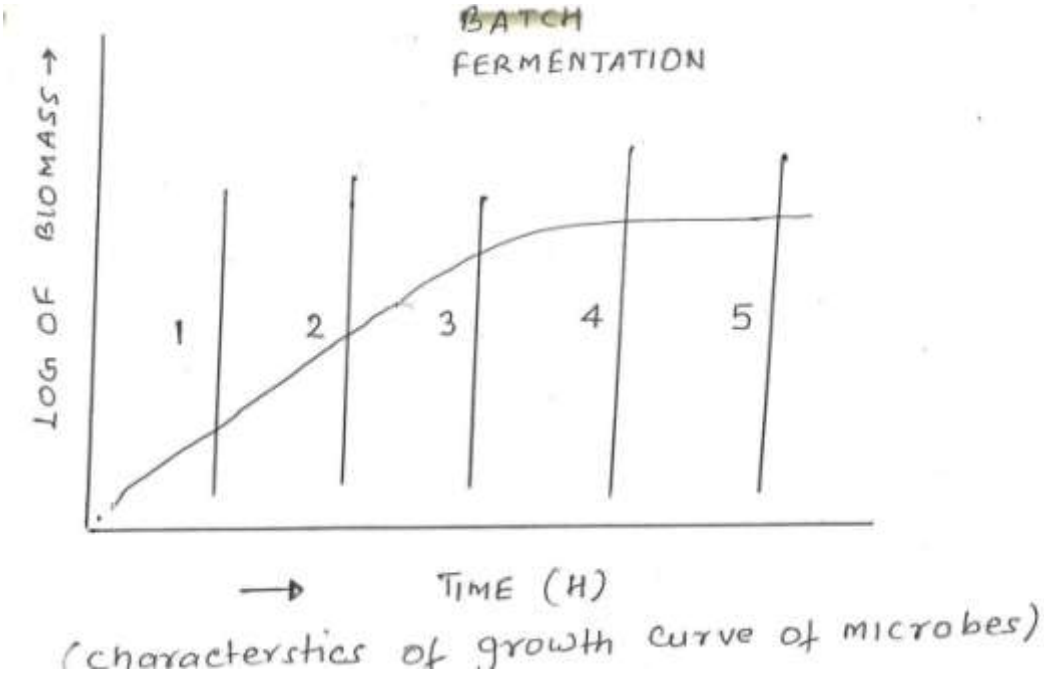
Bacterial population was determined by photo spectrometer.

S.N.	Humus in k.g.	Cow dung dry mass	pH	Temp ^{o}C	Bio-gas yield L/kg
1.	1 kg Humus dry mass	½ kg	7	20	502 L
2.	1 kg Humus in wet condition	½ kg	8	30	723 L
3.	1 kg Humus moistured	½ kg	9	40	618 L
4.	1 kg blank	blank	7	25	418 L

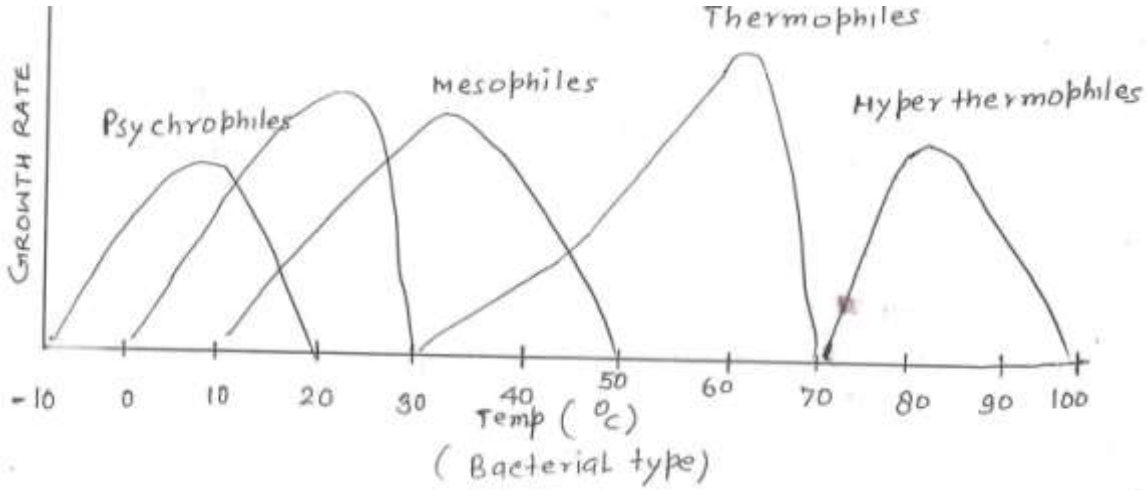
S.L. No.	Characteristics	Batch culture	Fed batch culture	Continuous culture
1.	**Cultivation system**	**Closed**	**semi closed**	**open**
2.	**Addition of Nutrient**	**No**	**Yes**	**Yes**
3.	**Volume of culture**	**Constant**	**Increase**	**Constant**
4.	**Removal of H_2O**	**No**	**No**	**Yes**
5.	**Contamination**	**Minimum**	**Intermediate**	**Maximum**
6.	**Growth Phase**	**Log**	**Log**	**Log**
7.	**Log phase**	**decline**	**decline**	**Longest**
8.	**Density of bacteria**	**change with time**	**change with time**	**Remain same**







(characterstics of growth curve of microbes)



(Bacterial type)

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