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PRESENCE OF TRACE METALS LIKE Mo, Se, W & Ni IS NECESSARY TO SUSTAIN ENZYME ACTIVITY DURING BIO-GAS GENERATION FROM FOREST RESIDUAL BIO-MASS

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ABSTRACT:

In this paper apart from other condition like temp., Ph, Carbon contents, valency of carbon of substrate, the study of presence of trace elements (Mo, Se,W, Ni) is taken for consideration. It is observed that the rate of generation of Bio-gas from forest bio-mass do, affected by the varied concentration of trance metals. Trance element basically catalysed the enzymatic activity took place during four stages of Anaerobic fermentation. Acclimatization of microbes to substrate take 3 to 8 weeks. Acclimated bacteria showed greater stability towards fluctuation in temperature, volatile acid and NH_3 concentration. The optimum Ph formethanoqens was 6.6-7.6 and for nonmethanoqens (like hydrolytic bacteria and acidogens is 05-8.5.Ph decreases due to short chain fatty acids by acidogenes. Anaerobic process operate well at mesophilic range (30-40^{o}c) but methanogenesis can occur at temperature as low as 12^o-15^{o}c. Optimum N/P ratio is 7, min. COD/N ratio is 350/7. Trace Metal like Mo, Se, W, and Ni was necessary to sustain enzyme activities. Alkanity concentration of 2000 to 3000 mg/L as CaCo3 needed to maintain acceptable Ph.

KEY WORDS:

Trace metals, Alkanity, Acclimatization,Methanogenesis, Methanogens, fermentation, Substrate, enzyme.

INTRODUCTION: Buffering agents like NaHCO3 or CaCo3 needed to be added regularly to maintain the pH in required range. Due to slow growth and sensitiveness of methanogens, unable to convert short chain fatty acids into methane. VFA (Volatile fatty acid) concentration in the digester required to be maintained below 500 mg/L. Propionic acid accumulation reported to be responsible for reactor activity failures. High NH_3 concentration cause rapid production of V.F.A. thereby Bio-gas yield decreases due to decrease in pH of substrate. Desulfovibrio a sulfur bacteria degrades Sulfur containing amino acids. Cu, Pb, Cr if present at higher concentration become toxic for anaerobic fermentation. Organic Loading rates of 3.2 to 32 Kg COD/m^3- d used in anaerobic fermentation compared to 0.5 – 3.2 kg COD/m^3-d in aerobic processes. Toxicity started killing of microbes and rate of biomethanation decreases. Genetic Constiitution of microbes is also affect the survival of bacteria.

The Mo contents in plant residue in highest in legumes (O.5 to 20 mgMo/Kg dw. Cereals contain 0.2-1.0 mgMo/Kg dw may exceeds upto 30 mg/kg dw, increased contents may be caused by unbalanced nutrition. It is localised in young growing organs like in chloroplast of leaves. The Mo contents lower than 0.10 mg/kg dw is refered as Mo deficiency. Mo involved in 'N' metabolism that in it's fixation, so act as promoter in development of leguminous plants. Alfalfa, clover, soybean, cauliflower, Cabbage, are applied with Mo/Mo^{+2}.

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EXPERIMENT AND PRACTICES:

Four sets of each two kg of dm of forest residual plant was taken in four separate digester of the capacity of 5 liters the substrate was washed repeatedly and successively with water and EDTA and converted in the form of paste and diluted by addition of one liter of water in each set of experiment. The favorable condition like temp., Ph, microbial density maintained. Mo contents of 0.10 (V.L.), 0.23 (M) and 0.55 (H) mg/kg dw of substrate was added in four sets of experiments and digester was left for over one month as anaerobic fermentation takes longer time to complete compared to aerobic mechanism.

RESULT, DISCUSSIONS AND NOTES:

Micronutrients literature review and study of table depicting the result of four set of experiment indicate following results with reference to varied concentration of Mo in mg/kg dw subjected to substrate before Experimentation.

1. In experiment no.4 where the concentration of Mo was 0.55 mg/kg dw of biomass, yields minimum amount of CH4/L/Kg of biomass, due to Mo toxicity, which hampers the catalytic activities of enzymes.
2. In experiment no. 3 the CH4 produced had highest yield due to survival rate of microbes was highest and enzymatic activities promoted by the Mo present in medium concentration.
3. In experiment no.3 and 4^{th}, the yield of CH4 was reported to be low, because of slow rate of promotion of enzymatic activities by low Mo Concentration.
4. In present Experimentation concentration of Mo taken into consideration compared to Ni, W, Cr, concentration in Bio-mass 'N' contents alters the composition of fatty acids – Table – 3

Table-1

S. No.	Conc of Mo Mg/Kg dw	Dw of Bio-mass	pH	Temp ^{o}C	Additive	Bio-gas L/kg dw
1	0.10	2 kg	6.5	30^{o}	Pigmanure	2.10
2	0.23	2 kg	7.0	30^{o}	Pigmanure	4.00
3	0.38	2 kg	7.5	30^{o}	Cow dung	4.25
4	0.55	2 kg	7.5	30^{o}	Cow dung	3.30
5	0.35	2 kg	8.0	30^{o}	Cow dung	2.70

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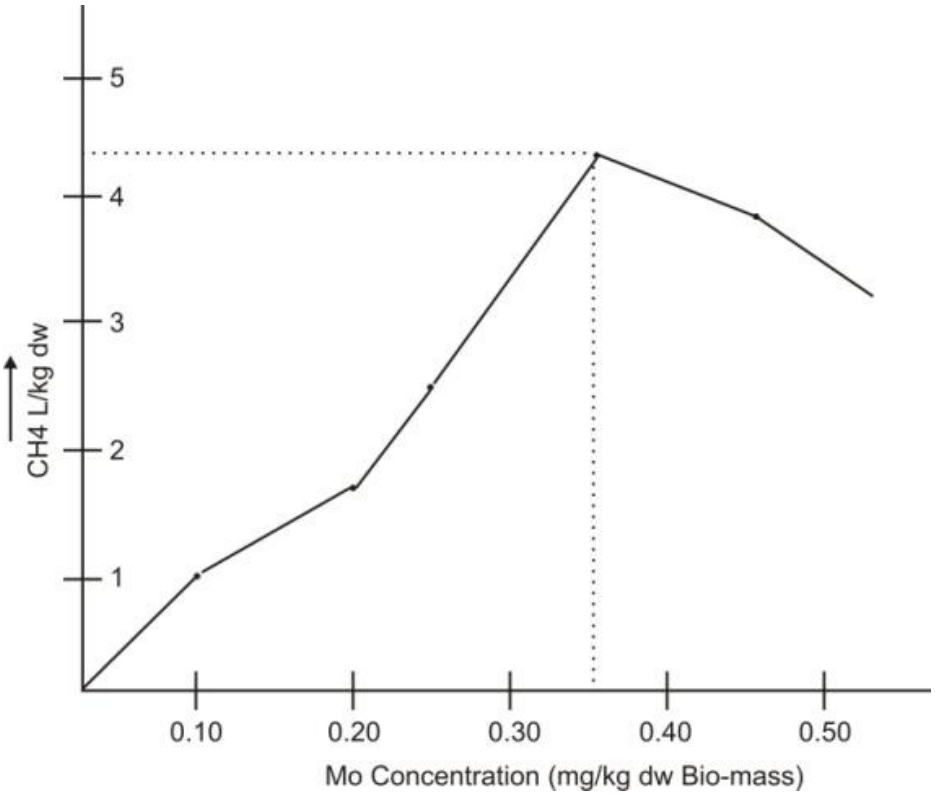
Table-2 (Micronutrient Contents in Bio-mass of India)

Micro-Nutrient	Bio-geo Chemical Zone	Micronutrient in (Mg/Kg Dw of Bio-mass)				
		Very low	Low	Medium	High	V. High
Mo	Eastern region	0.08	0.14	0.30	0.46	0.46
Cr		0.02	0.08	0.20	0.26	0.31
Ni		0.08	0.18	3.00	3.60	4.60
W		0.001	0.006	0.10	0.16	0.50
Mo	Northern region	0.05	0.15	0.50	1.20	1.20
Cr		0.02	0.06	0.16	0.20	0.28
Ni		0.08	0.20	0.21	0.28	0.5
W		0.001	0.004	0.14	0.21	0.40

Table-3 (Percentage of fatty acids in substrate)

S.No.	Palmitic Acid	Stearic Acid	Oleic Acid	Linoleic acid	N
1	6.6	1.8	21.2	70.3	0.2
2	7.7	2.2	21.5	68.1	0.4
3	5.7	3.4	41.00	47.1	0.8



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