# ASSESSMENT OF DIFFERENT NUTRIENT LEVELS TO OPTIMIZE THE EFFICIENCY OF RICE STRAW BIOMETHANATION AND MICROBIAL STUDY OF THEIR BY-PRODUCTS.


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## ABSTRACT

Experiments were carried out at the department of Microbiology, Faculty of Science, University of Kelaniya, Sri Lanka and the faculty of Agriculture, University of Ruhuna, Mapalana, Sri Lanka to assess the different process parameters to increase the gas liberation efficiency of rice straw Biomethanation and microbial study of by-products of straw Biomethanation and their utilization.

In Sri Lankan dry batch type biogas generator (Volume $6m^3$), first batch of straw (1000kg) was filled in September 1999 and second and third batch in October2000, April 2001 respectively. It was revealed that average gas production from the digester was 1.19 $m^3$ /day with a peak value of 1.83 $m^3$/day. Total gas production during the four and half month period of digestion was 167.85 $m^3$. The maximum average percentage and the average methane percentage and the average lag phase during the digestion were 52% and 20 days respectively.

Rice straw with a C: N ratio of 80:1 was amended with urea (46% Nitrogen) to maintain C: N ratio at 10: 1 to 40:1 in laboratory experimental set up of made up plastic 20 L containers in four replicates and temperature maintained at mesophilic range 30°c -35°c using electric bulbs. After mixing with the urea the highest total biogas production of 54.12L and 55% maximum methane were given at 30:1 C: N ratio with 8 days of lag phase. The lowest gas production and minimum methane production were taken place at 10:1 C: N ratio with 23.59 L and 18.5% respectively.

Concentrated Supper Phosphate (CSP) was used to adjust the C: P ratio on biogas production keeping the ratios in between 100:1 to 200:1 While keeping a constant ratio of 30:1 of C: N ratio. The original C: P ratio of rice straw was 333:1. Adjusting C: P ratio to 200:1 ratio produced the maximum gas yield of 54.99L with the 5 days of lag phase. Maximum percentage of methane also produced at 200:1 C;P ratio while lowest was given at 100:1 C: P ratio.

Molasses were used as a source of readily available energy source and micro nutrient source to detect the effect on biogas production under batch fermentation keeping a constant C: N ratio of 30:1 and C: P ratio 200:1 in all experimental units. Molasses 100mL was found to be the best maximum yield of 63:13mL and 200mL did not give any gas. Molasses addition drastically affect to reduce lag phase time up to 3 days with 60% methane.

NPK content of the digested material of straw coming out from Sri Lanka dry batch type anaerobic digester was found to be 1.9%, 0.14% and 1.6% respectively in NPK .

Biogas slurry coming out from Sri Lanka digester can be used as a liquid fertilizer source due to its NPK values 0.14%, 0.48%, and 0.16% respectively.

Average total aerobic and anaerobic plate counts of digested solid phase materials coming out from straw digester vary in between 29 X $10^5$ -37X $10^5$ CFU/g and 8 X$10^6$ -14 X$10^6$ CFU/g respectively. Average total aerobic and anaerobic plate counts of digested liquid phase materials coming out from straw digester vary in between 10 x $10^5$ - 16X $10^5$ CFU/ml and 6 x $10^6$ – 9 X $10^6$ CFU/ml respectively.

Digested material and Biogas Slurry were detected for indicator organism, viz. *E.Coli* and *Salmonella there* were no evidence was found to detect *Salmonella* and *E.Coli* in biogas slurry and the digested materials through the anaerobic straw digester. There fore anaerobic digestion is an attractive method for pathogen control while it converts materials into useful products such as biogas and fertilizer material.