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Short Communication

Rumen derived anaerobic digestion of water hyacinth (*Eicchornia crassipes*)

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Samples of water hyacinth were obtained from Sidi fish farm located in Sokoto metropolis. The samples were chopped, dried and ground into powder. The ground water hyacinth (25 g) was introduced into Buchner flask which served as digesters. The rumen bacteria used in this experiment was isolated from fresh rumen content. The content was pressed into a sterile container and immediately brought to the Laboratory. Serial dilution was carried out and used to inoculate nutrient agar and chocolate agar. The agar plates were then incubated anaerobically at 37°C for 24 h. The digesters were seeded with rumen bacteria and immersed into water bath operated at 37°C. During the anaerobic digestion, volume of biogas produced was recorded accordingly. This paper, therefore, suggests ways by which water hyacinth can be put into better use through biogas production.

Key words: Rumen, anaerobic digestion, water hyacinth.

INTRODUCTION

The potential application of rumen microorganisms to anaerobic digestion of lignocellulosics has been demonstrated in what is now called rumen derived anaerobic digestion (RUDAD) process (Gijzen et al., 1988). Also, Kivaisi and Eliapenda (1995) reported the use of rumen microorganisms in the anaerobic degradation of bagasse and maize bran. Previous studies had indicated that water hyacinth has between 7 and 13% dry weight protein and about 1.48% fats (Hutabarat et al., 1986; Lucas and Bamgboye, 1998). The hemicellulose in the hyacinth is acted upon by the enzymes of rumen bacteria. In this way, the intermediate compounds such as organic acids are formed. The acids are subsequently converted to biogas. Biogas is a colourless and odourless mixture of methane and carbon dioxide. The proportion of methane is about three to four times that of carbon dioxide, and this is what account for its use in domestic cooking. It can also be used in electricity generation, lighting purposes and useful agricultural applications (Itodo and Kucha, 1997).

Water hyacinth is a large floating tropical aquatic plant with an attractive pale violet flower and broad bright green leaves. Water hyacinth has been declared a nuisance plant weed because of its interference with the use of water causing direct obstruction to navigation, fishing and other commercial activities whose survival depend upon the waterways (Kusemiju and Chizea, 1992). The infestation of Kainji Lake in Nigeria by water hyacinth is a source of concern. This is particularly so because the weed displaces water and increase the rate of evapotranspiration. This reduces the volume of water and consequently electricity generation. Water hyacinths also harbour snakes and other disease vectors and thus constitute a hazard to villagers that uses the water for recreational purposes (Kusimeju, 2000). It is against this background that this research is undertaken with the view to suggesting ways by which the weed can be put to better use and curbing its menace.

MATERIALS AND METHODS

Sample collection and processing

Fresh and living water hyacinth growing on fish ponds at Sidi fish farm was collected. The hyacinth was chopped into small pieces using sharp

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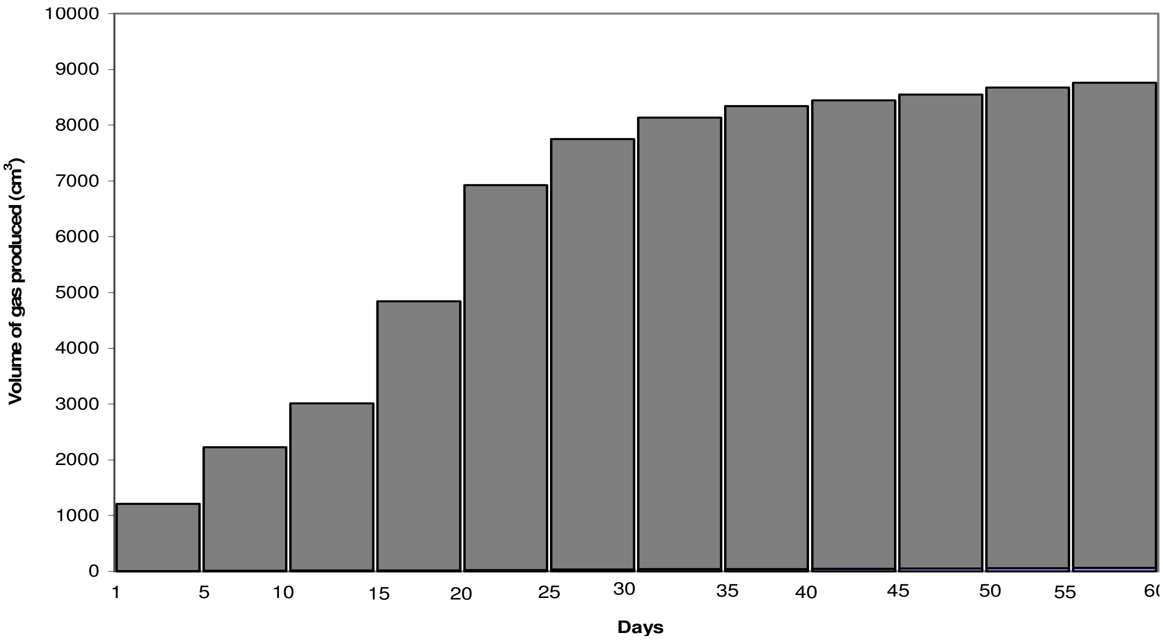

Figure 1. Volume of gas produced for sixty days.

knife. The pieces were then dried and ground into fine powder using pestle and mortar. The rumen bacteria used in this experiment were isolated from samples of rumen fluid obtained from freshly slaughtered cow in Sokoto Abattoir. A small portion of rumen fluid was inoculated on to a pre-reduced nutrient agar and incubated at 37°C for 24 h.

Digestion of water hyacinth

Buchner flasks of were used as digesters, into each about 400 ml of 0.2 M phosphate buffer was mixed with 25 g of powdered water hyacinth. The digesters were then seeded with 50 ml young cultures of the rumen bacteria. The content of each digester was swirled thoroughly to ensure proper mixing. The content of each digester was allowed to stand in water bath operated at 37°C for sixty days. The biogas produced was measured and collected over water.

RESULTS AND DISCUSSION

The cumulative biogas produced for the period of digestion is shown on Figure 1. The figure depicts the average volume of biogas produced in each five days. From the results shown in the two figures, it can be seen that on the average 1 g of digested water hyacinth produces about 145 cm^3 of biogas. This volume is substantial enough in terms of usage in cooking and other applications. This result is markedly different from what was reported by Lucas and Bamgboye (1998). They obtained an average of 3.95 cm^3 biogas. A number of reasons may be advanced to explain the difference. The powdered water hyacinth provide a greater surface area for bacterial action, hence more digestion and more product formation. Secondly the use of phosphate buffer also provided an ideal environment in terms of pH for the rumen bacteria. It also serves as a source of phosphate used in biosynthesis of DNA and hence synthesis of new enzymes that attack the fibrous water hyacinth leading to product formation.

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