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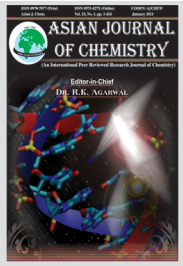

NOTE

Production of Biogas and Alcohol from *Aloe barbadensis* Miller

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Biogas is an alternate of fuel produced by the action of various groups of anaerobic bacteria on biomass, manure, sewage, municipal waste and green waste. It useful for cooking and for electricity production. Production of biogas and alcohol from the rind of Aloe barbadensis Miller is presented in this communication.

Key Words: Aloe barbadensis Miller, rind, biogas and alcohol

Biogas contains a mixture of methane and carbon dioxide. It is found be a good fuel in rural areas where the infrastructure is poor. Relatively it is inexpensive and environmentally clean. It can be used as a fuel for stationary and mobile engines. Biogas is also useful to power the vehicles. In India biogas is produced from the anaerobic digestion of manure in small-scale digestion facilities called Gobar gas. The digester is an airtight circular pit made of concrete with a pipe connection. The manure is directed to the pit, usually obtained from the cattle shed. The pit is then filled with a required quantity of waste water. The gas pipe is connected to the kitchen fire place through control valves. The combustion of this biogas has little odour or smoke. Owing to simplicity in implementation and use of cheap raw materials in villages, it is one of the most environmentally sound energy sources for rural needs. Aloe barbadensis Miller is one of the highest used plants in the herbal industries, both for medical and cosmetic products[1-5]. Annually over a million tones of this plant is processed and it is believed that only its gel has wide applications, the outer rind part is usually decomposed or disposed off.

Aloe vera's leaf rind is rich in carbohydrates and other polysaccharides. This waste has been processed for the production of biogas and alcohol. The Rind part of the *Aloe barbadensis* Miller plant collected during gyro filtration is processed and analyzed for further industrial applications.

The waste which is collected after the gyro filtration step in the production process of aloe powder is subjected to the following processing.

Alkaline washing is done to remove the surface aloin which could stop the degradation of complex polysaccharides to simple carbohydrates or derivatives of glucose.

As the rind is in the form of paste it has to be heated and dried in a hot air oven or can even be sun dried at considerable high temperatures.

Mixing/grinding: The mixing or grinding can be done as per the requirement and any mechanical power driver grinder can be used. After the dried paste is ground, the powder or flakes obtained can be used in the production of biogas and alcohol. The powder obtained is dry brown in colour. The following combinations were used for the production of biogas.

By product {250 g} (without alkali digestion) + 100 mL water.
By product {250 g} (after alkali digestion) + 100 mL water.
By product {250 g} (without alkali digestion) + cow manure (100 mL).
By product {250 g} (with alkali digestion) + cow manure (100 mL).
Only cow manure {100 mL} + 250 mL water.

The cow dung was not directly used. 750 g of unaltered cow dung was taken and the volume was made to 1000 mL by adding distilled water. All the 5 types of inoculations are processed for biogas in heated environment at *ca.* 50 ºC (similar quantities). A bottle pressure gauge was used to calculate the pressure developed due to the production of gas in the setup. The readings were taken after 48 h of incubation. Splinter apparatus is used for initial tests. Pressure reading of the gauge is shown in psi. The initial reading of the bottle pressure gauge was 0000 psi.

Production of alcohol: The byproduct is processed after alkali treatment to remove microbial elements. Later it is

inoculated in to 4 % bakers yeast culture. Elephant manure has been used to prepare the broth and it is believed to have facultative anaerobic bacteria which break down complex polysaccharides to simple carbohydrates and produce alcohol. Degradation of cellulose is done by the aerobic or facultative anaerobic bacteria. Elephant is an animal that feeds only on plant matter. Its fecal matter was subjected to screening and it is found that the bacteria present in the fecal matter were Cellulomonas species. The isolate was able to degrade (200 mg/50 mL cellulose mineral salts medium) pure cellulose (Whatman Grade-1) in 7 days All processing done in anaerobic conditions. The flask is plugged with sterile air tight cotton and incubated in a shaker for 6 days.

Test for alcohol

Jones oxidation: The product is subjected for Jones oxidation (using commercially available Jones reagent) with a mixture of chromium trioxide and sulphuric acid. The standards taken were 1-butanol, 2-butanol or *t*-butyl alcohol.

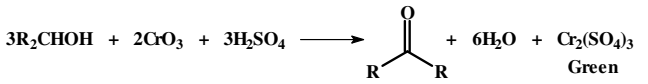
Procedure: About 10 mg or 2 drops of the sample collected after incubation in shaker is dissolved in 1mL of pure acetone in a boiling tube and o it 2 drops of Jones reagent is added.

Lucas test: Commercially available Lucas reagent is used for this test. The standards chosen were 1-butanol, 2-butanol or *t*-butyl alcohol. To about 0.2 mL or 0.2 g of the unknown sample (collected after incubation) in a test tube is added with 2 mL of the Lucas reagent at room temperature. The tube stoppered and shakes vigorously. Later the mixture is allowed to stand. Time required for the formation of the alkyl chloride in the form of an insoluble layer or emulsion is noted.

The readings obtained in different combinations are as follows: Byproduct (without alkali digestion) = 0008 psi; Byproduct (after alkali digestion) = 0014 psi; Byproduct (without alkali digestion) + cow manure = 0034 psi ; Byproduct (with alkali digestion) + Cow Manure = 0047psi; Only cow manure = 0029 psi.

The results indicate that in the presence of cow manure, the alkali digested byproduct is yielding more amount of biogas. It is evident that, due to alkali digestion and presence of cow manure help the process of conversion of complex organic molecules to methane and carbon dioxide.

Alcohol: In the Jones oxidation, within 15 s green colour is observed.



This is an indicative of presence of alcohol. Reaction with Lucas reagent also resulted in the appearance of a cloudy second layer or emulsion. This observation is also favourable for the presence of alcohol.

After a tedious process of culture and incubation, both the tests have resulted positive in majority of the inoculations using elephant dung. The tests confirmed the release of tertiary as well as primary and secondary alcohols. Selective process can result in the production of commercially useful alcohol.

Conclusion

From the results obtained it is suggested that the presence of cow manure when intimately mixed with the alkali digested byproduct, is yielding more amount of biogas. It can also be understood that, alkali digestion and presence of cow manure help the process of conversion of complex organic molecules to methane and carbon dioxide. In case of alcohol production, one can conclude that the byproduct is undergoing oxidation to give a mixture of alcohols. Further, the separation and identification of these alcohols may be accomplished. Also procedures can be standardized for the production of required alcohols selectively.

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