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Original Research Article

Laboratory Scale Synthesis of Ethanol from Maize

Ajitesh Yadav, Chirag Bolar

Datta Meghe College of Engineering, Airoli, Navi Mumbai, Maharashtra, India.

Corresponding Author: Ajitesh Yadav

ABSTRACT

Ethanol can be produced various agricultural feed stocks. This serves two purposes. One is ethanol synthesis in cost effective and environment friendly manner. Second is minimization of biodegradable waste. One such raw material for ethanol synthesis is maize. Bio ethanol can be produced from maize by two methods namely wet milling and dry milling. Grain is steeped and separated into starch, germ and fiber components in wet milling. In a dry milling process, grain is first grand into flour, and processed without separation of starch. Lower capital and easy operation makes dry mill process better alternative. In the current work, various investigations for ethanol production from raw feed stocks are summarized. Experimental synthesis of ethanol from maize is done on laboratory scale and the ethanol product is analyzed by gas chromatography.

Key words: Fees stock, dry milling, wet milling, cost, and yield.

INTRODUCTION

Ethanol production by low cost methods is gaining momentum because of increasing demand for petroleum fuel. As the petroleum fuel sources are vastly depleted, the need for alternative sources of fuel is realized and efforts are being done to encourage use of nonconventional sources. Various forms of energy, such as solar energy, tidal energy and fuel cells are being explored. [1-9] Bio-ethanol is one such alternative. It can be added to petrol or diesel to reduce the cost. According to one estimate, 5% blending (105 cr. liters) can result in replacement of around 1.8 million barrels of crude oil. Emission of pollutants such as carbon dioxide, carbon monoxide (CO) and hydrocarbons (HC) is also minimized due to use of bio-ethanol fuel. Apart from molasses and sugarcane, other feed stocks such as maize, starch, maize grain, sweet sorghum, tapioca, sugar beet are also equally getting importance in India.

REVIEW OF PAST WORK

Bio-diesel production by using different feed stocks is being explored by large number of investigators. [10-14] Various investigators have reported synthesis of ethanol from various feed stocks. Potato waste was used for ethanol synthesis by Ghosal et.al. [15] They obtained 9 percent yield of ethanol. Cashew nut shell extract was used for ethanol production by Ebabhi et.al. [16] They found that the extract of cashew nut shell is capable of producing cellulases and xylanase enzyme. Carica papaya (pawpaw) agro waste was used for ethanol production by Sarkar et.al. [17] They found that Brewer's yeast gave a higher ethanol yield than baker's yeast. Maximum ethanol yield of 12.124 percent was obtained by Rath et.al for waste potatoes. [18] Many investigations are reported for ethanol production from corn, groundnut shell waste, potato peel, banana peel, rice straw and corn cob. [19,20]

IMPORTANCE OF ETHANOL

Ethyl alcohol is an important feed stock for the manufacture of chemicals like butanol, acetic acid, acetic anhydride, PVC, acetaldehyde etc. It finds application in potable liquor, synthetic rubber, plastic, perfumes, homeopathic medicines, tonics, pharmaceutical products. According to government guidelines, it is mandatory to blend 5% ethanol. But oil marketing agencies have been able to provide only 2 %

average ethanol blend. The reason for this is the limited feed stock for ethanol. Sugar mills are the primary source of ethanol in India. The efforts on ethanol production are concentrated on non edible and low cost feed stocks. The food scarcity in India and many other developing countries limits the use of food stocks such as sugar, food grains and other materials. The use of waste feed stock can render acceptability to ethanol blending in fuels.

METHODOLOGY

Steps in ethanol production from maize -

1. Sample collection.
2. Size reduction of maize.
3. Hydrolysis of powdered maize to breakdown starch into simple sugar mixture.
4. Yeast fermentation of resulting sugar solution.
5. Distillation of fermented solution to produce ethanol.

EXPERIMENTAL SETUP OF SIMPLE DISTILLATION

Experimental consists of a round bottom flask as shown in fig. 1. It was equipped with temperature indicator. The condenser was connected to it and coupled with other flask for product collection.

Fig.1: Experimental setup of simple distillation

RESULTS OBTAINED

The chromatograph for ethanol product is shown in fig.2.

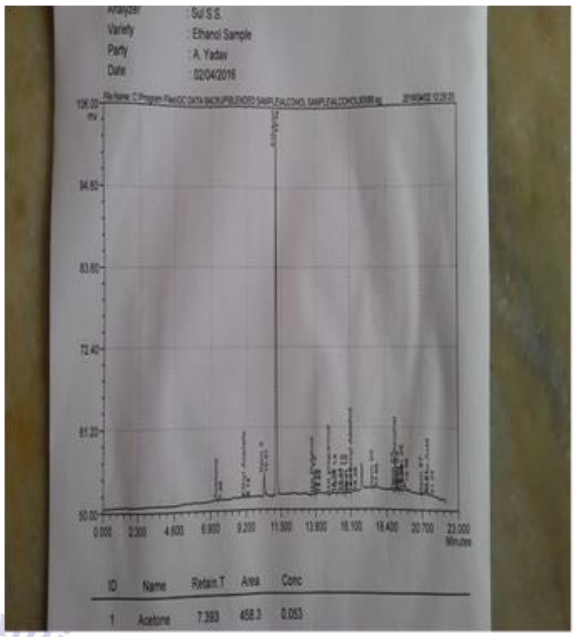

Fig. 2: Gas chromatography for ethanol

CONCLUSION

It can be seen from the chromatographic analysis (Fig.2) that the ethanol obtained is having good purity. The process explained for ethanol production is easy and economical. It can be concluded that maize is very good feed stock for ethanol production on industrial scale.

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