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Research Paper :

Studies on effect of different hydrolysis method and particle sizes of corncob on bioethanol production

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ABSTRACT

Among the available agricultural products, corn cob is an abundant lignocellulosic raw material which could be a potential source of bioethanol production. This possible substrate contains cellulose which cannot be fermented by conventional yeast. For these reasons, corncob should be hydrolyzed first to simple sugars, followed by yeast fermentation of glucose to ethanol. In present investigation, efforts were made to utilize the agricultural waste *viz.,* corncob in production of bioethanol. Corn cob from different varieties were analyzed to judge there suitability for bioethanol production. The corncob variety with high lignocellulosic content was used for further studies, which was hydrolyzed by two different methods (*i.e.* acid and enzyme) to prepare corncob hydrolysate. The different particle sizes of corn cob flour were also considered during study so as to analyze the effect of particle size on the ethanol yield. The results revealed that amongst various local varieties, sweet corn variety was found to have maximum carbohydrate content (87 per cent), out of which 43.20 per cent was cellulose content. On hydrolysis, higher sugar concentration liberated from acid hydrolysate compared to enzyme hydrolysate, while particle size inversely correlates with the production of reducing sugar during hydrolysis. It is found that, Acid hydrolysis of corn cob with 0.5 mm particle size, 2 per cent inoculums level and fermentation period of 78 hr given maximum yield of 24.50 per cent of bioethanol.

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Bioethanol is an alcohol made through the fermentation of plant sugars from agricultural crops and biomass resources. In the search for viable alternative of biofuel, corn cobs has been pursued as suitable lignocellulosic waste for bioethanol production in process involving chemical pretreatment (Lin and Tanaka, 2006). The lignocellulosic biomass comprises of cellulose, hemicellulose and lignin (Hayn *et al.*, 1993). During recent years considerable interest has been shown in the utilization of lignocellulosic materials as renewable resource for the production of industrially potential products such as ethanol, organic acids, single cell proteins, plastics, resins, chemical solvents etc. Lignification and crystallinity of cellulose are major barrier in the process of conversion of lignocellulosic biomass into bioethanol. It is essential to alter or remove structural and compositional impediments by pretreatment to improve rate of hydrolysis. Enzymatic methods have advantage of being eco-friendly besides applicable under mild condition of hydrolysis (Ghose, 2005). Bioethanol is one of the most important renewable fuels contributing to the reduction of negative environmental impacts generated by the worldwide utilization of fossil fuels. Lignocellulosic biomass is a cheap, renewable, abundantly available resource and its conversion to glucose and other fermentable sugars has been considered, in the last few decades, to be an attractive route for ethanol production (Curreli *et al.*, 1997).

Maize (*Zea mays*) known as corn utilized in more diversified ways than any other cereals. With its high percentage of carbohydrates, lipids and proteins, it is nutritious for human consumption. Apart from its nutritional qualities its waste can also be utilized to produce bioethanol and bio gas etc. Basically the corn cob could be preferred over other agricultural byproducts due to its composition which is easily convertible to bioethanol (Cao *et al.,* 1996). Corn cobs are available as 20 per cent of the total weight of unshelled corns and are available as agricultural waste after shelling. The total production of corn cobs was 1.4 million tons in India while in the world 30.1 million tonnes of corn cobs used for furfural production due to its high hexose and pentose content (Kuhad and Singh, 1993). Considering the importance of lignocellulosic material in biothanol production, corn cob could be a good agriculture waste material for bioethanol production. Hence, present investigation was carried out with an objective to utilize lignocellulosic waste from corn cob in bioethanol production. In present study, different particle sizes of