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Bioethanol Production from Marine Algae Ulva Lactuca and Sargassum Swartzii: Saccharification and Process Optimization

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Abstract : Bioethanol is a sustainable biofuel that can be used alternative to fossil fuels. Today, third generation (3G) biofuel is gaining more attention than first and second-generation biofuel. The more lignin content in the lignocellulosic biomass is the major drawback of second generation biofuels. Algae are the renewable feedstock used in the third generation biofuel production. Algae contain a large number of carbohydrates, therefore it can be used for the fermentation by hydrolysis process. There are two groups of Algae, such as micro and macroalgae. In the present investigation, Macroalgae was chosen as raw material for the production of bioethanol. Two marine algae viz. Ulva Lactuca and Sargassum swartzii were used for the experimental studies. The algal biomass was characterized using various analytical techniques like Elemental Analysis, Scanning Electron Microscopy Analysis and Fourier Transform Infrared Spectroscopy to understand the physio-Chemical characteristics. The batch experiment was done to study the hydrolysis and operation parameters such as pH, agitation, fermentation time, inoculum size. The saccharification was done with acid and alkali treatment. The experimental results showed that NaOH treatment was shown to enhance the bioethanol. From the hydrolysis study, it was found that 0.5 M Alkali treatment would serve as optimum concentration for the saccharification of polysaccharide sugar to monomeric sugar. The maximum yield of bioethanol was attained at a fermentation time of 9 days. The inoculum volume of 1mL was found to be lowest for the ethanol fermentation. The agitation studies show that the fermentation was higher during the process. The percentage yield of bioethanol was found to be 22.752% and 14.23 %. The elemental analysis showed that S. swartzii contains a higher carbon source. The results confirmed hydrolysis was not completed to recover the sugar from biomass. The specific gravity of ethanol was found to 0.8047 and 0.808 for Ulva Lactuca and Sargassum swartzii, respectively. The purity of bioethanol also studied and found to be 92.55 %. Therefore, marine algae can be used as a most promising renewable feedstock for the production of bioethanol.

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