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Bioethanol Production from Perennial Grasses

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Abstract

Different perennial grasses are one of the biomass options for lignocellulosic bioethanol production. The benefits of cultivating this form of biomass in terms of natural diversity and landscape protection are numerous. The NED pretreatment was combined with a traditional three-step bioethanol manufacturing procedure. The results demonstrate that glucose concentrations and hydrolysis efficiencies were similar at all pretreatment temperatures, ranging from 4.3 to 5.1 g/l and 15.2 percent to 17th.7%, respectively. On the other hand, as the pretreatment temperature climbed, the ethanol production fell. However, utilising this type of feedstock, the mass balance found that 100 g of biomass could create 3.3-4th.0 g ethanol. Because of the pretreatment, which may not have been adequate for soft biomass, the total efficiency and yield of the process were lower than predicted. Perennial grasses give interesting choices in the current demand for renewable and sustainable energy sources to alleviate the load of the global energy crisis. The ligno-cellulosic perennial grass Panicum virgatum (Switchgrass), which is used as a cheaper and more efficient feedstock for bioethanol production in Europe and the United States, might also be used in India for the same reason. The current study focuses on bioethanol production using P. virgatum (for the first time in India) and P. maxima. Switch grass seeds were received from the University of Bologna in Italy, whereas guinea grass seeds were obtained from the IGFRI in Jhansi, Uttar Pradesh, India. Both grasses were grown at IIT Delhi's Micromodel (an experimental field location). The harvested grass biomass was analyzed for various parameters including reducing sugars for subsequent bioethanol production. Among different pretreatment methods (Acid pretreatment, Alkali pretreatment and Microwave pretreatment) tested , alkali method showed maximum reducing sugars (280 mg/g for P. virgatum and 262 mg/g for P. maximum) with 15 % reduction in crystallinity of cellulose in P. virgatum and 12% in P. maximum. RSM and CCD were used to improve it even further. To increase reducing sugar content, the impacts of four independent variables were investigated: NaOH (1-5%), temperature (60-100 C), substrate loading (1-3%), and reaction time (30-150 min). The following were the combined best conditions for maximum reducing sugar (68.3 percent): 2.5 percent substrate, 5% NaOH, and a reaction duration of 120 minutes at 100 degrees Celsius. A second order polynomial equation was used to evaluate the results (ANOVA). demonstrated a considerable increase in lowering sugars of 62-68 percent. The potential ethanol production from switch grass was calculated to be 26.72 percent, while it was 25.24 percent for P. maxima. This study shows that sugar yield is greatly increased under optimum pretreatment conditions, indicating that both P. virgatum and P. maximum grasses could be used as feedstock for bioethanol production in India. At the conference, all data related to all stages of cultivation, characterisation, pretreatment and hydrolysis procedures, and bioethanol production from these grasses will be discussed. Recent Publications 1. Adak, A., Tiwari, R., Singh, S., Sharma, S., & Nain, L. (2016) Laccase Production by a Novel White-Rot Fungus, Pseudolagarobasidium acaciicola LA 1 Through Solid-State Fermentation of Parthenium Biomass and Its Application in Dyes Decolorization. Waste and Biomass Valorization, 7, 1427-1435. 2. Arora, K., Sharma, S., & Monti, A. (2016) Bio- remediation of Pb and Cd polluted soils by switchgrass: A case study in India. International Journal of Phytoremediation, 7(18), 704-709. 3. Arora, K.; Kumar, A., & Sharma, S. (2012) Energy from Waste: Present Scenario, Challenges and Future Prospects towards Sustainable Development. IGI Global, 271-296. 4. Tiwari, G., Shivangi, Sharma, S., & Prasad, R. (2015) Bioethanol production: Future prospects from non-traditional sources in India. International Journal of Research in Biosciences, 4, 1-15. 5. Kumar, A., & Sharma, S. (2011) Non-edible oil seeds as biodiesel feedstock for meeting energy demands in India, Renewable and Sustainable Energy Reviews, 15, 1791-1800.

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