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Alkaline Treatment of Filter Paper as Cellulosic Material for Bioethanol Production

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Structured Abstract

Background: Fossil energy, derived from the decomposition of buried plants and animals, is a non-renewable and dominant source of energy worldwide. It is primarily used by industries like the automotive sector, which heavily relies on petroleum. However, due to rapid industrialization and urbanization, fossil fuels are expected to be depleted within the next half-century. Alternative sources like bioenergy, biofuel, and bioelectricity are being introduced to reduce dependence on fossil fuels, such as bioethanol, which is widely used today. So, this research aims to explore the efficiency of bioethanol production from second-generation biomass, specifically filter paper, using sodium hydroxide (NaOH) treatment. The study compares the effect of NaOH treatment on glucose liberation rate, total ethanol production, and efficiency of different NaOH concentrations.

Methods: The research includes five stages: pre-treatment, yeast inoculation, ethanol fermentation, DNS (Dinitrosalicylic) analysis, and biomass estimation. The filter paper was cut in a similar size and treated with three different NaOH concentration (1.0%, 1.5% and 2.0%) for 24 hours. Yeast was inoculated in media for 24 hours. Filter paper was added into the fermentation media with the inoculation of yeast to conduct batch ethanol fermentation for 48 hours. The data was analysed within 3 hours interval for DNS analysis and biomass estimation.

Results: The study found that filter paper treated with 2.0% NaOH showed the highest sugar liberation at 20.12% and produced 0.067 g/L of ethanol followed by 1.5%, 1.0% and Control. The untreated paper had the lowest sugar liberation at 12.13% and 0.021 g/L of ethanol after 48 hours. Specific growth rate of the Yeast in the sample 2.0% NaOH also the highest compared to 1.5%, 1.0% and untreated filter paper. So, the higher the concentration of NaOH, the higher the glucose liberation, ethanol production and specific growth rate of the Yeast.

Conclusion: In conclusion, the alkaline treatment has potential as a good pre-treatment for filter paper, illustrating its potential for ethanol production. Further research could optimize the breakdown of cellulose into fermentable sugars, particularly glucose, by using higher NaOH concentrations and additional sources like lignocellulosic biomass.

Keywords: Alkaline treatment, Lignocellulosic Material, Filter paper, Yeast, DNS Analysis

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