Second Generation Bioethanol Production: Green Alternative Energy for Future Energy Crisis

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Abstract

Emerging environmental pollution and depleting fossil fuel resources issues are creating a requirement for more environmentally friendly alternative renewable fuels. In that case bioethanol has gathered much attention as a fuel additive and fuel enhancer. In the current study, corncob and paper waste were used as lignocellulosic biomass and followed the simultaneous saccharification and fermentation via bacterial pathways to produce second generation bioethanol. Both biomasses were pretreated initially using mechanical and chemical pretreatments and they were hydrolysed by two bacterial strains; Bacillus sp. and Norcardiopsis sp. and fermented by Achromobacter sp. which were previously isolated. The bioethanol production was followed by hydrolysing of biomass by Bacillus sp. and Norcardiopsis sp. for 72 hours at 37°C and then the fermentation was done using the bacterium Achromobacter sp. for 72 hours at 37°C. Detecting gas trapped in Durham tubes and Solid Phase Micro Extraction coupled with GCMS were used to screen and quantify the ethanol production respectively. The highest ethanol percentage (v/v) was obtained from alkaline pretreated paper waste hydrolysed by the Bacillus sp. (0.734±0.154%) and the lowest ethanol percentage (v/v) was obtained from alkaline pretreated corn cob hydrolysed by the Norcardiopsis sp. (0.155±0.154%). Acid pretreated corn cobs, alkaline pretreated corn cobs, and acid pretreated paper waste which was hydrolysed by Bacillus sp. and fermented by Achromobacter sp. produced ethanol percentages (v/v) of 0.726±0.154%, 0.564±0.154%, and 0.657±0.154% respectively. Acid pretreated corn cobs, acid pretreated paper waste, and alkaline pretreated paper waste which was hydrolysed by Norcardiopsis sp. and fermented by Achromobacter sp. produced ethanol percentages (v/v) of 0.587±0.154%, 0.599±0.154%, and 0.627±0.154% respectively. Thus, the results of the study revealed that both cernsobs and paper waste have high potential for bioethanol production, and paper waste is the best feedstock for second-generation bioethanol production among used biomasses.

Keywords: Bioethanol production, Lignocellulosic biomass, Corn cobs, Paper waste