Bioethanol production through syngas fermentation in a tar free bioreactor using *Clostridium butyricum*

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ABSTRACT

Biomass-generated syngas conversion through fermentation is a promising technique for bioethanol production due to increasing demand for clean and sustainable energy. However, lignocellulosic biomass is difficult to degrade wholly, and traditional pretreatment process has several drawbacks. The present study emphasizes on bioethanol production from lignocellulosic biomass-based syngas including the main composition of N_2 (45.58%), CO (22.92%), CO_2 (7.9%), H_2 (13.05%), and CH_4 (1.13%). Field emission electronic microscopic analysis was used to characterize freshly cultured *Clostridium butyricum* for syngas fermentation and experiment was run in a bioreactor (TFB). The obtained yield of bioethanol was analyzed by nuclear magnetic resonance and gas chromatography-mass spectrometry analyses. For this syngas fermentation, treated syngas was preferred, as most of the *Clostridium butyricum* grown on best fermentation conditions. The results show that except 0.03% of CO_2, other gases were dissolved entirely. It is also found that extracted bioethanol was identified by corresponding NMR (^1H) spectra of methyle group (CH_3-), methylene group (–CH_2–) and hydroxyl group (OH). The yield of bioethanol was 29.94 mmol from 1 L of syngas. Hence, this biomass-generated syngas is the appropriate renewable energy source for the meetup of future energy needs.

KEYWORDS

Bioethanol; *Clostridium butyricum;* Syngas; Syngas fermentation; TFB

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