Ethanol Production using Thermophilic Cellulose-degrading Anaerobes for Pennisetum Alopecoider

吳秋芬、林啟文

E-mail: 9708328@mail.dyu.edu.tw

ABSTRACT

Pennisetum Alopecoider (Napiergrass Taishigrass No.2) was selected as a main carbon source for cellulose in this study. The microbes were grown under anaerobic and thermophilic conditions, and isolated form Pennisetum Alopecoider and sheep dung composts. It was focused on bioconversion of Pennisetum Alopecoider to ethanol in a single-step process and determining the best growth conditions by using response surface methodology analysis. In addidtion, Clostirdium thermocellum was used to set up the protocol and conditions of culturing. Results indicated that the degradation capability is similar for cellulose-degrading mixed culture and Clostridium thermocellum, and the ethanol production increased as the carbon source addition increased. Moreover, Pennisetum Alopecoider also provides certain type of sugar and will even increase ethanol production. The results also showed that microbes can use avicel and Pennisetum Alopecoider to produce ethanol. The best culturing time was approximately 95-142 hr. It was found that the maximum ethanol production concentrations (the ratio of Ethanol/Acetic acid) were 1066 mg/L (2.06) and 1582 mg/L (1.73) under substrate concentrations at 10 g/L and 40 g/L for avicel and Pennisetum Alopecoider, respectively. Furthermore, the microbe can produce butanol, and the maximum production concentration was 876 mg/L using avicel at 10 g/L. The effect of initial pH on microbes showed that the best pH was pH 7 and ethanol concentration was 530 mg/L under 20 g/L Pennisetum Alopecoider. The best growth conditions of microbes were pH 7.18 and incubating time of 129.2 hr using response surface methodology analysis, and the best ethanol producing concentration was 754 mg/L. Co-culture of Clostridium thermocellum and microbes in this study resulted in enhancement for ethanol production.

Keywords : bioenergy ; cellulose ; ethanol ; Pennisetum Alopecoider ; response surface methodology

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