Topic: Effectiveness of Fungal Treatment and Acclimated Microbial Consortium on Biodegradation and Biogas Yields of Lignocellulosic Grass

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ABSTRACT

This study aims to improve the biodegradability of paragrass and its methane potential using (1) fungal pretreatment, and (2) acclimated microbial consortium (AMC) as the inoculum. The effectiveness of fungal treatment by *Coprinopsis cinerea* and *Polyporus tricholoma* on biodegradability and methane yield of paragrass was investigated. After 15 days fungal treatment, reduction in cellulose crystallinity was found in the grass treated with *C. cinerea* and *P. tricholoma*. Biogas production from the fungal treated grass and from the untreated grass with original sludge were compared. The maximum methane production rate of the treated grass occurred earlier than the untreated grass; i.e., at day 10 for the grass treated with *C. cinerea*, day 13 for the grass treated with *P. tricholoma*, and day 22 for the untreated grass. However, after 140 day anaerobic digestion, the methane yield of the grass treated by *C. cinerea* and by *P.tricholoma* was approximately 15% lower than that of the untreated grass, which was 368 mL STP/g VS added. Using the two-stage fungal treatment and anaerobic digestion, the recalcitrant cellulose in the fungal treated grass was significantly lower than that of the untreated grass ($P<0.05$), while the amounts of recalcitrant hemicellulose were approximately the same.

The specific methane yields of a wide variety of paragrass was investigated. The untreated grass was inoculated with two types of sludge: (1) a typical anaerobic sludge obtained from a domestic wastewater treatment plant, and (2) a sludge acclimated to fibrous substrates in raw palm oil mill effluent (POME). The acclimated microbial consortium could enhance the hydrolytic, acetogenic and methanogenic activities of the sludge significantly ($p < 0.05$). After 80 days of anaerobic digestion, the methane yield of the OS and the AMC were 277 and 316 mL STP/g VS added, respectively. The cellulose, hemicellulose and lignin were reduced by 40%, 48% and 37%, respectively, by the OS, while 51% cellulose, 59% hemicellulose and 40% lignin, respectively, by the AMC. The acclimatization of the

mesophilic microbial community in raw POME can significantly enhance the methanogenic activity, the biodegradation and the methane yield of the paragrass ($P < 0.05$).

Keywords : fungal pretreatment, acclimated microbial consortium, biodegradation, biogas yield, paragrass