Biodegradation of Lignocellulose by Microbial Biofilms Developed From White Rot Fungi and Soil Bacteria

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Cellulolytic microorganisms are responsible for much of the cellulose degradation in soils. Although a variety of microorganisms i.e. white-rot fungi (WRF) are capable of degrading cellulose, only a few of them produce significant quantities of enzyme fractions which hydrolyse cellulose into simple sugars. Biofilms for hydrolysing lignocellulosic biomass have been reported in several studies. However, when compared to monocultures, their efficiency is lower, but no one has used WRF to develop biofilms. Thus, this study was focused on evaluating the efficiency of cellulolytic activity of mono and mixed microbial cultures. Microbial isolations were carried out using coir retting water and soil samples and were inoculated on Congo Red Agar with Carboxy Methyl Cellulose to screen the most effective cellulolytic WRF and bacteria. Fungal-bacterial biofilms (FBB) were developed from the selected microorganisms. The efficiency of cellulolytic activity of the selected FBB was evaluated using the production of reducing sugar through the Anthrone method. Two WRF (F3 and F4) and three bacterial isolates (B3, B4, and B6) were selected as the best cellulolytic microorganisms. Out of that, F4 and B3 showed the significantly highest cellulolytic activities ($P < 0.05$). All the biofilm combinations showed significantly higher sugar yield than that of the other monocultures. The highest mean sugar level (1823.90 ppm) and the highest sugar formation rate were observed in biofilm combination FBB2, with one WRF and two cellulolytic bacteria, after eight days of incubation. Thus, the selected FBB combination can be used to enhance the hydrolysis efficiency of cellulose for different industrial applications.

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