

Determination of Lignocellulose Biodegradation Efficiency of Enriched Microbial Consortia from Compost, Cow Dung and Coir Retting Water

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Various drawbacks of fossil fuels have demanded the need for alternative sources of energy such as biofuels and second-generation bioethanol from lignocelluloses is favoured because of the food insecurity caused by first-generation bioethanol production. Even though lignocellulose is the most abundant, sustainable and cost-effective renewable biomass on earth, degradation of lignocelluloses to produce bioethanol is difficult because of its complex and robust structure. This study investigated the capability of microbial consortia enriched from compost, cow dung and coir retting water to degrade three lignocellulosic materials i.e., rice straw, corn straw and sawdust. Alkaline pretreated lignocellulosic substrates and a mixture of the three substrates in equal ratios were inoculated separately with the three microbial sources and a mixture of the three microbial sources, which were enriched twice (4 days each) using the same pretreated lignocellulosic substrate or the substrate mixture as the only source of carbon in basal culture medium (5 g of peptone powder and 3 g of yeast extract powder in 1 L of distilled water of pH 7). Four replicates each per treatment and a non-inoculated control was maintained in a completely randomized design, with no aeration at room temperature. The lignocellulose biodegradation ratio was tested by acetic acid-nitric acid reagent after 5 days of incubation. Statistical significance of the results were analyzed using one-way ANOVA ($p < 0.05$). Subsequent mean comparisons of treatments were done by Turkey's test using Minitab 19.2 version. All the substrates had a significantly higher degradation ranged from 21.43% - 66.70% compared to their control. Highest degradations of 66.70% and 58.12% were found in rice straw by enriched consortia from microbial mixture and compost, respectively. The values are comparable to 60% and 75% of rice straw degradation in two different studies which were incubated for 4 and 7 days respectively at 50 °C utilizing microbial consortia developed from compost by several enrichment cultures. The use of mixtures compared to the individual components alone both in the case of lignocellulosic substrates and microbial sources showed a positive effect on lignocellulose biodegradation. Further studies will reveal the bioethanol production efficiency of these lignocellulosic substrates and microbial sources.

Keywords: Biofuels, Lignocellulose, Enriched microbial consortia, Biodegradation