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In-House Enzyme Blends from Polyporus ciliatus CBS 366.74 for Enzymatic Saccharification of Pretreated Corn Stover

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Abstract : The study investigated the saccharification potential of in-house enzymes produced from a white-rot basidiomycete strain, Polyporus ciliatus CBS 366.74. The in-house enzymes were produced by growing the fungus on mono and composite substrates of cocoa pod husk (CPH) and green seaweed (GS) (Ulva lactuca sp.) with and without the addition of 25mM ammonium nitrate at 4%w/v substrate concentration in submerged condition for 144 hours. The crude enzyme extracts preparations (CEE 1-5 and CEE 1-5+AN) obtained from the fungal cultivation process were sterile-filtered and used as enzyme sources for enzymatic hydrolysis of hydrothermally pretreated corn stover using a commercial cocktail enzyme, Cellic Ctec3, as benchmark. The hydrolysis was conducted at 50°C with 50mM sodium acetate buffer, pH 5 based on enzyme dosages of 5 and 10 CMCase Units/g biomass at 1%w/v dry weight substrate concentration at time points of 6, 24, and 72 hours. The enzyme activity profile of the in-house enzymes varied among the growth substrates with the composite substrates (50-75% GS and AN inclusion), yielding better enzyme activities, especially endoglucanases (0.4-0.5U/mL), β-glucosidases (0.1-0.2 U/mL), and xylanases (3-10 U/mL). However, nitrogen supplementation had no significant effect on enzyme activities of crude extracts from 100% GS substituted substrates. From the enzymatic hydrolysis, it was observed that the in-house enzymes were capable of hydrolysing the pretreated corn stover at varying degrees; however, the saccharification yield was less than 10%. Consequently, theoretical glucose yield was ten times lower than Cellic Ctec3 at both dosage levels. There was no linear correlation between glucose yield and enzyme dosage for the in-house enzymes, unlike the benchmark enzyme. It is therefore recommended that the in-house enzymes are used to complement the dosage of commercial enzymes to reduce the cost of biomass saccharification.

Keywords : enzyme production, hydrolysis yield, feedstock, enzyme blend, Polyporus ciliatus
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