Enhancing Soybean Value Chain through Enzymatic Hydrolysis

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Resumo

Soybean is a major agricultural commodity in the Brazilian economy, with an estimated 2023/2024 grain harvest of 294.1 million tons. Its processing generates by-products such as soybean hulls and molasses. The enzymatic hydrolysis of sugars in these by-products by α-galactosidases and cellulases releases simple sugars like glucose and galactose, which can be fermented by yeasts to produce ethanol and other high-value products. This study aimed to evaluate the potential of the enzymatic arsenal of the fungi *Trichoderma virens* and *Trichoderma yunnanese* for the valorization of these agro-industrial residues. Conditions for enzyme production using wheat straw were optimized for each fungus. The enzymes were biochemically characterized by determining their optimal pH and temperature, as well as their thermostability. The crude extracts were evaluated for soybean molasses hydrolysis and pretreated soybean hull hydrolysis. α-Galactosidase production was optimized in solid state fermentation for 4 and 6 days by *T. virens* (0.75 U/mL) and *T. yunnanense* (0.6 U/mL). Enzyme was analyzed in SDS-PAGE and zymogram presenting bands with activity. Both enzymes exhibited an optimal pH of 4.0 and an optimal temperature of 55°C. The enzyme from *T. virens* showed high thermostability, retaining 100% of its activity after 11 days of pre-incubation at 40°C and a half-life of 135 min at 55°C, while the enzyme from *T. yunnanense* did not exhibit thermostability. The alpha-galactosidase from *T. virens* completely hydrolyzed stachyose and most of the raffinose in soybean molasses after 12 h. The production of cellulases, FPase, and β-glucosidase were optimized in liquid media for *T. yunnanense* resulting in 0.083 and 0.130 U/mL, respectively. The β-glucosidase exhibited an optimal pH of 4.0, and FPase had an optimal pH of 4.5, while the optimal temperatures were 45°C and 65°C, respectively. The enzymatic extract with cellulase activity was applied to soybean hulls and showed median efficiency in hydrolyzing them. Hydrolysis was also evaluated using the commercial enzyme CellicCTec2 at 2 and 3 FPU/g, allowing for 11,66 and 40,63% of biomass hydrolysis. Soybean by-products have high potential to increase the added value of the grain and bring economic benefits to producers in a biorefinery concept for maximum material utilization. Apoio: UFSJ, Fapemig

Palavras chaves:

Informe de 4 a 8 palavras chaves, por exemplo:

Soy; Soy molasses; Soy hull; cellulase, alpha-galactosidase, biorefinery, saccharification

Área temática:

Escolher uma das áreas temática descritas:

xA2.3 - Aproveitamento de subprodutos agroindustriais

Preferência de apresentação:

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