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Use of Corn Stover for the Production of 2G Bioethanol, Enzymes, and Xylitol Under a Biorefinery Concept

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Abstract : The use of biomass as feedstock for the production of fuels and other chemicals of interest is an ever-growing accepted option in the way to the development of biorefinery complexes; in the Mexican state of Sinaloa, two million tons of residues from corn crops are produced every year, most of which can be converted to bioethanol and other products through biotechnological conversion using yeast and other microorganisms. Therefore, the objective of this work was to take advantage of corn stover and evaluate its potential as a substrate for the production of second-generation bioethanol (2G), enzymes, and xylitol. To produce bioethanol 2G, an acid-alkaline pretreatment was carried out prior to saccharification and fermentation. The microorganisms used for the production of enzymes, as well as for the production of xylitol, were isolated and characterized in our workgroup. Statistical analysis was performed using Design Expert version 11.0. The results showed that it is possible to obtain 2G bioethanol employing corn stover as a carbon source and Saccharomyces cerevisiae ItVer01 and Candida intermedia CBE002 with yields of 0.42 g and 0.31 g, respectively. It was also shown that C. intermedia has the ability to produce xylitol with a good yield (0.46 g/g). On the other hand, qualitative and quantitative studies showed that the native strains of Fusarium equiseti (0.4 IU/mL - xylanase), Bacillus velezensis (1.2 IU/mL – xylanase and 0.4 UI/mL - amylase) and Penicillium funiculosum (1.5 IU / mL - cellulases) have the capacity to produce xylanases, amylases or cellulases using corn stover as raw material. This study allowed us to demonstrate that it is possible to use corn stover as a carbon source, a low-cost raw material with high availability in our country, to obtain bioproducts of industrial interest, using processes that are more environmentally friendly and sustainable. It is necessary to continue the optimization of each bioprocess.

Keywords : biomass, corn stover, biorefinery, bioethanol 2G, enzymes, xylitol
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