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Novel saccharification of lignocellulosic biomasses using whole broth enzymes: Towards on-site manufacturing (osm) of enzymes for production of 2nd generation ethanol from eucalyptus wastes in biorefinery configurations

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Abstract

Saccharification of lignocellulosic biomasses using enzymatic hydrolysis has been proven to be an attractive route for the production of second generation (2G) ethanol from abundant low-cost renewable feedstocks such as eucalyptus wastes. Nevertheless, approximately 30-40% of the overall production cost of ethanol from biomasses might be attributed to the price of outsourced enzymes, which incorporates significant cost parameters related to the need for purification, stabilization, packing, transportation, storage and conservation, among others. In this scenario, the use of crude non-purified???whole broth??? enzyme cocktails produced on-site (OSM, onsite manufacturing) emerges as a promising option to significantly reduce the impact of the cost of the enzymes on the overall production cost of the cellulosic ethanol. As result, economically feasible bio refineries for the production of ethanol from eucalyptus wastes might become a commercial reality in countries such as Brazil and Portugal, for example. In this study, cellulosic sugars were produced from Eucalyptus grandis wastes using???whole broth??? cellulases produced from Penicillium echinulatum. Fed-batch enzymatic hydrolyzes of steam-only pretreated and steam treated/organosolv delignified chips were performed at 15% WIS at 50C and pH 4.8-5.2 for 48h runtime. ???Whole broth??? cellulase cocktails of 6mgP/g product (Bradford method) were employed to achieve an enzyme load of 6 mgP/g DM. A commercial enzyme cocktail (160mgP/g product) was used as control at similar protein load. Cellulose conversions of 62% and 76% and glucose (monomer) yields of 292kg/ton DM and 358kg/ton DM were achieved from the enzymatic hydrolyzes of the steam-only pretreated and steam treated/organosolv delignified eucalyptus chips, respectively, using ???whole broth??? enzymes. Conversely, cellulose conversions of 77% and 84% and glucose (monomer) yields of 363kg/ton DM and 396kg/ton DM were obtained from the enzymatic hydrolyzes of the respective pretreated eucalyptus chips using commercial enzyme cocktails.

Biography

Henrique Baudel has completed his PhD in Environmental Sciences from University of Concepción (Chile), Chemical Engineering from Federal University of Pernambuco (Brazil) and Postdoctoral studies from Lund University (Sweden). He works as P&D and Technology Director of America Biomass Technologies, a premier chem and biotech company. His publications reach more than 50 works including papers in journals and proceedings, patents and specialized technical reports. He has been working as a Supervisor of research works at both academia and industry, as well as serving as Reviewer and Editorial Board Member of repute.