Second Generation Bioethanol: Opportunity to Decrease Production Cost

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Among alternatives of bioenergy resources, lignocellulose has been identified as a potential raw material for production of second generation bioethanol. Although, sustainability advantages of biofuel have been recognized, the cost production is the most important challenge in large scale production. This research investigates different dilute acid hydrolysis methods versus the opportunity of decreasing cost production of bioethanol. Different dilute acid hydrolysis methods are compared to determine the highest glucose and pentose yields under mild operating conditions. The raw material used was agricultural waste that was pretreated under mechanical milling and steam explosion. Dilute sulfuric acid , hydrochloric acid , nitric acid and phosphoric acid solutions were used for acid hydrolysis under different temperatures (100ºC and 140ºC) and different times of exposition. Results indicate that the highest cellulose-to-glucose conversion rate of 146.0 g kg-1 and cellulose-to-pentose 71.0 g kg-1 of biomass was achieved by the pretreatment with nitric acid under 100ºC of temperature. The economical bottlenecks were solved by three different approaches. First, the effectiveness of nitric acid hydrolysis is supported by its low cost in comparison to the enzymatic process; the reaction is effective under low temperature and acid concentrations. Second, the nitric acid is able of forming a protective barrier against reducing drastically the equipment maintenance costs. Third, the nitric acid is environmentally friendly because it is easily neutralized by ammonia increasing the capacity of water recovery and reducing the energy costs. These techno-economic advantages are the key factors of a large scale bioethanol production reaching a competitive cost against fossil fuels.

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