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Pretreatment of Aquatic Weed Typha latifolia with Sodium Bisulphate for Enhanced Acid and Enzyme Hydrolysis for Production of Xylitol and Bioethanol

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Abstract : Employing lignocellulosic biomass in fermentative production of xylitol and bioethanol is gaining interest as it is renewable, cheap, and abundantly available. Xylitol is a polyol, gaining its importance in the food and pharmacological industry due to its low calorific value and anti-cariogenic nature. Bioethanol from lignocellulosic biomass is widely accepted as an alternative fuel for transportation with reduced CO_2 emissions, thus reducing the greenhouse effect. Typha latifolia, an aquatic weed, was found to be promising lignocellulosic substrate as it posses a high amount of sugars and does not compete with arable lands and interfere with food and feed competition. In the present study, xylose from hemicellulosic fraction of typha is converted to xylitol by isolate Jfh5 (Candida. tropicalis) and cellulose part to ethanol using Saccharomyces cerevisiaeVS3. Initially, alkali pretreatment of typha using sodium hydroxide, potassium hydroxide, ammonium hydroxide, calcium hydroxide, sodium bisulphate and sodium dithionate for overnight (18h) at room temperature (28 ± 2°C), resulted in maximum delignification of 75% with 2% (v/v) sodium bisulphate. Later, pretreated biomass was subjected to acid hydrolysis with 1%, 1.5%, 2%, and 3% H_2SO_4 at 110 °C and 121°C for 30 and 60 min, respectively. 2% H_2SO_4 at 121°C for 60 min was found to release 13.5 g /l sugars, which on detoxification and fermentation produced 8.1g/l xylitol with yield and productivity of 0.65g/g and 0.112g/l/h respectively. Further enzymatic hydrolysis of the residual substrate obtained after acid hydrolysis released 11g/l sugar, which on fermentation with VS3 produced 4.9g/l ethanol with yield and productivity of 0.22g/g and 0.136g/l/h respectively.

Keywords : delignification, xylitol, bioethanol, acid hydrolysis, enzyme hydrolysis
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