World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:8, No:09, 2014

Enzymatic Saccharification of Dilute Alkaline Pre-treated Microalgal (Tetraselmis suecica) Biomass for Biobutanol Production

Authors : M. A. Kassim, R. Potumarthi, A. Tanksale, S. C. Srivatsa, S. Bhattacharya

Abstract : Enzymatic saccharification of biomass for reducing sugar production is one of the crucial processes in biofuel production through biochemical conversion. In this study, enzymatic saccharification of dilute potassium hydroxide (KOH) pre-treated Tetraselmis suecica biomass was carried out by using cellulase enzyme obtained from Trichoderma longibrachiatum. Initially, the pre-treatment conditions were optimised by changing alkali reagent concentration, retention time for reaction, and temperature. The T. suecica biomass after pre-treatment was also characterized using Fourier Transform Infrared Spectra and Scanning Electron Microscope. These analyses revealed that the functional group such as acetyl and hydroxyl groups, structure and surface of T. suecica biomass were changed through pre-treatment, which is favourable for enzymatic saccharification process. Comparison of enzymatic saccharification of untreated and pre-treated microalgal biomass indicated that higher level of reducing sugar can be obtained from pre-treated T. suecica. Enzymatic saccharification of pre-treated T. suecica biomass was optimised by changing temperature, pH, and enzyme concentration to solid ratio ([E]/[S]). Highest conversion of carbohydrate into reducing sugar of 95% amounted to reducing sugar yield of 20 (wt%) from pre-treated T. suecica was obtained from saccharification, at temperature: 40°C, pH: 4.5 and [E]/[S] of 0.1 after 72 h of incubation. Hydrolysate obtained from enzymatic saccharification of pretreated T. suecica biomass was further fermented into biobutanol using Clostridium saccharoperbutyliticum as biocatalyst. The results from this study demonstrate a positive prospect of application of dilute alkaline pre-treatment to enhance enzymatic saccharification and biobutanol production from microalgal biomass.

Keywords : microalgal biomass, enzymatic saccharification, biobutanol, fermentation
Conference Title : ICBFT 2014 : International Conference on Bioprocess and Fermentation Technology
Conference Location : Istanbul, Türkiye
Conference Dates : September 29-30, 2014