Abstract

Lignocellulosic ethanol is the energy of the future that has the potential to replace petro-fuels when driven by a simple and competent biomass processing technology. In the midst of alarming environmental consequences of industrialization and excessive fossil fuel combustion, it is obligatory to seek for a greener and benign approach for 2G ethanol production. The present study is one such attempt that deals with enzymatic processing of carbon neutral lignocellulosics. For this, blends of nonedible lignocellulosics namely, *Ricinus communis, Saccharum officinarum* tops, *Saccharum spontaneum, Bambusa bambos, Ananus comosus* leaf waste and *Lantana camara* were taken as a substrate, since collection of a single type of biomass to feed a refinery is time consuming, laborious and cost-intensive. Whereas, mixed feedstocks are readily available, sustainable and moreover are tailor-made to fit in the best biochemical composition.

The present study involved the use of ligninolytic laccase from *Pleurotus djamor* for delignification and a complete holocellulolytic system (cellulase and xylanase) from *Trichoderma reseei* RUT C30 was used for conducting saccharification studies. Fourier-Transform Infra-Red (FTIR) spectroscopy and simplex centroid mixture design algorithm based studies were conducted to probe the correlation between biomass composition and laccase mediated lignin degradation. FTIR peak intensity analyses of the mixtures i.e., combination 20, 21 and 31 from 57 mixed biomass sets studied suggested that G type lignin has synergistic effect on laccase mediated delignification. While, presence of S type lignin showed antagonistic relationship with laccase adsorption and delignification. Simplex centroid and central composite design based response surface methodology studies for optimization of the selected mixture (i.e., combination 31) resulted in a concoction composed of *Saccharum spontaneum* (0.2031), *Saccharum officinarum* tops (0.1968), *Ricinus communis* (0.6000) with maximum delignification 85.70%.

Simultaneous biomass pretreatment and saccharification (SPS), using a cocktail of laccase and holocellulase consisting of endo-glucanase, exo-glucanase, β-glucosidase and xylanase was attempted to reduce the time, labour and the energy input involved in separate pretreatment and saccharification method. This enzyme based SPS of biomass was found to yield comparable reducing sugars (612.33 mg/g raw biomass) to that of separate saccharification (600 mg/g) of pretreated biomass (C11), chemical