**Enhancement of holocellulose content of agro-waste Elephant grass by alkaline hydrogen peroxide mediated thermo-chemical delignification process**

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**Abstract**

Elephant grass (EG) is an opportunisitic weed with invasive nature and is least exploited lignocellulosic agriculture waste for bioethanol based biorefineries. Raw Elephant grass (EG) contains 49.4% (w/w) cellulose, 26.2% (w/w) hemicellulose and 22.39% (w/w) lignin. Alkaline Hydrogen peroxide (AHP) mediated pretreatment for EG was carried out. AHP causes breakdown of ester bonds in the carbohydrate-lignin complex and also causes further depolymerization of lignin. RSM-based pretreatment process optimization of EG was performed with AHP concentration (1-5%, v/v), pretreatment time (20-180 min) and temperature (30-120°C) as significant factors for pretreatment. Lignin content and total carbohydrate content as two major responses were selected in the AHP-mediated pretreatment process of EG. This study aimed to minimize the lignin content and maximize the total carbohydrate content for making enzymatic saccharification process efficient. Central composite design approach was used to model the process and optimized by a quadratic regression with ANOVA (analysis of variance). The model was validated on optimum conditions, AHP 4.2% (v/v), 101.8°C and 147.6 min with 7.5% (w/v) raw EG loading in 50 ml reaction volume. The AHP pretreated EG (AHPpEG) under optimized conditions gave 6.5% (w/w), lignin content, 920 mg/gpretreated EG total carbohydrate content with 71% delignification. 73% Cellulose recovery and 75% pretreatment efficiency were achieved upon pretreating EG by AHP under the statistically optimized conditions. Structure and morphological characterization of AHPpEG was performed, which showed a 26.5% higher crystallinity index than raw EG. AHPpEG on hydrolysis by commercial cellulase (*Trichoderma reesei*) gave 16.1 g/L of total reducing sugar with 71.4% saccharification efficiency.