ABSTRACT

Rice bran and rice straw have been abandoned as agricultural waste for million tonnes per year in Thailand. This lignocellulosic biomass is an attractive material for bioethanol fuel production since it rich of cellulose and hemicellulose which are converted into glucose and other fermentable sugars for ethanol production (A. Boonmee, 2009). Therefore they have been proposed to be utilized as a rich carbon source in the production of bioethanol. However, many toxic compounds are possibly released during the pretreatment prior the fermentation process. This study aims to analyze on the availability of toxic compounds from pretreatments using sulfuric acid and cellulase enzymes with the detoxification by delignification, overliming and activated charcoal method. The concentrations of furfural, 5- hydroxymethyl furfural (5-HMF), levulinic acid, vanillin, syringaldehyde and 4-hydroxybenzaldehyde (4-HB) and the percent acetic acid under the pretreatment process with delignification/ activated charcoal treatment were measured. The delignification/ activated charcoal treatment certainly tended to significantly reduce the concentration of acetic acid and other toxic compound in the hydrolysate. The concentration of furfural, 5- hydroxymethyl furfural (5-HMF), levulinic acid, vanillin, syringaldehyde and 4-hydroxybenzaldehyde (4-HB) and the percent acetic acid in rice bran and concentrated rice bran hydrolysate were found to be 256.64±81.724 mg/L, 384.47±99.015 mg/L; 0.065±0.000 mg/L, 0.068±0.000 mg/L; 82744±4540.500 mg/L, 142107.62±8664.600 mg/L; 1.5±0.260 mg/L, 0.19 ± 0.0094 mg/L, 1.47±0.900 mg/L, 3.191 ± 0.023 mg/L; 2.35±0.960 mg/L, 4.806 ± 0.760 mg/L and 0.248±0.066 % , 0.258±0.077 % respectively. The concentration of furfural, 5- hydroxymethyl furfural (5-HMF), levulinic acid, vanillin, syringaldehyde and 4-hydroxybenzaldehyde (4-HB) and the percent acetic acid in rice straw and concentrated rice straw hydrolysate were found to be 384.47±99.015 mg/L or ppm, 271.95±76.295 mg/L or ppm; 0.068±0.000 mg/L or ppm, 0.065±0.000 mg/L or ppm; 142107.62±8664.600 mg/L or ppm, 136354.18±4373.700 mg/L or ppm; 0.19±0.009 mg/L or ppm, 1.807±0.003 mg/L or ppm; 5.43±3.290 mg/L or ppm, 5.069±0.832 mg/L or ppm; 4.806±0.760 mg/L or ppm, 2.39±1.200 mg/L or ppm and 0.256±0.061%, 0.254 ± 0.075 % respectively.

Z. mobilis ZM4 and TISS 551 biofilm showed inhibitors resistance capacity by producing higher percent ethanol yield than planktonic cell. The concentrated rice bran hydrolysate also gave the optimum ethanol production comparing to other hydrolysate. Percent theoretical yield of *Z. mobilis* ZM4 and TISTR 551 biofilm in concentrated rice bran hydrolysate was 72.474±6.133 % and 48.373±16.639 %. The use of diethylaminoethyl cellulose (DEAE) as the carrier was also clearly showed biofilm forming development. However, the efficiency of biofilm attachment and ethanol production in the repeated batch were respectively dropped down.