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OPTIMIZATION OF ACID HYDROLYSIS CONDITIONS OF SPENT BLACK TEA WASTE AND BIOETHANOL PRODUCTION BY *Escherichia coli* KO11

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Abstract

Tea is among the most consumed beverages in the world. Spent tea wastes have been occurred in the world due to high consumption. Because of cellulose, hemicellulose, and lignin, they can be named as lignocellulosic biomass. The reducing sugars are obtained from the lignocellulosic biomass using acid hydrolysis. The aim of this study was to investigate bioethanol production from spent black tea hydrolyzate by fermentation using *Escherichia coli (E. coli)* KO11, which can metabolize sugars with 5 and 6 carbons simultaneously, in a batch system. The spent tea samples were subjected to acid hydrolysis in order to obtain reducing sugars. The acidic hydrolysis conditions were optimized with Response Surface Method (RSM) based on Central Composite Design (CCD). The reducing sugar concentration obtained from optimization studies for the spent tea wastes was 20.5 g/L from the batch system of 50 mL volume. The effective parameters of the method obtained by RSM-ANOVA were determined as the time, the solid concentration, the acid concentration, temperature-time and time-acid concentration binary interactions, and quadratic effect of all parameters except for the particle size. The fermentation experiments were carried out by using the hydrolyzates obtained at the optimum conditions (the temperature of 122°C, the time of 130 min, the acid concentration of 1.13 % (v/v), the solid concentration of 55 g/L) in the volume of 50 mL at the temperature of 37°C. All experiments were performed during 72 h. Ethanol and reducing sugar concentrations of samples taken at various time intervals were measured by gas chromatography (GC) and dinitrosalicylic acid method (DNS) method, respectively. Maximum ethanol production time was achieved at the 12 h in Luria Bertani (LB) with the hydrolyzate media. The bioethanol yield was 0.422 (g/g).

Key words: acid hydrolysis, bioethanol production, *E. coli* KO11, fermentation, optimization, spent black tea

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