Microwave Assisted Pretreatment of Lignocellulosic Biomass

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Due to effects such as global warming, environmental pollution and health hazards directly linked with the intensive exploitation of fossil fuels, there is an urgent need to find alternative energy resources. Vegetal biomass is a renewable resource with high availability worldwide. Current research is focused on developing efficient processes to transform this resource into fuel and valuable products [1, 2].

The objective of this research is to improve the yield of enzymatic hydrolysis of wood residues by removal of lignin using alkaline wash assisted by microwave heating.

The treatments were carried out for 30 minutes in a pressurized microwave reactor (Synthwave-Milestone). The efficiency of the alkaline wash was assessed by monitoring the concentration of lignin (determined by UV absorbance at 320 nm against a calibration curve) from the washing solution. The solid biomass obtained after the alkaline treatment was washed with distilled water until neutral pH and subjected to enzymatic hydrolysis. Sugar concentrations (as glucose equivalents obtained per one gram of dry mass) were determined every 24h for three days to monitor the yield of enzymatic hydrolysis. Each experiment was carried out in duplicate. The treatment conditions were established according to an experimental matrix constructed (in Design Expert 11) after the careful selection of the most important factors that affect the lignin removal from wood residue: liquid to solid ratio and temperature. A central composite design was constructed with the independent factors mentioned above. ANOVA indicated adequate fitting of the model (correlation coefficient R^2=0.95).

The exploration of the experimental space with the fitted model indicates the dominant effect of temperature as independent factor.

Optimization of experimental conditions within the experimental space was carried according to the following criteria: minimization of temperature and liquid to solid ratio; maximization of the response variables (lignin concentration and concentration of sugars obtained by enzymatic hydrolysis).

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