

Evaluation of Microwave-Assisted Pretreatment for Spent Coffee Grounds

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Abstract : Waste materials from a wide range of agro-industrial processes may be used as substrates for microbial growth, and subsequently the production of a range of high value products and bioenergy. In addition, utilization of these agro-residues in bioprocesses has the dual advantage of providing alternative substrates, as well as solving their disposal problems. Spent coffee grounds (SCG) are a by-product (45%) of coffee processing. SCG is a lignocellulosic material, which is composed mainly of cellulose, hemicelluloses, and lignin. Thus, a pretreatment process is required to facilitate an efficient enzymatic hydrolysis of such carbohydrates. In this context, microwave pretreatment of lignocellulosic biomass without the addition of harsh chemicals represents a green technology. Moreover, microwave treatment has a high heating efficiency and is easy to implement. Thus, microwave pretreatment of SCG without adding of harsh chemicals investigated as a green technology to enhance enzyme hydrolysis. In the present work, microwave pretreatment experiments were conducted on SCG at varying power levels (100, 250, 440, 600, and 1000 W) for 60 s. By increasing microwave power to a certain level (which vary by varying biomass), reducing sugar increases, then reducing sugar from biomass start to decrease with microwave power increase beyond this level. Microwave pretreatment of SCG at 60s followed by enzymatic hydrolysis resulted in total reducing sugars of 91.6 ± 7.0 mg/g of biomass (at microwave power of 100 w). Fourier transform Infrared Spectroscopy (FTIR) was employed to investigate changes in functional groups of biomass after pretreatment, while high-performance liquid chromatography (HPLC) was employed for determination of glucose. Pretreatment of lignocellulose using microwave was found to be an effective and energy efficient technology to improve saccharification and glucose yield. Energy performance will be evaluated for the microwave pretreatment, and the enzyme hydrolysate will be used as media component substitute for the production of ethanol and other high value products.

Keywords : lignocellulose, microwave, pretreatment, spent coffee grounds

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