

Effect of Ultrasound-Assisted Pretreatment on Saccharification of Spent Coffee Grounds

Authors : Shady S. Hassan, Brijesh K. Tiwari, Gwilym A. Williams, Amit K. Jaiswal

Abstract : EU is known as the destination with the highest rate of the coffee consumption per capita in the world. Spent coffee grounds (SCG) are the main by-product of coffee brewing. SCG is either disposed as a solid waste or employed as compost, although the polysaccharides from such lignocellulosic biomass might be used as feedstock for fermentation processes. However, SCG as a lignocellulose have a complex structure and pretreatment process is required to facilitate an efficient enzymatic hydrolysis of carbohydrates. However, commonly used pretreatment methods, such as chemical, physico-chemical and biological techniques are still insufficient to meet optimal industrial production requirements in a sustainable way. Ultrasound is a promising candidate as a sustainable green pretreatment solution for lignocellulosic biomass utilization in a large scale biorefinery. Thus, ultrasound pretreatment of SCG without adding harsh chemicals investigated as a green technology to enhance enzyme hydrolysis. In the present work, ultrasound pretreatment experiments were conducted on SCG using different ultrasound frequencies (25, 35, 45, 130, and 950 kHz) for 60 min. Regardless of ultrasound power, low ultrasound frequency is more effective than high ultrasound frequency in pretreatment of biomass. Ultrasound pretreatment of SCG (at ultrasound frequency of 25 kHz for 60 min) followed by enzymatic hydrolysis resulted in total reducing sugars of 56.1 ± 2.8 mg/g of biomass. 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 by low frequency ultrasound in water only was found to be an effective green approach for SCG to improve saccharification and glucose yield compared to native biomass. Pretreatment conditions will be optimized, and the enzyme hydrolysate will be used as media component substitute for the production of ethanol.

Keywords : lignocellulose, ultrasound, pretreatment, spent coffee grounds

Conference Title : ICBEPT 2019 : International Conference on Biomass Energy and Pretreatment Technologies

Conference Location : London, United Kingdom

Conference Dates : January 21-22, 2019