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# Ultrasound Assisted Alkaline Potassium Permanganate Pre-Treatment of Spent Coffee Waste

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**Abstract :** Lignocellulose is the largest reservoir of inexpensive, renewable source of carbon. It is composed of lignin, cellulose and hemicellulose. Cellulose and hemicellulose is composed of reducing sugars glucose, xylose and several other monosaccharides which can be metabolised by microorganisms to produce several value added products such as biofuels, enzymes, aminoacids etc. Enzymatic treatment of lignocellulose leads to the release of monosaccharides such as glucose and xylose. However, factors such as the presence of lignin, crystalline cellulose, acetyl groups, pectin etc. contributes to recalcitrance restricting the effective enzymatic hydrolysis of cellulose and hemicellulose. In order to overcome these problems, pre-treatment of lignocellulose is generally carried out which essentially facilitate better degradation of lignocellulose. A range of pre-treatment strategy is commonly employed based on its mode of action viz. physical, chemical, biological and physico-chemical. However, existing pretreatment strategies result in lower sugar yield and formation of inhibitory compounds. In order to overcome these problems, we proposes a novel pre-treatment, which utilises the superior oxidising capacity of alkaline potassium permanganate assisted by ultra-sonication to break the covalent bonds in spent coffee waste to remove recalcitrant compounds such as lignin. The pre-treatment was conducted for 30 minutes using 2% (w/v) potassium permanganate at room temperature with solid to liquid ratio of 1:10. The pre-treated spent coffee waste (SCW) was subjected to enzymatic hydrolysis using enzymes cellulase and hemicellulase. Shake flask experiments were conducted with a working volume of 50mL buffer containing 1% substrate. The results showed that the novel pre-treatment strategy yielded 7 g/L of reducing sugar as compared to 3.71 g/L obtained from biomass that had undergone dilute acid hydrolysis after 24 hours. From the results obtained it is fairly certain that ultrasonication assists the oxidation of recalcitrant components in lignocellulose by potassium permanganate. Enzyme hydrolysis studies suggest that ultrasound assisted alkaline potassium permanganate pre-treatment is far superior over treatment by dilute acid. Furthermore, SEM, XRD and FTIR were carried out to analyse the effect of the new pre-treatment strategy on structure and crystallinity of pre-treated spent coffee wastes. This novel one-step pre-treatment strategy was implemented under mild conditions and exhibited high efficiency in the enzymatic hydrolysis of spent coffee waste. Further study and scale up is in progress in order to realise future industrial applications.

**Keywords :** spent coffee waste, alkaline potassium permanganate, ultra-sonication, physical characterisation
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