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Development of a Steam or Microwave-Assisted Sequential Salt-Alkali Pretreatment for Sugarcane Leaf Waste

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Abstract : This study compares two different pretreatments for sugarcane leaf waste (SLW): steam salt-alkali (SSA) and microwave salt-alkali (MSA). The two pretreatment types were modelled, optimized, and validated with $R^2 > 0.97$. Reducing sugar yields of 1.21g/g were obtained with optimized SSA pretreatment using 1.73M $ZnCl_2$, 1.36M NaOH and 9.69% solid loading, and 1.17g/g with optimized MSA pretreatment using 1.67M $ZnCl_2$, 1.52M NaOH at 400W for 10min. A lower pretreatment time (10min) was required for the MSA model (83% lower). The structure of pretreated SLW was assessed using scanning electron microscopy (SEM) and Fourier Transform Infrared analysis (FTIR). The optimized SSA and MSA models showed lignin removal of 80.5 and 73% respectively. The MSA pretreatment was further examined on sorghum leaves and Napier grass and showed yield improvements of 1.9- and 2.8-fold compared to recent reports. The developed pretreatment methods demonstrated high efficiency at enhancing enzymatic hydrolysis on various lignocellulosic substrates.

Keywords : lignocellulosic biomass, pretreatment, salt, sugarcane leaves
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