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Assessment of biomass torrefaction effect on gasification efficiency

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Abstract content
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Sugarcane bagasse was torrefied to improve its quality in terms of thermal and physical properties prior to gasification. Torrefaction of sugarcane bagasse was undertaken at 300 °C in a chemically inactive atmosphere of N₂, and at 10 °C min⁻¹ heating rate. A residence time of 5 minutes allowed for the rapid reaction of the material during torrefaction. Torrefied and untorrefied (untreated) bagasse were characterised to compare their suitabilities as feedstocks for gasification. The results showed that torrefied SCB has a lower O-C ratio, a higher H-C ratio and a higher heating value of 20.19 MJ kg⁻¹ than untorrefied bagasse, confirming that the former is much more suitable as a feedstock for gasification than the latter. SEM results also revealed a fibrous structure and pith in the micrographs of both torrefied and untorrefied bagasse, indicating that both materials are carbonaceous in nature, with torrefied bagasse exhibiting a more permeable structure with larger surface area; these are features which favour gasification. The gasification process of the torrefied material relied on computer simulation to establish the impact of torrefaction on the conversion efficiency of the process. Optimum conversion efficiency was achieved with torrefied bagasse due to a number of factors, one of which included the slightly modified properties of torrefied bagasse. Conversion efficiency of the gasification process of torrefied bagasse increased from 50 % to approximately 60 % after computer simulation, whereas that of untorrefied bagasse remained constant at 50 % even as gasification time increased.

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