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Experimental investigation on biomass gasification using chemical looping in a batch reactor and a continuous dual reactor

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HIGHLIGHTS:

- BGCL process was investigated experimentally in batch and continuous reactor.
- Natural hematite as oxygen carrier promoted biomass gasification in BGCL.
- The experimental results were compared in batch and continuous reactor.
- Phase analyzing for hematite was investigated in batch and continuous reactor.

Abstract: Biomass gasification using chemical looping (BGCL) is an innovative biomass gasification technique using lattice oxygen from oxygen carrier. The present work selected natural hematite as oxygen carrier, and experimental results from batch reactor and continuous reactor were compared in this work. The results showed that the presence of hematite would accelerate the process of biomass gasification and enhance carbon conversion rate, and hematite could increase the heat-carrier capacity of bed materials in the continuous reactor. In the batch reactor, carbon conversion efficiency and fraction of CO+H₂ increased within the temperature range of 750 - 900 °C. However, syngas yield in the continuous reactor reached the maximum of 0.64 Nm³kg⁻¹ at 850 °C. Besides, the effect of hematite fraction on the gasification performance was similar between the batch reactor and the continuous reactor. When hematite fraction was exceed 40 wt.%, higher hematite fraction

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