Optimizing Biomass-to-Hydrogen Conversion: Nickel Catalysis and Alkali-Thermal Integration for Net Zero Emissions.

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SUMMARY

This research investigates the possibility of biomass conversion technology in achieving the global net zero emission target of 2050 by combining bioenergy with carbon capture and storage (BECCS). Because biomass absorbs carbon during growth, BECCS has several benefits over traditional CCUS. This strategy can dramatically lower atmospheric CO_2 concentrations and provide a more noticeable negative carbon balance by combining bioenergy with carbon capture and storage. The efficacy of many nickel-modified catalysts, such as ZSM-5, ZrO_2, and Al_2O_3, in the process of producing hydrogen by Alkaline Thermal Treatment (ATT) of biomass is assessed in this study. With a conversion efficiency of 60.5%, the Ni/ZrO_2 catalyst greatly increases hydrogen yield. This contrasts with the Ni/Al_2O_3 and Ni/ZSM-5 catalysts, which had conversion efficiencies of 54.2% and 45.8%, respectively. Strong resistance to carbon deposition is exhibited by the ZrO_2 and Al_2O_3 catalysts, reducing catalytic deactivation during high-temperature processes. Additionally, the study investigates the use of ATT technology in biomass conversion, which facilitates carbon fixation inside biomass and promotes hydrogen generation, resulting in carbonate precipitates and efficient carbon capture and storage. This two-pronged strategy helps achieve global carbon reduction goals while simultaneously improving hydrogen generation.□□□□
