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In-depth study of rice husk torrefaction: Characterization of solid, liquid and gaseous products, oxygen migration and energy yield

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Abstract: Torrefaction is a promising method for biomass upgrading, and analysis of all products is the essential way to reveal torrefaction mechanism. In this study, torrefaction of rice husk was performed at 210-300°C. Results showed that the fuel properties of solid products were greatly enhanced upon removal of oxygen. The gaseous products were mainly CO₂ (52.9-73.8vol.%), followed by CO (26.3-39.2vol.%). The liquid product was mainly water and some tar, and the latter contained acids, furans, ketones, aldehydes, and phenols, among which the relative content of acids was the highest. Torrefaction temperature has obvious effects on the oxygen migration. Within the temperature range of 210-300°C, 9.5-63.2% of oxygen in rice husk was migrated to the gaseous and liquid products. The H₂O was the major contributor to deoxygenation, followed by CO₂ and CO. Thus, formation of H₂O, CO₂, and CO during torrefaction is important as it achieves the purpose of intense deoxygenation.

Keywords: Torrefaction; Rice husk; Deoxygenation; Oxygen migration; Product properties

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