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Phosphoric acid-activated wood biochar for catalytic conversion of starch-rich food waste into glucose and 5-hydroxymethylfurfural

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Abstract:

The catalytic activity of engineered biochar was scrutinized for generation of glucose and hydroxymethylfurfural (HMF) from starch-rich food waste (bread, rice, and spaghetti). The biochar catalysts were synthesized by chemical activation of pinewood sawdust with phosphoric acid at 400-600 °C. Higher activation temperatures enhanced the development of porosity and acidity (characterized by C–O–PO_3 and C–PO_3 surface groups), which imparted higher catalytic activity of H_3PO_4-activated biochar towards starch hydrolysis and fructose dehydration. Positive correlations were observed between HMF selectivity and ratio of mesopore to micropore volume, and between fructose conversion and total acid density. High yields of glucose (86.5 Cmol% at 150 °C, 20 min) and HMF (30.2 Cmol% at 180 °C, 20 min) were produced from rice starch and bread waste, respectively, over H_3PO_4-activated biochar.