Comparison of high temperature chars of wheat straw and rice husk with respect to chemistry, morphology and reactivity

Fast pyrolysis of wheat straw and rice husk was carried out in an entrained flow reactor at high temperatures (1000–1500) °C. The collected char was analyzed using X-ray diffractometry, N2-adsorption, scanning electron microscopy, particle size analysis with CAMSIZER XT, 29Si and 13C solid-state nuclear magnetic resonance spectroscopy and thermogravimetric analysis to investigate the effect of inorganic matter on the char morphology and oxygen reactivity. The silicon compounds were dispersed throughout the turbostratic structure of rice husk char in an amorphous phase with a low melting temperature (z730 °C), which led to the formation of a glassy char shell, resulting in a preserved particle size and shape of chars. The high alkali content in the wheat straw resulted in higher char reactivity, whereas the lower silicon content caused variations in the char shape from cylindrical to near-spherical char particles. The reactivities of pinewood and rice husk chars were similar with respect to oxidation, indicating less influence of silicon oxides on the char reactivity.
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