

ABSTRACT:

Investigations into the thermal behaviour during co-pyrolysis of coal, biomass materials and coal/biomass blends prepared at different ratios (10:90, 20:80, 30:70 and 50:50) have been conducted using a thermogravimetric analysis (TGA) apparatus. Coal sample selected was Collie subbituminous coal from Western Australia, while wood waste (WW) and wheat straw (WS) were used as biomass samples. Three thermal events were identified during the pyrolysis. The first two were dominated by the biomass pyrolysis, while the third was linked to the coal pyrolysis, which occurred at much higher temperatures. No interactions were seen between the coal and biomass during co-pyrolysis. The pyrolytic characteristics of the blends followed those of the parent fuels in an additive manner. Among the tested blends, 20:80 blends showed the lowest activation energies of 90.9 and 78.7 kJ mol⁻¹ for coal/WW and coal/WS blends, respectively. It was also found that the optimum blend ratio for pyrolysis of coal/WS to be 50:50 with a high degradation rate in all thermal events and a higher mass loss over the course of the co-pyrolysis compared to coal/WW blends examined. The reaction orders in these experiments were found to be in the range of 0.21–1.60, thus having a significant effect on the overall reaction rate. Besides the pyrolysis of coal alone, the 50:50 coal/biomass blends had the highest reaction rate, ranging from 1×10^9 to 2×10^9 min⁻¹.