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Combustion characteristics and air pollutant formation during oxy-fuel co-combustion of microalgae and lignite

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Abstract

Oxy-fuel combustion of solid fuels is seen as one of the key technologies for carbon capture to reduce greenhouse gas emissions. The combustion characteristics of lignite coal, *Chlorella vulgaris* microalgae, and their blends under O₂/N₂ and O₂/CO₂ conditions were studied using a Thermogravimetric-Mass Spectroscopy (TG-MS). During co-combustion of blends, three distinct were observed and were attributed to *C. vulgaris* volatiles combustion, combustion of lignite, and combustion of microalgae char. Activation energy during combustion was calculated using iso-conventional method. Increasing the microalgae content in the blend resulted in an increase in activation energy values for the blends combustion. The emissions of S- and N-species during blend fuel combustion were also investigated. The addition of microalgae to lignite during air combustion resulted in lower CO₂, CO, and NO₂ emission and enhanced NO, COS, and SO₂ formation. In oxy-fuel combustion, the addition of microalgae to lignite enhanced the formation of gaseous species.

Keywords: Oxy-fuel combustion; lignite; microalgae; synergy effect; kinetics analysis; air

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