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Estimation of Linear Heat Conduction and Thermal Conductivity of Bio-char and Coal-char

Waste biomass is now considered as a potential source of renewable energy to meet wide variety of energy needs, such as electricity generation, domestic heating, fueling vehicles and providing process heat in industrial facilities. Large amount of waste biomass and coal are being used to produce heat in industrial boilers. These industrial heating processes generate ample amount of coal-char and bio-char as by-product waste. The disposal of coal-char and bio-char waste causes significant environmental concerns if not handed carefully. In this study, the coal-char and bio-char were investigated to evaluate their applications as source of conducting and insulating materials. The linear heat conduction of char produced at different temperature were tested and discussed. The thermal conductivity (k) of pure coal-char was found 46.20 W/(m. K), whereas pure wheat straw and pine-nut bio-char showed 22.90 W/(m. K), 10.60 W/(m. K), respectively. The thermal conductivity of 50/50 wt% coal and wheat husk blended char and 50/50 wt% of coal and pine-nut blended char were estimated 12.30 W/(m. K), 53.60 W/(m.K), respectively. Coal-char with high thermal conductivity can be used in heat sink applications. Among the tested materials, pine-nut bio-char showed lower heat conduction of 10.6 W/(m.K) which can be utilized as a source of thermal insulation. The results indicated that the thermal conductivity of material depends mainly on the type and its composition.

Keywords: Bio-char, coal-char, blended char, linear heat conduction, thermal conductivity

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