Balochistan Journal of Engineering & Applied Sciences (BJEAS) – (p-ISSN: 2518-2706)
Volume 4, No. 1

Assessment of Thermal Behaviour of Coal and Bio-char Solids

Ramli Mat[1], Faisal Mushtaq[2], Fawad Israr[2], Muhammad Sheharyar[2], Asadullah[2], Syed Haseeb Sultan[2], Syed Zameer Ul Hassan[3], Zamir Ahmed Abro[3], Ali Asghar[3], Anila Ali[4],
[1]School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, UTM 81310, Skudai, Johor Bahru, Johor Darul T′azim, Malaysia
[2]Department of Chemical Engineering, BUITEMS, Quetta, Pakistan
[3]Department of Textile Engineering, BUITEMS, Quetta, Pakistan
[4]Department of Environmental Management and Policy, BUITEMS, Quetta, Pakistan
Corresponding Email: faisal.mushtaq@buitms.edu.pk

Abstract—Waste biomass is considered as a potential source for renewable energy and is used to meet wide variety of energy needs, including electricity generation, domestic heating, fueling vehicles and providing process heat in industrial facilities. The waste biomass is considered environment friendly when mixed with coal in industrial boilers to reduce carbon footprints. The by-product solid char generate in ample amount in boilers causes significant environmental concerns if not handed carefully. In this study, Dukki Coal (DC), Wheat Straw (WS) and Pinecone (PC) char solids was produced at difference temperature and investigated for thermal behavior in linear heat conduction unit. The char solids were analyzed for temperature profile, Temperature Difference (ΔT) and thermal conductivity. Pure Dukki Coal (DC) char resulted in highest thermal conductivity of 31.58W/m^{o}C with lowest ΔT of 13.1^{o}C, whereas pure WS char indicated lowest thermal conductivity of 22.89 W/m^{o}C with highest ΔT of 17.81^{o}C. Thermal conductivity of pure char solids was found in order of DC char>PC char>WS char and ΔT of WS char>PC char>DC char. The blend DC/WS and DC/PC char solids demonstrated additive behavior. Activation of DC char solids with sulfuric acid indicated small variation on ΔT and thermal conductivity. Among the tested char solids, DC char solids demonstrated highest thermal conductivity and lowest ΔT which can find applications as conductive material. The results indicated that the temperature profile, ΔT and thermal conductivity of material depend mainly on ash content.

Keywords—Dukki Coal Char, Wheat Straw Char, Pine-Cone Char, Linear Heat Conduction, Temperature Difference, Thermal Conductivity