Characteristics and synergistic effects of co-combustion of carbonaceous waste with coal

S. Onenc[1], S. Retschitzegger[2], N. Evic[2], N. Kienzl[2], J. Yanik [1]

[1]Department of l Chemistry, University of Ege, Izmir, Turkey
[2]BIOENERGY 2020+ GmbH, Head Office Graz, Graz, A 8010, Austria
Keywords: co-combustion, scrap tire, SO_2 emission, NOx emission.
Presenting author email: jale.yanikt@ege.edu.tr

In this study, the combustion behaviour of the char derived scrap tire (STC) and its' blend with lignite (at a ratio of 1:1) was investigated by thermogravimetric analyser and lab-scale reactor. For comparison, combustion characteristics of scrap tire (ST) were also determined. The combustion parameters, such as ignition temperature, burn-out temperature and reactivity were calculated from TG/DTG curves. Due to the low volatile contents, the ignition temperature and T_{max} (peak temperature) of char are higher than that of raw material. The burn-out temperature of char is also higher than that of raw materials. The TGA/DTG curve for blend showed additivity behaviour in volatilization and combustion steps. The addition of char (STC) to lignite caused lowering of reactivity (anti-synergistic effect).

Lab-Scale reactor provided to continuously measure the gas emissions during combustion (volatilization and char oxidation steps). The highest fuel bed temperature measured and combustion time varied with fuel type. The highest fuel bed temperature (1217 °C) was observed during combustion of STC and the highest combustion time was observed during combustion of lignite. For blend, there was no additive effect in combustion time but, the highest fuel bed temperature measured was approximately predicted value. For all type fuel, the minor amounts of hydrocarbons (mainly CH_4) were measured in flue gases. More than 90 wt. % of nitrogen in fuel (except ST) released as NOx. The minor amounts of NH_3 and also HCN were also detected in flue gases. The NOx emissions increased with the N content of the fuel, there was a linear correlation. However, no linear correlation between SO_2 emission and S content of the fuel there was observed.

It is worth noting that the main part of S released appeared in aerosol for ST, whereas the S released mainly as SO_2 in case of STC and lignite. For blend, the SO_2 release was approximately proportional to the mixing ratio of the fuels and to the emissions properties of the respective fuels. In this study, the combustion properties of fuels were also evaluated by using of some fuel indexes. From the data obtained, it can be speculated that all fuels tested have negligible risk of high temperature corrosion risk and low slagging potential.