Abstract:
This paper presents a detailed report on the effect of the effect of temperature on the concentration of 27 major and trace elements in bottom ash generated from oxy-combustion. The major elements are Na, Mg, Al, K, Ca and Fe, and the minor are Li, Cr, V, Mn, Sr and the trace elements are Cu, Zn, Rb, Co, Ni, Ga, Pb, Be, Mo, U, Ag, Cd, Te, Bi, Ti respectively. The effect of oxygen concentration at two different temperatures on the concentration of all the elements was investigated. The results obtained were compared with those obtained under air-combustion. The results show that the concentration of the major elements in the bottom ash samples (both from air and oxy combustion) were higher than that of the coal samples. Similar results were obtained for the minor and trace elements. Except for Bi (trace element) where the concentration was higher in coal sample than in the ash samples.

The results obtained showed that there was a lower enrichment for all elements in the bottom ash from oxy combustion than in the bottom ash from air combustion at 900 °C. Except for Al and Mn which were they were same and lower respectively. When the temperature was increased to 1000 °C, the enrichment was higher for some elements in the bottom ash from air combustion was higher than those from oxy combustion while some lower.

In oxy combustion conditions temperature had a higher effect on enrichment than oxygen concentration. From the results obtained, the highest level of emission for all the elements would be at oxy combustion conditions at 50% O₂ and 50% CO₂ at 900°C. The exception was for Fe, Mn and Mo where the highest level of emission would be at 21% O₂ and 79%CO₂ at 1000 °C, 21% O₂ and 79% CO₂ at 900 °C and 50% O₂ and 50% CO₂ 1000 °C respectively. This suggests that a change in the oxy-fuel combustion conditions can have an implication in the de-dusting and disposal of bottom ash.

Keywords: oxy-combustion, major and trace elements, coal bottom ash, oxygen concentration, temperature.

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