Muhammad Azam Saeed, Herodotos N. Phylaktou, Gordon E. Andrews & Bernard M. Gibbs. 2014. Reactivity of biomass crop residues based on MEC and flame speed. Proceedings of the 14th International Symposium on Handling and Hazards of Materials in Industry, ANQUE+ICCE+BIOTEC+14th HANHAZ. Madrid, Spain. ISBN: 978-84-697-0726-5

REACTIVITY OF BIOMASS CROP RESIDUES BASED ON MEC AND FLAME SPEED

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Keywords: dust explosion, biomass, flammability limits, combustion

1. Introducation

There is increasing use of biomass powders as an alternative green energy source within the rural ennvironment of developing countries ad in full or partial replacement of coal in the more developed nations. However, biomass substances in pulverised form carry fire and explosion hazards due to their higher reactivity in comparison to coal [2]. The associated fire and explosion risks with the solid biomass dusts need to be accessed accurately to maintain the safe working environment [1]. In this work, corn cob and peanut shell powders that are the second generation biomass crop residues were tested for explosibility characteristics and combustion properties as a function of particle size distribution and their reactivities were compared to those of coal and other biomass substances.

2. Experimental

Varying size range fractions (<63µm,63-150µm,150-300µm and 300-500µm) of the above mentioned biomass dusts were tested in a modified Hartmann dust explosion tube to study the effect of particle size distribution on the lean flammability limit and on the flame speed as well as determine the most reactive concentration.

3. Results

Fig.1 shows that lean the flammability limits increased for coarser size fractions and were similar to other biomasses but much leaner than coal. This indicates that these residues are more sensitive to fire and explosion hazards compared to coal. Corn cob powder with fairly large particle size (range 300-500µm) was shown to readily explode contrary to observations with coal powder (no ignition in the same particle range. The most reactive concentration for all size ranges samples were observed to be at equivalence ratio close to or greater than 1.

Peak flame speeds were in the range of 1-4m/s. A good correlation between % (ash+moisture) and the lean flammbility limit was also derived from the data.

4. References

[1] Eckhoff, R.K., Dust Explosions in the Process Industries. 3rd ed. 2003, USA: Gulf Professional Publishing. 719.

[2] Wilén, C., et al., Safe handling of renewable fuels and fuel mixtures. 1999, VTT Technical Research Cenre of Finland: Espoo. p. 117 p.+app. 8p.

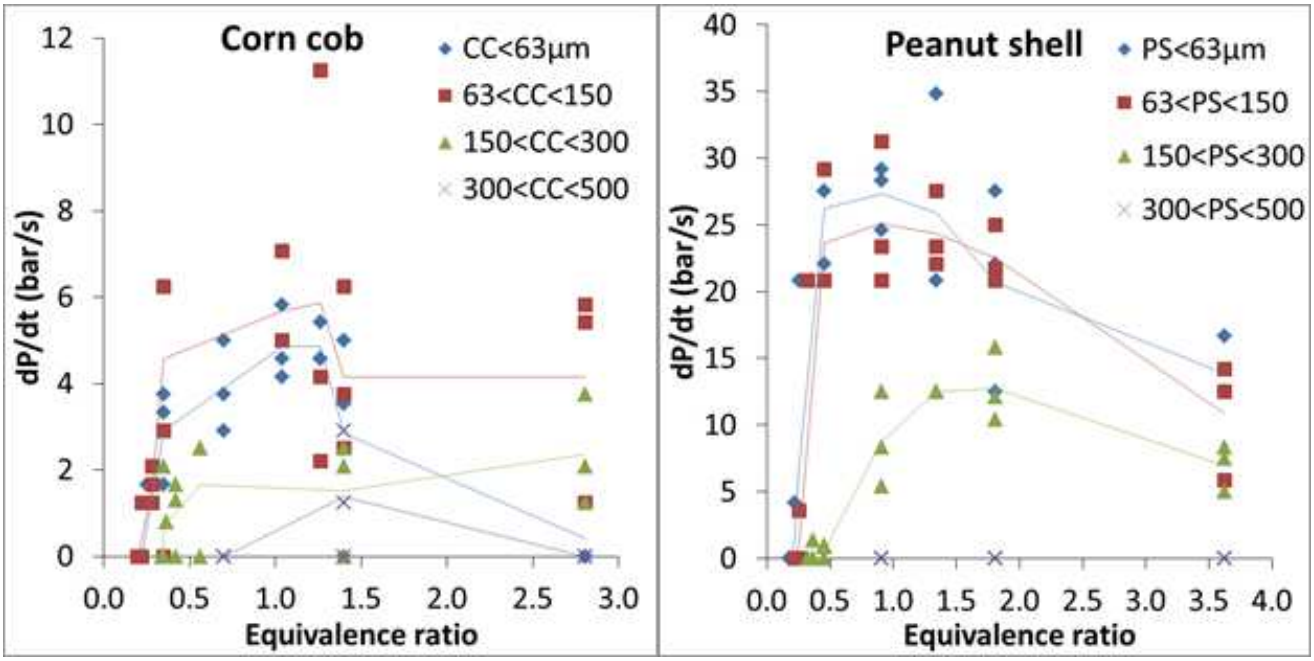

Fig. 1. Rate of pressure rise vs. equivalence ratio