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Flame propagation of pulverized biofuels of varying size distribution fractions

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Solid biofuel is one of the most viable options to substitute coal in the pulverized coal power plants for renewable environment. Their milling to acquire same pulverisation is not very easy for these power stations however; they can be employed in coarser form due to their higher reactivity than coals. In this work, the flame propagation of fine and coarse biofuels was studied using modified Hartmann and 1 m3 explosion vessel. The actual combustible mass was converted to equivalence ratio for identifying the lean and rich region relative to stoichiometric base point. Results revealed that the propagation of the flame for biomass samples was affecting by the key parameters of chemical characterization and particle size distribution. Biofuels with high volatiles and low ash were more reactive with fast rate of their flame spread. Fine size distribution of biomass released its volatiles more quickly due to more exposed surface area. High speed photography with 5000 frames rate were used to study the mechanism of flame propagation of different sized biomass particle. For fine sized bagasse particles of size smaller than 63 micron, flame propagated in 322mm long Hartman dust explosion tube in 180.4 ms whereas for coarse size bagasse particles, it took 1273 ms. Flame propagation for fine mixture was more luminous and uniform as compared to coarse fraction. Also there was less delay in the building of uniform flame with more mass burning as compared to coarse fractions with more unburnt residue mass. This work aims to study the biofuels flame propagation for lean and rich concentration in comparison to coal and effect of particle size distribution that have scant data in the literature.

Biography

Muhammad Azam Saeed has his expertise in biofuels and bioenergy. His research work is based on efficient utilization of biofuels with minimum fire/ explosibility risks. He worked on the kinetics for the volatile release rate and developed 'Series reaction model' and 'Competitive reaction model'. In his research work, he tested raw biomass crop residues and wood samples along-with the thermal treated biomass samples. Thermal treated (torrefied and steam exploded) biomass was found to have more energy per unit volume with less milling energy requirements due to high brittleness and more porous structure. He compared the results of flame propagation of biofuels in comparison to coal. His main findings are that biofuels can be a good substitute of coal in the power generation plants for green power generation; however they are more reactive and pose more fire/explosibility hazards that need to be evaluated before its application.

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