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Abstract

The purpose of this thesis is to develop an efficient process for the burning of sawdust in a cyclone combustor. Flow visualization studies were performed to observe particle motion in a plexi-glass cyclone model. Radial and axial temperature distributions both inside the combustor chamber and around the chamber exit were measured to determine the thermal characteristics and combustion mode at various equivalence ratio (Ø). Combustion product compositions at the combustor exit for for varying equivalence ratios were also analysed.

The results of cold flow experiments, obtained for a combustor of 155 mm chamber diameter (D_o), 310 mm in length (L) and 68.5 mm exit diameter (D_e), showed that there was a clear pattern of helical motion of particles from the cyclone inlet down to the bottom of chamber, and that part of the lighter particles would spiral up the inner core of the chamber to the exit.

The combustion experiments performed on a slightly smaller size cyclone, showed that flame temperatures as high as 1100 °C could be reached. The equivalence ratio which gives the better combustion characteristics lies in the range of 1.5 - 2.0, that is under highly air-rich conditions. Analyses of temperature distributions implied that different combustion modes exist with the combustion zone occupying

different regions of the chamber from the bottom through to the cyclone exit, depening on the equivalence ratio.

Combustion gas analysis showed that the CO content ranges from 800 to 2700 ppm for equivalence ratio of 2.0 to 1.5 respectively.