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Thesis Title : The Burning of Sawdust in a Multi-Air Inlet Cyclone Combustor

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Abstract

This paper discusses the effects of secondary air on the burning characteristics of sawdust in a cyclone combustor. A transparent plastics cyclone model was used to study the flow pattern of sawdust, while a mild-steel cyclone was used to study the combustion characteristics. Both of them are of nearly the same dimensions, having a lenght to diameter ratio (L/D_o) of 2.0. There are two tangential inlets at the top part of the cyclone , one for sawdust injection with air, another for primary air intake and the exit pipe is oriented vertically upwards. The secondary air intake ports, consisting of two tangential inlets, are located at the middle of the cylindrical chamber.

The results of cold flow experiments with secondary air, show that there is a clear pattern of helical motion of particles from the cyclone inlet down to the bottom , similar to the experiments without secondary air, but the pitch of helices are smaller and the number of helices greater. Combustion experiments were carried out for two cases. Firstly, by maintaining equivalence ratio (ϕ) at 1.5 and with the secondary air flows were varied from 5% ,10% to 15%

of the total air. The results show that the combustion zone tends to move deeper inside the chamber , as secondary air flow increases. The amount of CO emission also decreases to a minimum in the range of 885-2320 ppm. Secondly , with the secondary air fixed at 15% of total air flow while varying ϕ from 1.0 ,1.2 to 1.5 , it is found that the combustion zone moves inwards to the chamber with shortest flame lenght outside the chamber occurring at ϕ = 1.5. The CO emission for this latter condition is also lowest at 885-2120 ppm.