Abstract

The impact of porosity of pitch pine needle sample beds on their critical heat flux and time to ignition was experimentally estimated using cone calorimeter in the context of understanding the flammability behaviour of wildland fuel beds. Samples were tested in 63% porous sample baskets and under natural ventilation conditions. The effects of fuel moisture content were not studied in this thesis. Experimental results show that the there is a linear relation between the porosity of the sample beds and the critical heat flux for ignition in the range of 85%-94% porous samples for the species tested. Porosity was found to become less significant with increasing external heat flux as the bulk properties did not make any difference in ignition. It was attempted to separate the effects of convective cooling due to porosity from other dependent variables, such as fuel density and surface-to-volume ratio by carrying out experiments with open and closed baskets. Restricting the airflow through the sample was found to reduce the time to ignition significantly. From post-ignition analysis, it was observed that increasing the external heat flux had little effect on the heat release rate for samples of similar porosity, while the efficiency of combustion and peak heat release rate increased with increasing porosity. Considerable difference in heat release rates with porosity was also observed from post-ignition analysis.