

Numerical Study on Jatropha Oil Pool Fire Behavior in a Compartment

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Abstract : This paper presents the numerical study on Jatropha oil pool fire in a compartment. A fire experiment with jatropha oil was conducted in a compartment of size 4 m x 4 m x m to study the fire development and temperature distribution. Fuel is burned in the center of the compartment in a pool diameter of 0.5 m with an initial fuel depth of 0.045 m. Corner temperature in the compartment, doorway temperature and hot gas layer temperature at various locations are measured. Numerical simulations were carried out using Fire Dynamics Simulator (FDS) software at grid size of 0.05 m, 0.12 m and for performing simulation heat release rate of jatropha oil measured using mass loss method were inputted into FDS. Experimental results shows that like other fuel fires, the whole combustion process can be divided into four stages: initial stage, growth stage, steady profile or developed phase and decay stage. The fire behavior shows two zone profile where upper zone consists of mainly hot gases while lower zone is relatively at colder side. In this study, predicted temperatures from simulation are in good agreement in upper zone of compartment. Near the interface of hot and cold zone, deviations were reported between the simulated and experimental results which is probably due to the difference between the predictions of smoke layer height by FDS. Also, changing the grid size from 0.12 m to 0.05 m does not show any effect in temperatures at upper zone while in lower zone, grid size of 0.05 m showed satisfactory agreement with experimental results. Numerical results showed that calculated temperatures at various locations matched well with the experimental results. On the whole, an effective method is provided with reasonable results to study the burning characteristics of jatropha oil with numerical simulations.

Keywords : jatropha oil, compartment fire, heat release rate, FDS (fire dynamics simulator), numerical simulation

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