An Experimental and Numerical Study of the Effects of Design Parameters on Water Mist Suppression of Liquid Pool Fires

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Abstract: This report presents the results of an experimental and numerical parametric study of water mist suppression of liquid pool fires. The numerical part was conducted with small 2-D methanol pool fire, while the experiments were conducted with a 50 cm diameter pan heptane and JP8 pool fires. Analyses of results of the experimental and numerical parts lead to similar conclusions. First, the results show that base injection of droplets enhanced their suppression effectiveness by as much as two times compared to top injection. This is because the droplets evaporated within the lower region of the fire where a greater effect of oxygen dilution and water vapor higher heat capacity is fully realized. Secondly, the experimental results show that smaller droplets are more effective than larger droplets in both top and base injections. The similarity between the model predictions and the experimental data indicates that the results of the parametric study conducted with a small scale laminar pool fire can be useful in the design of water mist suppression systems for large scale fires. Finally, the experimental results show that water mist is more effective in suppressing JP8 fires than heptane fires. It is concluded that the difference in effectiveness is largely due to the additional effects of surface cooling.

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