

CHARACTERISTICS OF THE PROCESS OF EXTINGUISHING GROUND-LEVEL FOREST FIRES UNDER CONDITIONS OF DIFFERENT AEROSOL CONCENTRATIONS OF PROMISING FIRE EXTINGUISHING COMPOSITIONS

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Abstract: The paper defines the optimal conditions and characteristics of spraying fire extinguishing compositions to reduce the temperature in the combustion zone of typical combustible forest materials. A series of experiments was carried out to establish the conditions and characteristics of the processes occurring during localization and elimination of combustion of typical combustible forest materials (wood, mixed forest combustible materials) under conditions of exposure of different dispersion water drops. The times of thermal decomposition of solid combustible materials after suppression of fiery combustion by fire extinguishing compositions based on water with the addition of a foaming agent and FR-Les 01 were determined. The minimum volume and spraying mode (droplet sizes) of aerosols of different concentrations were established to effectively reduce the temperature in the combustion zone.

Keywords: wild fire; combustion source; fire extinguishing; fire-extinguishing agent; aerosol

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Figure Captions

Figure 1 Appearance of natural combustible materials: (a) wood; and (b) forest fuels mixture

Figure 2 Experimental stand for determining the liquid aerosols droplets size: 1 — laboratory table; 2 — metal pallet; 3 — tripod; 4 — irrigation system (spray device); 5 — laboratory lifting tables; 6 — light source; 7 — high-speed video camera; and 8 — laptop

Figure 3 A typical video frame of a water aerosol

Figure 4 Experimental stand for extinguishing solid combustible material: 1 — laboratory table; 2 — metal pallet; 3 — combustible material; 4 — thermocouples; 5 — National Instruments data acquisition system; 6 — laptop; 7 — video camera; 8 — exhaust system (exhaust hood); and 9 — irrigation system (spray devices)

Figure 5 Temperature distribution over the thickness of the wood layer (a) and the layer of the forest fuels mixture (b) in time during fire extinguishing with liquid water aerosol at droplet radii $R_d = 0.016\text{--}0.056$ mm: 1 — $h = 5$ mm; 2 — 15; and 3 — $h = 25$ mm. Time between injections: (a) 5 s; and (b) 10 s

Figure 6 Temperature distribution over the thickness of the wood layer during the experiment (extinguishing with an aerosol emulsion of foaming agent 5%): (a) the first spray mode (time between injections 5 (left) and 10 s (right)); (b) the second spray mode (time between injections 5 (left) and 10 s (right)); (c) the third spray mode; 1 — $h = 5$ mm; 2 — 15; and 3 — $h = 25$ mm

Figure 7 Temperature distribution over the thickness of the wood layer during the experiment (extinguishing with a spray of FR-Les 01 20 percent solution): (a) the first spray mode (time between injections 5 (left) and 10 s (right)); (b) the second spray mode (time between injections 5 (left) and 10 s (right)); (c) the third spray mode; $h = 5$ mm; 2 — 15; and 3 — $h = 25$ mm

Table Captions

Table 1 Registered characteristics of the process of the wood combustion suppressing with the foam emulsion

Table 2 Registered characteristics of the process of the wood combustion suppressing with the FR-Les 01 solution

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