The Impact of Water Mist on Combustion Products

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Bio[1]: Kemal Arsava received his Ph.D. in Civil Engineering in the US and has worked as a research engineer in Fire Protection Engineering at WPI for three years, focusing on experimental investigation of oil spill response technologies, pool fires, and hazardous waste combustion. Kemal has been working in RISE Fire Research since 2021 as a senior research scientist. He works on the façade, electric vehicle, tunnel, and forest fires. He is the project coordinator of a HORIZON2020 project (TREEADS), focusing on wildfires. He has been a member of IWMA since 2021 and part of the scientific council.

Abstract

This study aims to investigate the combustion byproducts of fires suppressed or extinguished by two water-based fire suppression systems: sprinklers and water mist systems. Thirteen experiments were conducted with various system configurations, including sprinklers, low-pressure (LP) water mist, and high-pressure (HP) water mist, operating at pressures ranging from 2 to 60 bar. The fuel consisted of high-density polyethylene (HDPE) pallets placed on two wooden pallets. Throughout all stages of fire development, suppression with water, and post-extinguishment, combustion products were sampled using Fourier-Transform Infrared Spectroscopy (FTIR) via a gas analyzer capable of functioning in high humidity conditions. The primary combustion products identified were CO_2, CO, and H_2O, with relatively high concentrations of NOx, CxHy, and HCN also present. All tested fire suppression systems effectively reduced fire size and cooled gases. However, instances where immediate extinguishment was not achieved saw higher concentrations of NOx, CxHy, and HCN compared to the baseline. The high-pressure water mist system exhibited greater effectiveness than the sprinkler system in reducing combustion gas production post-suppression.

KEYWORDS: low-pressure water mist, high-pressure water mist, sprinkler, combustion products

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