PROJECT PLAN

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Quantification of the Performance of Wildland Fire Chemicals Using a Thermal Canister

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ISSUE/GOAL

The application of wildland fire chemicals has become increasingly prominent in fighting forest fires. It is necessary to evaluate the relative performance of various wildland fire chemicals used. Quantifying the performance of these chemicals will provide information on the effectiveness of these chemicals, and also provide data for a cost-benefit analysis.

OBJECTIVE

The objective of this project is to manufacture an experimental setup to evaluate the performance of wildland fire chemicals. A custom built thermal calorimeter, known as the "Thermal Canister," will be fabricated to measure the heat released during the combustion of the fuel. The heat release rate will be used as the measure for the purpose of product evaluation and performance.

METHODS

The experiments using the Thermal Canister will be carried out at the Thermal Spray Lab at the University of Alberta. A fuel bed of dimensions 25 cm by 25 cm will be placed in the Thermal Canister. The fuel selected for the experiments is feather moss. The application of the wildland fire chemicals will be done before the placement of the fuel in the thermal canister.

A radiant heater will be placed below the Thermal Canister, facing the fuel bed. Radiant energy from the heater will be used to ignite the treated fuel. The radiant heater will be set at a fixed temperature of 500°C throughout the experiments.

Figure 1: Thermal Canister Assembly

The walls of the Thermal Canister will be divided into 10 different sections. Each section will have a set of thermocouples wired into them to measure the front face and back face temperatures. The thermocouple wires will be differentially wired to reduce any propagation of error. An exhaust tube will be fitted on the top plate of the Thermal Canister. The temperature and velocity of fume gases will be measured and computed. Each of the 10 different sections will correspond to a one-dimensional mathematical heat conduction model. Thermocouple data obtained from the walls of the canister combined with the measurements of the fuel gas will feed into the aggregated mathematical model. This mathematical model will output the total heat released by the combustion of the fuel.

The heat released from the combustion of fuel as a function of time will be plotted for different chemicals. This plot will be used to evaluate the relative performance of the wildland fire chemicals.

TIMELINE

This project is part of graduated studies program at the Department of Mechanical Engineering, University of Alberta. The thesis is to be completed in 2017.

RESOURCES

Razim Refai is a graduate student at the University of Alberta Mechanical Engineering and will carry out the experiments at the lab and analyze the results. FPInnovations will cooperate with University of Alberta to provide the material, support and expert advice.