CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

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Project Number

J1108

Project Title

A Comparison of Cost, Heat Output, and Particulate Emissions in Artificial Logs vs. Ordinary Wood

Abstract

Objectives/Goals

In my project I attempted to answer whether artificial fire logs or ordinary wood logs would produce any significant differences in their particulate emissions (during burning) at < or = 2.5 micrometer particle size. I also evaluated which log heated the room most effectively, and which type of log was the best value (per hour of burn time). Ordinary wood logs and seven different types of artificial logs were purchased and compared.

Methods/Materials

All of the samples were tested in both a two-story chimney setting and a one-story chimney setting in the same house. A PersonalDataRAM was used to assess particulate emissions of < or =2.5µm (micrometers) in diameter. Two digital thermometers were monitored every half hour and temperatures at 1m and 2m were recorded and averaged. The cost of each log and the amount of time each log burned was recorded.

Results

The log that heated the room most effectively was the "Duraflame Crackleflame" (2.72 kg) log. It raised the temperature of the room an average of 8.25° C! The next closest in heat production was the large "Stater Bros. Firelog" which raised the temperature of the room 5.95º C.

With a shorter flue length, the logs burned much more rapidly than in a two-story setting. The logs burned for 1-3 hours in the one-story setting, and 2.5-5.5 hours in the two-story fireplace setting. The large "Stater Bros. Firelog" (2.72 kg), the "Pine Mountain Giant Size" (2.27 kg), and the "Duraflame Crackleflame" (2.72 kg) logs were the best values.

The log that had the most particulate emissions at the < or =2.5µm size was the large "Stater Bros. Firelog." It had a maximum of 373µg/m^3 of < or =2.5µm particulates. The standard safe level for 24-hour exposure is only 65µg/m^3 < or =2.5µm particulates!

Conclusions/Discussion

Ordinary wood was by far most expensive log to burn. The artificial logs "Duraflame Crackleflame" (2.72 kg), the large "Stater Bros. Firelog" (2.72 kg), and "Pine Mountain Giant Size" (2.27 kg) were the best values. The "Duraflame Crackleflame" (2.72 kg) produced the greatest amount of heat during the time it burned. Surprisingly, the large "Stater Bros. Firelog" (2.72 kg) emitted significantly more particulates (373µg/m^3) at < or =2.5 micrometers than any other log tested. No other log exceeded 150µg/m^3 of < or =2.5µm particulates at any time.

Summary Statement

This project attempted to discover if significant differences exist between artificial fire logs and ordinary wood in their particulate emissions (of < or =2.5 micrometers), heat output, and cost (per hour of burn time).

Help Received

Dr. Jenny Quintana for allowing me to borrow the PersonalDataRAM for the particulate emissions testing for my report; My science teacher for helping to edit my report; My parents for purchasing the logs.