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Project Summary

Emissions From Burning Cabinet Making Scraps

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The object of this project was to make an initial determination of differences in emissions when burning ordinary cordwood compared to kitchen cabinet making scraps. The tests were performed in an instrumented woodstove testing laboratory on a stove which simulated units observed in use at a kitchen cabinet manufacturer's facility. Three test burns were made using a stove made from a 55 gal. (0.208 m^3) drum and a kit sold for that purpose. Test burn 1 used seasoned oak cordwood fuel, Test burn 2 used particle board scraps, and Test burn 3 used Formica®-faced particle board scraps. The scraps for tests 2 and 3 were obtained from a kitchen cabinet manufacturer in Vermont. In general the cordwood produced higher emissions of carbon monoxide and total hydrocarbons, while the composite woods produced higher emissions of the heavier molecular weight organic compounds. There were significant differences in burnrate between the tests, which introduced some uncertainty in interpreting the analytical results.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Emissions generated by the combustion of scrap wood composite products at small cabinet manufacturing companies in Vermont were characterized. The scrap is burned to heat the facilities and reduce the companies' waste disposal costs. The state of Vermont asked for assistance after receiving citizens' complaints about visible emissions and odors emanating from two facilities.

One of the Vermont facilities (facility A) specializes in manufacturing countertops. The laminated-surface composite wood material is received ready-to-use and then cut to specifications. Four simple steel furnaces with 10 ft^3 (0.283 m^3)combustion chambers are used for burning scrap. Draft on the furnaces is regulated manually and the fuel is fed manually as needed. The smoke has an odor of burning plastic, which is stronger at startup and refueling. Complaints have come mainly from passersby.

Scrap produced by the other facility (facility B) consists of saw dust, small pieces of particle board, and plywood. The furnaces have primary and secondary air controls. Scrap chunks are fed by hand, but saw dust is fed automatically.

Composite woods contain several typed of phenolic resins including phenol-formaldehyde resin and melamine resin. The chief components of phenolic resins are formaldehyde, acetaldehyde, and phenol. Characteristics of these resins are resistance to moisture, solvents, and heat up to 200° C. They are also dimensionally stable, sound absorbent, and noncombustible. Chief components of melamine resin are formaldehydes, phenols, and cyanobenzenes.

Experimental Approach

This project's goal was to characterize emissions from the burning of common kitchen countertop scrap material (plain

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particle board and particle board laminated with Formica). The conditions at Vermont facility A were emulated. To reduce expenditures, sampling was performed in the woodstove testing laboratory of EPA's Air and Energy Engineering Research Laboratory in North Carolina. Three varieties of wood were burned: cordwood (virgin wood), particle board, and Formica© board (Formica©-covered particle board). Cordwood was sampled for comparison purposes. Both composite woods were provided by Vermont facility A. Only one test was performed per day, lasting 2-5.3 hours. Again, to reduce expenditures, only one sample was planned for each fuel. Acurex Environmental performed all sampling, and prepared and analyzed all filter and XAD-2 samples. Nonvolatile organic compounds (NVOCs) were analyzed by gravimetric (GRAV) methodologies . Semi-volatile organic compounds (SVOCs) were analyzed by gas chromatograph/flame ionization detection (GC/FID) and gas chromatograph/mass spectroscopy (GC/MS). Samples for volatile organic compounds (VOCs) were transferred to EPA/AREAL for analysis.

Summary and Conclusions

This study determined a number of differences between the combustion of composite woods and cordwood. The composite woods burned faster than cordwood because of the higher surface area of the former, which are burned as scraps, relative to the same mass of cordwood. Higher stack temperatures and oxygen concentrations, and lower carbon monoxide and total hydrocarbons (mass/mass basis) were observed during composite wood vs. cordwood combustion.

VOC levels were much higher during composite wood combustion, with the major components in the C4-C6 region. Total emission levels (based on the total capture value) were also higher for the composite woods. The higher total capture results were due, in large part, to higher NVOC levels. SVOC levels, on the other hand, were equivalent (Formica©) to or even lower (particle board) than those generated by cordwood. There was a trend towards larger molecular weight components for these emissions. The composite wood fitter extracts showed higher concentrations of higher retention time analytes during the GC/MS analysis. These components were primarily straight-chain hydrocarbons.

Significant differences were observed in the compounds identified from the extractable organics. Most PAHs were associated with the cordwood rather than the composite wood combustion. For example, isocyano-benzene was identified from the Formica© samples and 4-hydroxyl-benzenesuffonic acid was found in the composite wood samples.

No aldehydes were detected from any of the samples collected during this study. What this means is not clear. Based on airtight woodstove studies, aldehydes were expected for at least the cordwood samples. However, the combustion conditions during this study were probably closer to those of a fireplace than a woodstove. No significance can be attached to these aldehyde results without further testing.

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The complete report, entitled "Emissions from Burning Cabinet Making Scraps," (Order No. PB94-130408/AS; Cost: $27.00, subject to change) will be available only from:
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5285 Port Royal Road
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Telephone: 703-487-4650
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