

Detecting Arson Accelerants by Gas Chromatography

References

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Goal

To discover if a fire was set deliberately by detecting and identifying any accelerant, if present.

Suggested Method of Analysis

Vapor concentration of the accelerant in an activated charcoal strip, elution with carbon disulfide, and gas chromatographic analysis.

Available Standards

Accelerants: ethanol, gasoline, kerosene, lighter fluid. Unburned carpet from the scene.

Collecting the Accelerant Vapor

Carefully remove a carbon DFLEX strip from the storage vial with forceps. Attach it to the inner side of the paint can lid with a loop of adhesive tape. (Alternatively, to reduce the background, attach the carbon strip to a paper clip and suspend the clip with unwaxed dental floss. The floss is held in place as the lid is secured to the paint can.) Place the carpet sample in the paint can and firmly put on the lid. Pound around the edges of the lid with a mallet or hammer to seal the can. Put the sealed paint can in an 80 to 90 °C oven for one hour. If too much accelerant was placed on the carpet sample, the generated vapor pressure may blow the lid off the can. If so, simply replace the lid and continue heating the can and its contents for the remainder of the hour.

After the paint can has cooled, remove the lid and remove the DFLEX strip with the forceps. Use scissors or a sharp knife to cut the strip into four small pieces. Place the pieces in a small, sealable vial. In a fume hood, add 10 drops of diethyl ether to the vial. Immediately close the vial; ether is very volatile. Gently slosh the ether over the carbon strips. Allow the vial to stand for at least ten minutes.

To clean a paint can, empty out the carpet debris and place the open can and lid in a 110 °C oven for at least an hour. Allow the can to cool.

CAUTION. Diethyl ether should only be handled in a fume hood. Always wear gloves when using ether. Ether is also extremely flammable; do not use it near flame or any other source of heat. Properly dispose of waste containing ether.

Gas Chromatographic Analysis

Follow instructions to set up the gas chromatograph for split injection of the sample and a temperature-programmed separation in a mid-polar column (e.g. DB-5, phenyl methyl silane, 30 m \times 0.25 mm \times 0.25 μ m). The temperature program (in $^{\circ}$ C) is 100 for 3 min, 20/min, 220 for 3 min.

Perform the analysis in the following manner. Push the syringe needle through the vial's septum. Slowly fill and rapidly empty the syringe repeatedly to remove air. Fill the syringe with solution and set the plunger to the exactly 1 μ L. Remove the syringe/needle from the vial, and then pull \sim 1 μ L of air into the syringe. Immediately insert the syringe/needle into the GC injection port and inject the sample. Start the instrument and data acquisition. Set the integrator or computer to display and integrate only the dozen or so largest peaks.

Compare the retention times and relative peak heights of the largest peaks in standard and sample chromatograms in order to identify the flammable present.