

Evaluation and refinement of the procedure used to prepare training samples for arson detection K-9s

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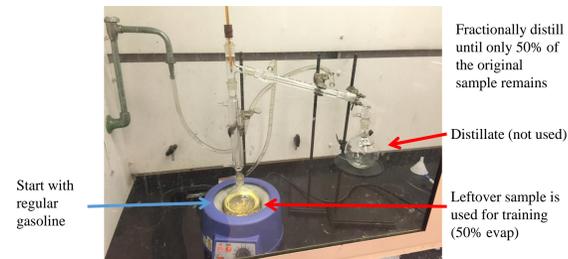


Facts about accelerant detection canines

- Transforms from a loving pet to an arson detection tool as soon as the handler puts on the food/reward pouch.
- Has a sense of smell that is 100,000 times more acute than a human's.
- Knows how to work a crowd. At a fire scene, the dog is encouraged to mingle with spectators and give them a good sniff. If the arsonist is in the crowd watching, the ADC will alert to the smell of the accelerant on his or her clothes, shoes or body.
- Is fast, covering an entire scene in less than 30 minutes. It can take humans days to do what a dog does in minutes.



Preparation of training sample (50% evap gasoline) by fractional distillation



50% Evap Samples are highly hygroscopic

An initial attempt to evaluate vapor pressure changes between gasoline samples and 50% evap samples revealed the solutions readily absorb water from the atmosphere as evidenced by dropping vapor pressure values when measurements were attempted.

Gasoline Sample	Vapor Pressure Before Distillation	Vapor Pressure of 50% Evap Sample	Vapor Pressure Difference (from atmospheric pressure at time of experiment)
Flex Fuel	774.4 mmHg	754.7 mmHg	-6.3
87 Octane	778.1 mmHg	749.2 mmHg	-11.8
93 Octane	774.8 mmHg	752.1 mmHg	-8.9

Training samples exposed to air while evaporating may absorb significant amounts of water compared to distilled samples

Conclusions

50% evap samples are hygroscopic and the training samples will dilute upon air exposure

Ambient Evaporation to produce 50% evap samples leads to water incorporation into the training sample with more water incorporated at higher humidity levels

Fractional distillation (or other techniques that would limit air exposure such as using reduced pressure) leads to more consistent training samples and should be the preferred production method

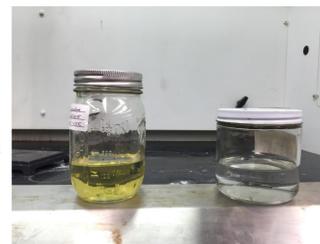
Helping out the local fire department

Collaboration between New Bern Fire and Rescue and Craven Community College – to support the continued training of Accelerant Detection K9 Darby - began in September 2015

Online sources for preparing samples for training describe allowing gasoline samples to evaporate at ambient temperatures in an open environment: "place say eight ounces of in an old glass measuring cup and set it somewhere that the gasoline can evaporate down to four ounces". This information did not match with the description provided by the chemist associated with the training program that Fire Marshall Hill attended which called for fractional distillation of the gasoline sample.

"Starting an Accelerant Detection Dog" <http://www.angelfire.com/ny3/arsonk9.arson.html>

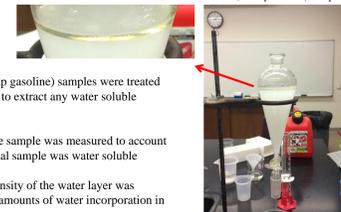
The fraction that does not distill (the 50% evap sample) resembles the residue that would be left over from an accelerant used in an arson – it is used to train the K9.



The distilled fraction represents the portion of the accelerant that would burn off during a fire – it is not used for training.

Analyzing hydrophilic (potentially water absorbing) content in gasoline samples by preparation method

Photos are ESS Flex Fuel (mostly ethanol) samples



100 mL gasoline (or 50% evap gasoline) samples were treated with 25 mL of distilled water to extract any water soluble components

Volume of remaining gasoline sample was measured to account for what volume of the original sample was water soluble

For 50% evap samples the density of the water layer was determined to gauge relative amounts of water incorporation in the sample

Sometimes you're a serious fire fighter ...



... and sometimes you just want a belly rub.

Consistent samples help with training

The Canine Accelerant Detection Association requires dogs to be able to detect gasoline, 50% evaporated gasoline and 75% evaporated gasoline (and other materials not relevant to this project). Considering the variability in preparation techniques as well as the inherent nebulous nature of the term 'gasoline' (a volatile, flammable liquid mixture of hydrocarbons, obtained from petroleum, and used as fuel for internal-combustion engines, as a solvent, etc.) it was apparent that there could be a large variation in the composition of training samples based on the initial gasoline sample used and the method by which the evaporation took place.

Our project attempts to evaluate sample preparation methods and the reliability of the training samples produced.

"Canine Accelerant Detection Association – Standards for Accelerant Detection Canine Team" <http://cadafiredogs.com/wp-content/uploads/2013/08/CADA-Standard-2013.pdf>

Fire Marshal Danny Hill and K-9 Darby from City of New Bern Fire-Rescue making good use of training samples



Using Ambient Evaporation to create the 50% evap sample leads to significant dilution of the training sample and is effected by the relative humidity

Sample	Percent water soluble material (by volume)	Additional volume of water soluble layer (compared to distilled sample)	Density of Water Layer from separation
87 Octane	10.5		
50% evap (by distillation)	5.5		0.926 g/mL
50% evap (by ambient evaporation at 28% humidity)	7.1	1.6 mL	0.934 g/mL
50% evap (by ambient evaporation at 92 - 100% humidity)	8.4	2.9 mL	0.944 g/mL

Partners and support:



Collaborative Opportunities Grant
Faculty/Student Travel Grant



Faculty Enrichment Grant
Student Enrichment Grant