B44 Practical Methods for Prohibiting Microbial Degradation of Ignitable Liquids in Soil Samples

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After attending this presentation, attendees will: (1) understand how ignitable liquids found in soil are degraded; (2) understand why this type of evidence should be refrigerated to prevent degradation; and, (3) be aware of new possible, practical alternatives to refrigeration.

This presentation will impact the forensic science community by offering arson investigators and analysts a new practical alternative to refrigeration to prevent microbial degradation of ignitable liquids. Prohibiting the degradation of ignitable liquids before they can be analyzed in the laboratory will increase the odds that ignitable liquids in problematic samples will be identified using Gas Chromatography/Mass Spectrometry (GC/MS), even when refrigeration is not possible.

It has been well established that microbes in soil and moldy building materials can degrade ignitable liquids through preferential degradation of select compounds.[1,2] Refrigerating soil samples with potential ignitable liquid samples has been found to slow microbial degradation, but this requires large amounts of refrigerated space that are expensive and not always available.[3] Ignitable liquid samples found in soil can also become degraded prior to reaching a laboratory due to the fast rate of degradation. The use of triclosan in place of refrigeration is an exciting development, but pure triclosan is not readily available to fire investigators, would need mixing in the field, and could have possible negative health effects.[3]

Carbon dioxide canisters, dry ice, and oxygen-absorbing pouches were chosen as possible practical alternatives to triclosan. These experiments sought to make the atmosphere in the sampling cans more anaerobic by reducing the amount of oxygen present or replacing the air with carbon dioxide. This is ideal because anaerobic metabolism of ignitable liquids has been shown to be less efficient than aerobic metabolism.[4]

To test if carbon dioxide canisters could prohibit microbial degradation, an adjustable bicycle tire inflator was used to displace the air in the cans with carbon dioxide. Positive samples were spiked with 20µL of gasoline or diesel. The cans treated with carbon dioxide were compared to spiked soil samples that were kept at room temperature or in a freezer. In early experiments, the addition of carbon dioxide appeared to prohibit microbial degradation; however, with further testing it was shown that carbon dioxide canisters are unreliable as a means of prohibiting microbial degradation. It was also evident that there was wide variation in the canisters' contents.

Dry ice was also tested as a possible alternative to the carbon dioxide canisters. Dry ice offered less potential contamination than carbon dioxide canisters and cooling of the soil to help prohibit degradation; however, the sublimation of the solid dry ice to gas caused the pressure in the cans to increase and several lids exploded off the cans. The small amounts of dry ice that could safely be used failed to stop microbial degradation.

Finally, Oxy-Sorb® pouches were added to cans of soil spiked with gasoline. Oxy-Sorb® pouches are used to keep food fresh by reducing the amount of oxygen that is present.[5] The pouches are iron-based oxygen scavengers that reduce the available oxygen due to the reaction of oxygen with ferrous iron.[5] The samples with Oxy-Sorb® pouches added were compared to gasoline-spiked soil samples that were kept at room temperature. The Oxy-Sorb® pouches prohibited microbial degradation for 28 days.

Oxy-Sorb® pouches are a promising alternative to refrigeration and could be used in the future to prohibit microbial degradation. Before the Oxy-Sorb® pouches can be reliably used to stop microbial degradation, further experiments are needed using ignitable liquids other than gasoline. Other brands and sizes of oxygen-scavenging pouches could also be explored.

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3. Turner D.A., Goodpaster J.V. Preserving Ignitable Liquid Residues on Soil Using Triclosan as an Anti-Microbial Agent. *Forensic Sci Int*. 2014;239:86-91.
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Fire Debris, Microbial Degradation, Ignitable Liquid