A167 Preventing Ignitable Liquid Degradation Using Antimicrobial Agents

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After attending this presentation, attendees will understand the concept of microbial degradation of ignitable liquid residues and what can be done to preserve fire debris evidence.

This presentation will impact the forensic science community by detailing means for delaying degradation, which will allow forensic analysts to determine if an ignitable liquid is present on soil or other organic substrates.

The analysis of fire debris evidence is important in the investigation of arson cases. Although most of the ignitable liquid is burned as fuel in a fire, its residue is often collected in conjunction with substrates such as soil and wood. However, certain organic compounds present in the residue evidence that are necessary for their positive identification are also food sources for bacteria commonly found in these environments. It is believed that if degradation can be delayed or eliminated completely then forensic analysis can accurately identify the types of ignitable liquids used in arson cases.

Based on literature review and work previously done at Indiana University Purdue University Indianapolis (IUPUI), it is hypothesized that the antimicrobial agents triclosan, benzethonium chloride, and benzalkonium chloride could be effective at slowing or preventing degradation. Also, certain species of soil amoeba are being explored as a possible means of eliminating or delaying microbial degradation because the main food source for these organisms is bacteria.

In a preliminary qualitative investigation, culturing studies were carried out using solutions of triclosan in varying concentrate ions and solvents. Solutions were made accordingly: 0.1%, 0.5%, and 1.0% triclosan in methanol and 0.1% and 0.5% triclosan in glycerin. Water was not used as a solvent because of triclosan's low solubility. After preparing these solutions, 5.0 mL of each type were mixed with 2.0 g of two types of soil: potting soil and lawn soil from the IUPUI campus. Plastic culture tubes housed these mixtures, and they were stored in a cool, dry area in the lab. After specific time points (one hour, one, two, and seven days) inoculating loops were used to spread 10 mL of the liquid onto agar plates.

The 1% triclosan solutions (in both methanol and glycerin) proved to be most effective, preventing growth for up to seven days. Although both solutions successfully delayed biodegradation, a water-based solution is needed. For this reason, culturing studies were ultimately completed using a 1.0% solution of triclosan, benzethonium chloride, and benzalkonium chloride in a 5.0% glycerin in water solution. Research has been conducted using both benzethonium chloride and benzalkonium chloride as biocides and antimicrobial agents. These chemicals also have surfactant properties making a mixture using them potentially doubly effective for this study as triclosan might have greater solubility in their presence and antimicrobial action may be increased. Glycerin was added to this mixture to increase the solubility of triclosan, but the solution still needed to be sonicated in a heated bath for at least 45 minutes before the triclosan was mostly dissolved. The previously described procedure was repeated with these solutions. Except, for this study all of the agar plates were sealed with parafilm after inoculation to mimic an airtight situation found in real life scenarios. This solution was seen to inhibit microbial growth for up to two days.

During a passive headspace study, cans with mixtures of soil, gas, and antimicrobial solution were analyzed via GC/MS. Based on the results, the degradation of gasoline on potting soil was more pronounced than on lawn soil. Also, degradation is only noticeable on soil when

smaller volumes of gasoline are present (20mL). Furthermore, the recovery of gasoline was not adversely affected by the antimicrobial solution. Finally, residues of gasoline were preserved on potting and lawn soil for time periods of up to seven days.

Ignitable Liquid, Microbial Degradation, Fire Debris

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