A105 The Effect of Accelerant and Passive Headspace Analysis on DNA From Simulated Arson Evidence

Gina M. Dougherty, BS, 751 Arthur Street, Hazle Township, PA 18201; and Lawrence Quarino, PhD, Cedar Crest College, Department of Chemistry & Physical Science, 100 College Avenue, Allentown, PA 18104*

After attending this presentation attendees will gain knowledge of the potential negative effects that passive headspace has on DNA present on evidentiary material taken from an arson investigation. Attendees will also understand the potential damage to DNA that can be caused by the accelerant and the burning of the material.

This presentation will impact the forensic science community by determining the optimal headspace analysis parameters of the detection of accelerants on simulated arson evidence that will maximize DNA typing results.

Fires are a very destructive force of nature. However, not all fires are naturally occurring. Many fires are deliberately set to cause damage to one's property or even to another individual. These types of fires are classified as arson. Unlike most crimes, in an arson case evidence is typically destroyed by the fire which leads to a more difficult investigation. Accelerants are generally flammable or volatile liquids used to aid the ignition of the fire and are therefore, commonly found at the scene.

DNA can be used to link a suspect or victim to the scene of the crime. DNA can be extracted from any type of body fluid, hair, and even skin cells. Studies have shown that by briefly touching an object a detectable amount of DNA is left behind. In order to deliberately start a fire one must typically be present at the scene of the fire. For instance, blood may be present if a suspect or victim is injured during the commission of the arson. Furthermore, items simply touched by individuals may transfer DNA to the object.

In an arson investigation, items of evidence may be collected to undergo accelerant analysis and then later sampled for DNA. A very common method for extracting accelerants from evidence is passive headspace. Heat is used to help speed up the volatilization process. By heating the evidence in a metal paint can, the accelerant volatilizes and becomes concentrated in the headspace of the can which can then be sampled. However, this method for accelerant analysis involves high temperatures, which could damage DNA, potentially impacting DNA typing methodologies.

A series of experiments have been carried out to simulate analysis of evidence that may be commonly collected at the scene of a fire and tested for both DNA and accelerants. Six porous substrates: 100% cotton, 100% nylon, wood, foam, carpet, and cardboard along with one non- porous substrate (glass) were used throughout all experiments. All substrates were stratalinked to crosslink any DNA that may have been present. Three different volumes of whole blood were added in triplicate to all seven substrates simulating high copy number DNA. This was to ensure that DNA extraction and downstream applications would have a higher success rate and differences could be seen.

Two different extraction methods, Chelex and DNA IQ™ System (Promega), were utilized to extract DNA from the simulated evidence. A mock passive headspace procedure was followed to mimic the prolonged heat exposure to the DNA present in the blood. The maximum ASTM recommendations for time and temperature were used. [1] DNA extraction was performed on one set of samples prior to the mock passive headspace and one set of samples after the mock passive headspace.

Statistical analysis of quantitation results showed that DNA on simulated evidence was not adversely affected by passive headspace analysis. Two substrates, cardboard and carpet, yielded very low concentrations of DNA before and after passive headspace analysis, possibly due to the presence of PCR inhibitors. However, all samples produced a full genetic profile with 15 STR loci and amelogenin.

Results will also be presented on the effect of passive headspace analysis on samples of blood and touch DNA placed on the individual substrates mixed with accelerants. Optimal headspace analysis criteria maximizing both accelerant detection and DNA typing results will be determined. Substrates will also be burned with DNA sampled before and after passive headspace.

Reference:

1. American Society of Testing and /Materials. ASTM Method D1412-00 Standard practice for separation and concentration of ignitable liquid residues from fire debris samples by passive heasdspace concentration with activated charcoal. In: annual book of ASTM standards. Philadelphia, PA: ASTM, 2001:431-3.

Passive Headspace, Accelerant Analysis, DNA Quantitation and Typing

Copyright 20?? by the AAFS. Unless stated otherwise, noncommercial *photocopying* of editorial published in this periodical is permitted by AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained by AAFS. ** Presenting Author*