K3 Detection of Inhalants and N-Propanol in Forensic Toxicology: A Six-Month Review

Jillian Loisel, 10900 Ulmerton Road, Largo, FL 33778-1633; Michele Merves, PhD, Pinellas County Forensic Lab, 10900 Ulmerton Road, Largo, FL 33778; and Reta Newman, BS, Pinellas County Forensic Lab, 10900 Ulmerton Road, Largo, FL 33778*

After attending this presentation, attendees will understand the procedure for identifying inhalants and Volatile Organic Compounds (VOCs) using headspace sampling coupled with Gas Chromatography-Mass Spectrometry (Headspace GC/MS), the prevalence of inhalants in biological specimens, and the potential risk of using the internal standard, n-propanol, in postmortem sample analyses.

This presentation will impact the forensic science community by offering insight to the qualitative analysis of common inhalants observed in biological samples. This study also discusses the use of n-propanol as an internal standard for postmortem analyses.

Due to their extensive availability, low cost, and potential for euphoric effects, inhalants have the potential for abuse. They are present in many commercial products including paint thinners, nail polish removers, degreasers, dry-cleaning fluids, correction fluids, and various aerosol products. The main objective of this study was to determine the prevalence of inhalant use through the analyses of blood or similar biological specimens. Chemicals of interest include, but are not limited to, 1,1–difluoroethane, difluorochloromethane, 1,1,1,2 – tetrafluoroethane, nitrous oxide, propane, methanol, and toluene. A secondary element of this study was to look at the prevalence of n-propanol in postmortem cases as a postmortem artifact. The complex processes of decomposition produce a variety of chemicals as the soft tissues break down and n-propanol may be generated as a by-product. N-propanol is often used as an internal standard in the quantitation of ethanol and similar volatile compounds.

Headspace GC/MS is a useful method of analysis for VOCs because it requires minimal sample preparation. Six months of postmortem and Driving Under the Influence (DUI) case samples were analyzed to determine the prevalence of inhalants and n-propanol in biological samples. An Agilent® 7890A gas chromatograph equipped with a 7697A Headspace Autosampler and Agilent® 5975C mass spectrometer was utilized for this study. The GC capillary column used was a DB-1 column 30m x 0.32mm x 5.0µm.

Of 783 cases analyzed, four cases returned positive results for inhalants. 1,1-difluoroethane was present in three of the cases. 1,1-difluoroethane is a halogenated aliphatic compound that is a colorless and odorless gas at standard temperature and pressure. It is the main component of some gas dusters and dust removers used to clean electronic devices. It can cause nausea, vomiting, confusion, dizziness, drowsiness, lethargy, depressed reflexes, muscle weakness, stupor, and, in extreme cases, coma or death.

Difluorochloromethane (chlorodifluoromethane, Freon® 22), an air conditioner fluid, was detected in one sample. Difluorochloromethane is a halogenated hydrocarbon that, when inhaled, can cause symptoms similar to other inhaled gases. All four cases positive for inhalants were postmortem cases where heart blood was tested. Of the 557 postmortem specimens analyzed, n-propanol was observed in 25 cases; 19 were chest fluids (cases in advanced stage of decomposition), the other 6 were heart bloods. Of the 41 chest fluids analyzed, 19 (43%) were positive for n-propanol. Other cases showed indications of n-propanol; however, the abundance was insufficient for identification. It was concluded that the prevalence of n-propanol in postmortem samples was not significant enough to warrant a change of internal standard; however, in cases of decomposition, it should be taken into consideration when evaluating samples.

Inhalants, Headspace GC/MS, N-Propanol

 ** Presenting Author*