



K48 Helium Detection in Postmortem Specimens

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After attending this presentation, attendees will gain knowledge about the detection of helium in postmortem specimens using headspace gas chromatography/thermal conductivity detection (GC/TCD) in cases where death by asphyxiation using helium is suspected.

This presentation will impact the forensic science community by providing a method for the detection of helium in a variety of different postmortem specimens, allowing for a toxicological confirmation for the cause of death.

Currently, in the majority of cases, helium toxicity is only listed as the cause of death based on scene investigation; common scene observations in cases of suicide by helium inhalation includes a plastic bag covering the head with a hose running from it to a helium tank.

Helium is the second lightest element and the second most abundant element in the universe after hydrogen. Its major use is in cryogenics to cool superconducting magnets, such as those used in MRI devices. It is also used as a lifting gas in balloons and airships, as well as in combination with oxygen and nitrogen for deep sea diving in order to reduce the effects of narcosis, an alteration in consciousness that can occur; the proportions of oxygen, nitrogen, and helium are adjusted depending on the circumstances. Because of its low density, it can be inhaled unconsciously, making it a potential asphyxiant under certain conditions. There have only been a few cases reported of accidental asphyxiation by helium, but over recent years, its use as a means of suicide has increased. The increase in the occurrence of suicidal asphyxiation by helium is believed to be, in part, due to certain groups and internet sites advocating helium as the preferred method of suicide because it is widely available and a quick, painless death. One of the most influential publications is "*Final Exit – The Practicalities of Self-Deliverance and Assisted Suicide for the Dying*," in several reported cases, this literature was found on the scene.

The typical signs of asphyxia include cerebral and pulmonary edema, congestion of internal organs, petechial hemorrhages, and frothy edema in the respiratory tract. These signs are sometimes present, although there are often no significant postmortem abnormalities. In cases where such a cause of death is suspected, a reliable detection method is needed.

Postmortem specimens of five cases in which helium asphyxiation was cited as the cause of death were analyzed for the presence of helium. At the time of autopsy, samples of lung, brain, and blood were collected and sealed in 22 mL headspace vials by the forensic pathologist. Three of the five blood samples analyzed were femoral, and the source of the other two samples is not known. Each specimen was analyzed using headspace GC/TCD, with separation performed at 50°C (isothermal) on an HP-Molesieve column using nitrogen as the carrier gas. The vials were incubated at 38°C for 2 minutes, and then 100 µL of headspace was removed from the vial and injected into the GC.

Helium was detected in four of the five cases analyzed. In each of the positive cases, helium was detected in the lung. Two of the cases also tested positive for helium in the brain. The limit of detection for this technique was determined using the formula $LOD = X_m + 3SD$, where X_m is the mean value of the peak areas for blank samples and SD is the

standard deviation of the mean value. Using this approach, the limit of detection was calculated to be a peak area of 3.13×10^3 . Samples of lung and brain from cases in which the cause of death was not related to helium or any other inhalants were also analyzed and found to be negative. Confirmatory analyses are being conducted using gas chromatography/mass spectrometry (GC/MS) in order to verify GC/TCD identification of helium.

In conclusion, this analysis provides a method for detection of helium that is easily conducted, both in the acquiring of the specimen and the toxicological analysis.

Helium, Gas Chromatography, Postmortem