K11 Alcohol Intoxication

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After attending this presentation, attendees will be informed about HS-GC/MS analysis of alcohols with specific toxicity and case reports.

This presentation will impact the forensic science community by providing details on the analysis and validation alcohol intoxications demonstrating a multi-disciplinarily approach to the toxicity evaluation process.

Methanol, also known as methyl alcohol, wood alcohol, wood naphtha, or wood spirits, is a chemical with the formula CH3OH (often abbreviated MeOH). It is the simplest alcohol, and is a light, volatile, colorless, flammable liquid with a distinctive odor very similar to, but slightly sweeter than, ethanol (drinking alcohol). Methanol, is a commonly used organic solvent, the ingestion of which has severe potential ramifications. It is a constituent in many commercially available industrial solvents and in poorly adulterated alcoholic beverages. Toxicity usually occurs from intentional overdose or accidental ingestion and results in metabolic acidosis, neurological sequelae, and even death. Methanol toxicity remains a common problem in many parts of the developing world, especially among members of lower socioeconomic classes.

The pathological effects of methanol are attributed to the accumulation of the toxic metabolites formaldehyde and formic acid. Thus, symptoms of methanol poisoning may be delayed by 12 hours or more from the time of ingestion and may be accompanied by a severe metabolic acidosis. The early non-specific symptoms of nausea, headache, abdominal discomfort, generalized weakness, and deteriorating conscious level can be accompanied by visual impairment. This picture can then proceed to blindness, coma, and death in association with a profound metabolic acidosis. Recommended management aims to delay methanol metabolism by using intravenous ethanol infusion; to reduce methanol levels with hemodialysis; to control metabolic acidosis; and to support cardiorespiratory function.

A case is presented involving a transient loss of consciousness resulting from self-administered denaturated alcohol (methylated alcohol). A 60-year-old woman was found unconscious at home, with a needle mark on her leg. A bottle of purple liquid was found next to the body. The compound was identified and quantified by headspace gas chromatography coupled to mass spectrometry. Headspace Gas Chromatography Coupled to Mass Spectrometry (HS-GC-MS) is one of the most commonly used techniques for the analysis of volatile compounds. At the intensive care unit, specimens of whole blood and centrifuged blood serum were collected at arrival to the emergency clinic. Post-dialysis serum sample from the second day and whole blood samples from the third day were collected for toxicological analysis, and stored at 4°C until analysis. A sample of the purple liquid from the bottle found near the patient was also collected. A sample of whole blood was collected at the clinic a week after the incident and was sent for toxicological analysis for the control and confirmation of the treatment.

The purple liquid found in the bottle was diluted 100 times and tested for ethanol and methanol using the headspace-GC/MS method. The whole blood sample collected at the arrival was found to be un-fit for the analysis due to clotting and low volume, the centrifuged blood serum was preferred instead. Remaining specimens were also tested for methanol and ethanol, respectively.

Methanol, a volatile compound that was identified by the following ions, m/z 29 and 31 after chromatography on a HP5-MS capillary. A headspace gas chromatographic-mass spectrometric (HS-GC-MS) method was developed for detection of ethanol and methanol in blood and quality control and validation was performed. The linearity ranges of the method were 0-2g/L for ethanol and methanol. The limit of detection was 0.03g/L for ethanol and methanol. The limit of quantitation was 0.05g/L for ethanol and methanol. The range of recoveries was between 94%-120% for both ethanol and methanol.

A similar case that was studied involved alcohol intoxication which included a child who was abused and toxicated continuously with anti-freeze. The case was brought due to nausea, dizziness, and fainting of the child and was suspected of a case of intoxication. After, using the same method mentioned above, it was clear by the qualitative analysis carried out that the child was toxicated with methanol and ethylene glycol.

Another interesting case of alcohol intoxication was also studied using this method. The analysis was carried out on blood samples sent by the military. The person was found unconscious near an anti-freeze storage unit. The method was used for qualitative analysis and iso-propyl alcohol was detected.

Alcohols, Headspace, Intoxication

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