

Fatal intoxication by butenes: HS-GC/FID and HS-GC/MS determination of butene isomers in bio-fluids and tissues.

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AIMS: The deliberate inhalation or “sniffing” of gas fuel is a form of substance abuse diffused among young people and associated with a high morbidity and mortality. Cigarette lighter refills containing butane are the most frequently abused, together with butane-containing cans for portable cooking stoves. However, the chemical compositions of gas fuel are heterogeneous and other acyclic aliphatic hydrocarbons can be present. To the best of our knowledge, the first case of fatal intoxication due to inhalation of butene is reported, involving a 21-year-old convict man, known to have been an alcohol addict and in treatment with GHB and lormetazepam, who was found dead in his cell shortly after having inhaled the content of a canister for camping stove.

METHODS: Analysis of the fuel in the canister was performed by head space gas chromatography/mass spectrometry (HS-GC/MS). Three isomers of butene (1-butene, 2-cis-butene, 2-trans-butene) were identified as the principal components; the determination of the relative abundance of butene isomers in the gas fuel was accomplished by head space gas chromatography/flame ionization detection (HS-GC/FID). Subsequently, for the determination of butenes in biofluids and tissues, working standards of 1-butene, cis-butene, and trans-butene were prepared in iso-butanol as a trapping matrix. Working standard solutions were used to prepare calibration standards by spiking blank blood specimens. A solution of pentane in isobutanol (1% v/v) was used as the internal standard. Calibration curves were calculated using four concentration levels and HS-GC/FID. HS injection was performed at 28 °C after 10 min heating at 50 °C. Case samples were prepared by diluting 1 ml of blood or 1 g of homogenised tissue with water and adding sodium fluoride and the internal standard. GHB and lormetazepam determination were also performed in blood by GC-MS after liquid/liquid extraction.

RESULTS: Butene isomer concentrations were determined in blood from different districts and in tissues (brain, lungs, heart, liver, spleen and kidney); for each organ two different portions, collected at two different depths, were sampled for analysis. The concentration of butenes varied from 0.8 to 12.5 mcg/mL in blood and from 0.4 to 28.2 mcg/g in the tissues. Differences in the concentrations observed between superficial and deep sampling suggested the rapid diffusion of these volatile analytes from biofluids towards ambient air. Anatomic and histopathologic examination evidenced generalised visceral congestion, pulmonary oedema and emphysema, hepatic steatosis. GHB and lormetazepam were not detected in blood.

CONCLUSIONS: It was concluded that the cause of death was butene poisoning. The results of the toxicological determinations evidenced that pre-analytical conditions (sampling, storage, handling of specimens) are critical when a volatile substance inhalation is suspected as a cause of death.

KEYWORDS: *Butenes, Inhalation, Fatality, Volatile substance abuse*

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