

## K13 A Fatal Poisoning of Four Workers at a Farm: The Distribution of Hydrogen Sulfide (H<sub>2</sub>S) and Thiosulfate(TS) in Different Biological Matrices

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**Learning Overview:** After attending this presentation, attendees will have improved their knowledge about the principles of evaluation of distribution of H<sub>2</sub>S and TS in biological fluids and tissues in cadavers, together with the postmortem investigations and the circumstantial data.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by analyzing an unwitnessed case of four victims of acute intoxication by H<sub>2</sub>S, in particular showing how the concurrent measurement of sulfide and TS concentrations are fundamental to better understand the circumstances of the deaths, the timing, and the real sequence of the events, according to onsite and postmortem investigation.

H<sub>2</sub>S is a gas produced during putrefaction and found in many industrial processes, representing a not unusual cause of fatal events in workplaces. Reported here are the toxicological investigations applied in an accidental poisoning by H<sub>2</sub>S inhalation involving four dairy farmers. The men were found dead in a pit connected to a manure lagoon.

An onsite investigation was immediately conducted. A manure spreader tank truck was parked near the pit. The corpses were partially submerged in the sewage, at the corners of the half-full pit, but their position did not help explain the possible dynamics of the events. The valve that allows the sewage to exit from the manure pool to the pit was open but did not work properly.

Autopsies were performed four days after death. Biological samples were collected into vials. Toxicological analyses of sulfide and its main metabolite, TS, were made using an extractive alkylation technique combined with Gas Chromatography/Mass Spectrometry (GC/MS).

Autopsies revealed multiorgan congestion and pulmonary edema. Manure was found inside airways of Subjects 1, 2, and 4.

Sulfide concentrations were cardiac blood: 0.5–3.0µg/mL; femoral blood: 0.5–1.2µg/mL; urine <0.1µg/mL; bile: <0.1–2.2g/mL; liver 2.8–8.3µg/g; lung: 5.0–9.4µg/g; brain: 2.7–13.9µg/g; spleen: 3.3–6.3µg/g; fat: <0.1–1.5µg/g; and muscle: 2.6–3.5µg/g. TS concentrations were: cardiac blood: 2.1–4.9µg/mL; femoral blood: 2.1–2.3µg/mL; bile: 2.5–4.4µg/mL; urine: <0.5–1.8µg/mL; liver <0.5–2.6µg/g; lung: 2.8–5.4µg/g; brain: <0.5–1.9µg/g; spleen: 1.2–2.9µg/g; muscle: <0.5–5.6µg/g; and fat: <0.5µg/g. Concentrations of sulfide and TS were consistent with values found in fatal cases of hydrogen sulfide poisoning.<sup>1-4</sup>

The cause of the death was assessed to be acute poisoning for all victims. Manure inhalation contributed to the death of Subjects 1, 2, and 4. Interestingly, non-homogeneous toxicological values were detected. Data interpretation assumes that Subject 3 was the first to enter the pit, probably to open the blocked valve. He died immediately after that, considering he had the highest concentration of sulfide in brain: it is indeed known that sulfide may cause rapid loss of consciousness and respiratory depression. One by one, the other farmers entered the pit in attempts to rescue the coworkers but were overwhelmed: they all died shortly after. Despite the rapid deaths, Subject 3 was the only one with TS detectable in urine (1.8µg/mL). This could be due to differences in metabolism of H<sub>2</sub>S or to a previous exposure.

### Reference(s):

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2. K. Maebashi, K. Iwadata, K. Sakai, et al, Toxicological analysis of 17 autopsy cases of hydrogen sulfide poisoning resulting from the inhalation of intentionally generated hydrogen sulfide gas. *Forensic Sci Int* (2011).
3. E. Ventura Spagnolo, G. Romano, P. Zuccarello, et al. Toxicological investigations in a fatal and non-fatal accident due to hydrogen sulfide (H<sub>2</sub>S) poisoning. *Forensic Sci Int* (2019).
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### H<sub>2</sub>S, Thiosulphate, Intoxication