

A Rare Case of Insecticide Mixture Attempted Homicidal Poisoning Using Cake as a Medium: A Case Report

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Abstract: A 25 years old woman who ate her birthday cake, which was brought by her husband. After consumption of cake she felt some illness like irritation in chest and vomiting, so she was brought to hospital for treatment and doctors collected her gastric lavage during treatment. Chemical analysis of cake sample by thin layer chromatography and Gas chromatography-mass spectroscopy (GC-MS) revealed organophosphorus insecticide chlorpyrifos and pyrethroid insecticide cypermethrin, which confirmed intention of accused to cause health hazard to victim which may lead to homicide.

Keywords: Homicidal poisoning, Organophosphorus insecticide, Pyrethroid insecticide, Chlorpyrifos, Cypermethrin, GC-MS

Introduction

Chlorpyrifos (M.F. $C_9H_{11}Cl_3NO_3PS$, *O,O*-diethyl *O*-3,5,6-trichloropyridin-2-yl phosphorothioate) is an organophosphate pesticide; introduced in 1965 by Dow Chemical company¹. Chlorpyrifos is one of the most widely used organophosphate insecticides in India. It is used in agricultural sector for purpose of killing a number of pests including insects and worms. It acts on the nervous system of insects. Chlorpyrifos is considered moderately hazardous to human reported by WHO². But high use chlorpyrifos results into poisoning to non-target species like human.

Cypermethrin (M.F. $C_{22}H_{19}Cl_2NO_3$, [cyano-(3-phenoxyphenyl)methyl]3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-1-carboxylate) is belonging to pyrethroid class of insecticide that are synthetic esters derived from the naturally occurring toxin pyrethrins, introduced in 1970s³. It behaves as a fast-acting neurotoxin in insects because it's high insecticidal potential and slow resistance to pest. It is considered less toxic for human use, because of poor dermal absorption, rapid metabolism, less tissue accumulation and environmental persistence. So it is used in many household ant and cockroach killers,

including raid and ant chalk. Cypermethrin is also used in agriculture to control ectoparasites which infest cattle, sheep and poultry. In veterinary medicine, it is effective at controlling ticks on animals^{4,5}.

The trend towards the increased marketing of pesticide mixtures is likely to result in an increase impact of mixed toxicity. Organophosphates and pyrethroids belong to the most often used mixed groups of insecticides in agriculture⁶. These compound are characterized by high insecticidal potency, acute exposure can cause serious adverse effects in humans and other mammals mainly due to neurotoxic action. Exposure to chlorpyrifos and cypermethrin can occur through inhalation, ingestion, eye or skin contact. All routes of exposure can be hazardous, chlorpyrifos and cypermethrin affect on central nervous system (CNS) and respiratory system in humans⁷.

Case history

A 40 year old lady registered a complaint under IPC 307 against her son in law with alleged intention of poisoning his wife. He brought a cake late night for birthday celebration of his wife. After consuming the cake her daughter felt ill, hence admitted at hospital. Doctor collected gastric lavage during treatment, and investigating officer seized cake from crime scene and sent both samples to forensic laboratory for chemical analysis.

Experimental

For TLC analysis of Gastric lavage and cake sample were extracted in diethyl ether. The samples were spotted on TLC plates with fine capillary tubes along with pure insecticides as a standard. The plates were dried and developed in a pre-saturated tank containing the solvent system hexane-acetone (8:2, by volume). After developing the plates, the extra solvent was evaporated (dried) in fume hood. The plates were then sprayed with various chromogenic sprays, which are routinely and specifically used for detection of organochloro, organophosphosphate and pyrethroid insecticide.

Gas chromatography-mass spectrometry method

GC-MS analysis was performed of extract on Agilent 7890B GC equipped with Leco Pegasus HT high throughput TOF MS. Column: RTX-5, Capillary column, Max. Temp. 340 °C, 10 m x 180 µm x 0.20 µm. Column temperature program: Initial temperature 50 °C for 1 min then increased 10 °C/min to 280 °C, maintained for 5 min. Run time: 29 min. Injector temperature: 260 °C. Transfer line temperature: 260 °C. Mass range: 45-450 amu. Carrier Gas: Helium, Flow Rate: 1.5 mL/min. Injection mode: Split, Split Ratio: 50.

Results and Discussion

As per routine forensic toxicological analysis, insecticides are generally analyzed by thin-layer chromatography (TLC), few of chromogenic sprays showed positive response like mercurous nitrate in distilled water, *o*-toluidine in acetone and alkali-ferrous sulphate-acid *etc.*, Gastric lavage did not revealed any positive response, whereas chlorpyrifos and cypermethrin were detected by above mentioned spray reagents in cake sample.

For final confirmatory analysis the ether extract was evaporated to dryness and reconstituted with methanol and passed through anhydrous sodium sulphate to remove inorganic phosphate and water content. The methanol extract were filtered with 0.45 micron syringe filter and injected for GC-MS. Gastric lavage does not reveal any peak (Figure 1) while cake extract showed the presence of chlorpyrifos and cypermethrin (Figure 2) in gas

chromatography. The mass spectrometry shows the same results for the confirmation of chlorpyrifos (Figure 3) and cypermethrin (Figure 4).

This is probably for the first time that the cake extract was found positive for chlorpyrifos and cypermethrin inspite of the impurities and fatty acids in cake, which is referred medico legal case in forensic toxicology.

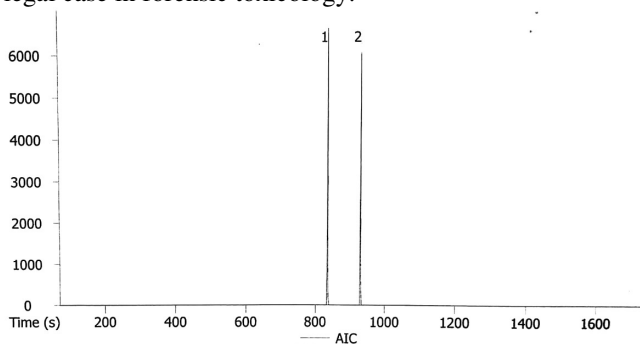


Figure 1. Gas chromatogram of gastric lavage

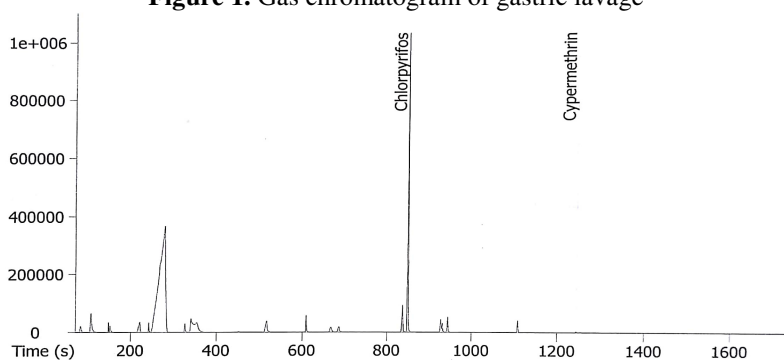


Figure 2. Gas chromatogram of cake sample

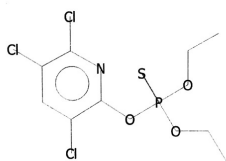
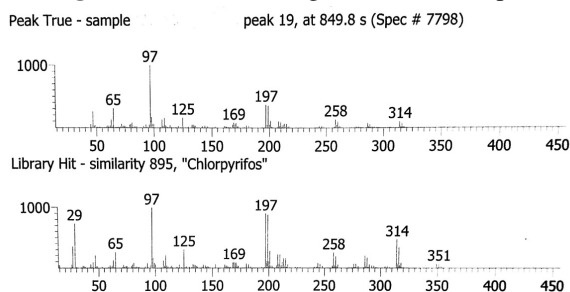


Figure 3. Mass spectrum of chlorpyrifos

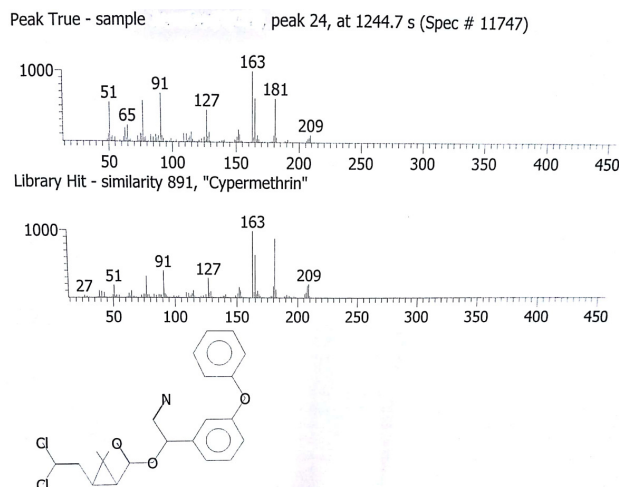


Figure 4. Mass spectrum of cypermethrin

Conclusion

In India the trend for wide use of pesticide mixtures in agricultural sector increases impact of toxicity. This is probably for the first time that the cake has been used as medium for alleged attempted of homicidal poisoning. Chlorpyrifos and cypermethrin were extracted from cake sample and analysed by gas chromatography-mass spectroscopy. In the present case, Husband of victim has intentionally spiked organophosphorous insecticide chlorpyrifos and pyrethroid insecticide cypermethrin in cake to cause some health hazard to victim, which may have lead to homicide.

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