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POISONING OF SEAMEN WITH METHYL
BROMIDE DUE TO FUMIGATION OF A POLISH
CARGO SHIP IN HAIPHONG (VIETNAM)

A. BRODNIEWICZ*

Department of Hygiene, Academy of Physical Education, Warsaw, Poland

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Ten cases of methyl bromide poisoning occurring among the crew of a Polish cargo ship are described. One patient died. Poisoning was due to fumigation of the rice cargo in the port of Haiphong in Vietnam. In the patient with fatal course of the poisoning convulsions and acute pulmonary edema were observed but the patient probably succumbed because of collapse and heart failure. In the non-fatal cases headache, dizziness and nausea were main complaints but no other signs or symptoms appeared. In spite of constant and thorough ventilation of holds during the stay in the port methyl bromide was repeatedly found by means of the halide detector lamp.

Sea navigation spreads like an enormous web all over globe. It therefore forms an easily accessible bridge permitting various sanitary and economic pests to invade ports and neighbouring territories of the countries importing infested cargoes of cereals and other food products, feeds, wood etc. Both – the improper way of storing merchandise before loading in some ports with low hygienic standards as well as long-lasting transport on board of ships – produce favourable environmental conditions for pests to multiply rapidly.

This was confirmed by several investigations and systematic inspections performed by sanitary control, quarantine and plant protection authorities in countries interested in importing agricultural and other food raw materials (9, 16, 17, 18).

Similar studies conducted in Polish ports, as for instance in Gdansk during 1956–1958 showed that 25 percent of the imported cereals were infested by pests. In some transports 41–43 pct specimens per kg of merchandise were found. Besides cereals, pests could be discovered on rice, peanuts, cocoa grains, coco-nuts, nuts and fruits (13, 17, 18).

* Formerly Head of Department of Disinfection, Disinsectization and Deratization of the State Institute of Hygiene, Warsaw.

In view of economic, commercial and consumers' protection and in order to assure sanitary safety of the population – the use of most efficient means of pest control is required (1, 2). Highly toxic gases (including hydrogen cyanide and methyl bromide) proved very suitable for fumigation of ships, warehouses and other infested premises.

During the past 20 years Cyclon B, originally the most frequently used substance, became gradually replaced by methyl bromide.

This compound is routinely employed in many ports of the Far East from where Polish ships frequently bring agricultural food product such as rice. These products require protection from destructive effects of pests during the voyage.

After the fumigation of the rice cargo on the Polish ship M/S »Marian Buczek« in the port of Haiphong in Vietnam (7th–10th January 1958) there occurred – for the first time in the Polish navy – methyl bromide poisoning of 10 seamen with one lethal case (20).

In view of special circumstances under which the accident happened it deserves to be shortly described and discussed.

At the time of accident the following procedure was locally accepted for methyl bromide fumigation of ships carrying rice cargoes: fumigation was limited to airproofing ship's holds; the crew remained on board, slept there and used cafeteria, kitchen, sanitary and other accommodations. According to the locally accepted technique, after the rice cargo had been loaded, the fumigation of the holds was performed lasting uninterruptedly 48 hours. The ship was then anchored outside the port; the fumigation team turned on the ventilators of the still closed holds and returned ashore. The crew of the ship starting homeward was obliged to continue ventilating the closed holds without interruption for the next 14 days.

Afterwards the crew was supposed, taking all precautions, to open the hatches of holds at open sea in order to remove the remainder of the gas.

The local fumigation team proceeded to prepare the ship for fumigation, still during the loading of the rice cargo. The team began to work by air proofing all the holds while neglecting the crew's living quarters situated in the middle ship and the stern. After the preliminary activities fumigation of individual holds began on January 7th 1958 at 3 p. m. in the following succession of holds: I, III, IV, V, VI and finally II. Methyl bromide was introduced through ventilators or by partly opening the holds which were then rapidly airproofed.

The amount of methyl bromide used was about 410 kg. for all holds with a total capacity of 16,942 m³; the average concentration was thus 24,2 g/m³ = 24,2 mg/l. As certain batches of rice in hold II showed a slightly higher degree of infestation 6 kg of methyl bromide were added.

The concentration of methyl bromide in this part of the ship increased therefore to 25,4 g/m³ = 25,4 mg/l. In hold I fumigation lasted without interruption until January, 9th, 8.30 p. m. and in the remaining ones

until the evening of January 10th. During this time 8 members of the local pest control team remained constantly on board the fumigated ship. Their duty was to watch constantly the fumigated holds to detect by means of halide detector lamps places where the gas leaked out, to repair nonairproof places and to safeguard general security.

Under these circumstances the captain decided it would be safe for the crew to remain and sleep on board of the fumigated ship. His decision was confirmed by the ship brokers and officials in charge of the fumigating team who argued that all ships loaded with rice in Haiphong were fumigated in this manner without any accidents or harm to the sailors.

After two unevenful days, during the night of January 8th to 9th after the crew's information meeting, before the ship sailed off the first officer was noticed to enter the messroom with an appearance and behaviour immediately suspicious of methyl bromide poisoning. The following symptoms appeared: stupor, conjunctival congestion, convulsions, finger lividity, tremor of extremities, vomiting and trismus. Alarm was called and first-aid given. The doctor was summoned who gave an injection. Although the patient was immediately taken to the hospital, he soon died.

Convulsions, collapse, acute bilateral pulmonary edema, acute cardiac failure were observed clinically. These could be interpreted as a result of a methyl bromide poisoning. The findings of postmortem examination in methyl bromide poisoning not being specific, the diagnosis is usually based on a toxicological examination and on the study of circumstances under which the patient fell ill. Autopsy confirmed the clinical diagnosis and samples of organs (lungs, liver, kidneys and intestine) as well as blood samples were taken for further toxicological examination.

According to results of toxicological analyses (both quantitative and qualitative) performed in the Chemical Laboratory of the Ministry of Health in Hanoi, by two different methods:

- a) pyrolytic method of Kohn-Abrest-Mafi, and
- b) direct saponification with alcoholic potassium hydroxide, the amount of CH_3Br in 1000 g of the viscera was 40 mg, and the amount of CH_3Br in 1000 g of the blood was 95 mg.

The results obtained doubtlessly confirmed the diagnosis of an acute and lethal poisoning caused by methyl bromide. The lethal dose of CH_3Br for man has not yet been exactly determined; there are data however showing its lethal concentration in the air is located somewhere within the broad range of 1-3 - 10-15 mg/l.

Other crew members were examined by a doctor: only 9 seamen showed symptoms of mild poisoning (headache, dizziness, nausea). The symptoms did not call for hospitalization and soon disappeared without any consequences.

On account of the tragic events and the official investigation performed, the ship stayed in port a week longer than it was planned, i. e.

until January 17th, 1958. The official inspection of the deceased officer's cabin, located just above holds II and III, took place on the afternoon following the accident. During this inspection methyl bromide was detected in various places, particularly around the berth; the gas probably penetrated through nonhermetical partitions. In spite of constant and thorough ventilation of holds during the stay in the port, during the next few days methyl bromide was repeatedly found by means of the halide detector lamp, even in the ship premises entirely excluded from fumigation such as: food storage room, pantry, the officer's cabin in the middle ship, refrigerator and compressor chamber.

Systematic checking of unfumigated cabins of the crew, performed daily since the beginning of the homeward journey (January 17th), demonstrated the presence of methyl bromide still at open sea. This lasted until January 27th, i. e. 17 days after fumigation and uninterrupted ventilation.

It may be asked why the first officer became the only victim of a deadly poisoning while other crew members were only slightly affected. This was caused by the victim's personal habits. The deceased officer used to spend leisure time in his cabin with »bull's eyes« and door closed and ventilators turned off. Under these conditions he could be strongly affected by the poisonous gas diffusing into his cabin; moreover the gas being odourless, it easily escaped detection by smell. While distinctly feeling sick and in a state of general malaise the man was still able to get up, take his clothes (losing his jacket on the way), walk over to the neighbouring messroom, sit down an attempt to put on his pants. The captain immediately noticed the man's unusual appearance (red and swollen face, foaming at the mouth, congested conjunctivae, tremor of extremities, uncertainty of movements, dizziness). The captain became alarmed; he ordered first-aid to be given (laying the patient down, feeding sweetened milk), a doctor and an ambulance to be called. Soon appeared further symptoms such as repeated convulsions, vomiting, finger lividity, collapse, trismus and dizziness. Taken to the hospital the officer deceased after one hour.

It should be stressed that on the fatal evening (at about 8 p. m.), 3 hours before heavy symptoms of poisoning could be observed, the victim talked to the ship carpenter in his cabin. The carpenter was giving an account of the ship's readiness to sail off; he did not notice anything unusual in the first officer's appearance or behaviour. The officer who sat in his armchair interrupted his reading, heard the report and gave orders. Two hours later (about 10 p. m.) during an information meeting of the crew in which the officer did not take part, he was talked to through closed door about some ship documents. The way he expressed himself in the conversation did not suggest anything suspicious so far as his voice, way of speaking and behaviour were concerned.

To the above information it may be added that the ship M/S »Marian Buczek« (ex »Quenn Anne« /1954/, ex »Kelmescatt« /1949/) is of an

older type with the capacity 7053 BRT (10150 DWT) built in Shield (Great Britain) in 1943. It is supposed that there were minute leaks within the partitions separating the victim's cabin from holds II and III located just above the cabin.

Methyl bromide is known as strong odourless poison which frequently causes accidents and death. In humans great differences in susceptibility were observed. Methyl bromide poisonings usually do not take such an acute course as in the described case and when medical help is available they seldom cause death. The deceased officer spent in his cabin the night of January 7th-8th, the whole next day and evening without any symptoms that appeared only in the night of January 8th-9th about 2 hours before death. These circumstances confirm the opinion of toxicologists claiming that the symptoms of methyl bromide poisoning do not appear immediately but only after a latent period (metatoxic effect) which may last from several hours to 1-2 days.

To summarize - the described poisoning of several seamen with methyl bromide was an unexpected accident, the more so as several ship fumigations had been previously successfully performed in Haiphong. The tragic accident was the result of several circumstances such as:

- the port fumigating team lacked experience and proper qualifications;
- the crew's living quarters were not controlled for possible penetration of gas during the long-lasting fumigation of holds;
- the captain's decision that the crew remain and sleep on board of the fumigated ship was based on the judgement of persons trustworthy but incompetent in toxicology;
- sanitary requirements for constant ventilation of the crew's living quarters, particularly during fumigation, were neglected.

The described poisoning of seamen remaining on board during a fumigation limited to the holds suggests some preventive measures to be taken in the future:

1) methyl bromide is an odourless dangerous poison, exerting a metatotoxic effect, often producing symptoms after a latent period (6 hours to 1-2 days). Consequently only specially trained fumigation teams ought to be allowed to apply it;

2) during the fumigation limited to the ship holds the crew must obligatorily leave the ship and may return only after opening the holes and turning on ventilation;

3) as long as traces of methyl bromide are detectable the crew's living quarters may be utilized solely with ventilators turned on or windows and doors open;

4) some competent international body (WHO, FAO etc.) ought to be called to publish instructions for fumigation as well as to organize uniform training courses in fumigation techniques in sea and river navigation. This would be of great value to the sanitary authorities of many developing countries which have recently gained independence.

Sadržaj

OTROVANJE METILBROMIDOM UZROKOVANO
FUMIGACIJOM JEDNOG POLJSKOG TERETNOG BRODA
U HAIPHONGU (VIETNAM)

Opisano je deset slučajeva otrovanja metilnim bromidom nastalih među posadom jednog poljskog teretnog broda. Jedan je bolesnik umro. Otrovanje je bilo posljedica fumigacije rižinog tereta u luci Haiphong u Vijetnamu. Kod bolesnika s fatalnim tokom otrovanja opažene su konvulzije i plućni edem, ali je vjerojatno podlegao zbog kolapsa i srčane insuficijencije. Kod preživjelih su glavni simptomi bili vrtoglavica i mučnina, dok se drugi subjektivni ili objektivni simptomi nisu pojavili. Usprkos stalne i izdašne ventilacije skladišta za vrijeme zadržavanja u luci, metilni bromid je bio opetovano nađen s pomoću detektorske svjetiljke za halide.

Odjel za higijenu, Akademija za fizički odgoj,
Varšava, Poljska

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