SIMPLIFIED INSTALLATION FOR OBTAINING POISONOUS GASES

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ABSTRACT

The problem of poisonous gas intoxication is of current importance. At times of war, different chemical weapons have been used, taking many peoples' lives, yet damaging the health of millions more. There have been massive chemical accidents, causing poisonous gas leaks.

Medical students need to be well prepared for providing adequate medical care in such cases. With a view to better preparing students for such cases, simplified installation for visual demonstration of some poisonous gas intoxication of laboratory animals was created at the Department of Chemistry and Biochemistry, in the Faculty of Medicine at Trakia University, Stara Zagora, Bulgaria

Key words*: gas mask, chemical weapons*

Introduction

Many of the substances used in the chemical industry and at home are toxic. Many chemical compounds have been used as chemical weapons at war times, causing many deaths and damaging the health of millions of people (1). Massive chemical accidents have happened, causing poisonous gas leaks of alarming proportions. Large quantities of hazardous gases are released in the atmosphere during fires. For example, carbon oxide is quite a hazardous chemical compound, which causes severe intoxication, often resulting in death (3). Nevertheless, CO is widely used in the chemical and metallurgical industries, it is released in the process of burning different fossil fuels in energy production plants, in transport and at peoples' homes. In fact, it is a chemical weapon.

In this respect, we believe that it is important for medical students to have a clear visual idea of what changes occur in cases of intoxication with poisonous gases. It was with that effect in mind that we, at the Department of Chemistry and Biochemistry, created simplified installation for carrying out experiments to demonstrate the effects poisonous gases have on laboratory animals.

Description

The installation consists of a litre distillation flask and a separating funnel, connected by means of a rubber plug (fig. 1) (6). Approximately 10 g of iron sulfide (necessary for obtaining hydrogen sulfide: equation 1); marble (necessary for obtaining carbon dioxide: equation 2) and approximately 100 ml of distilled water.

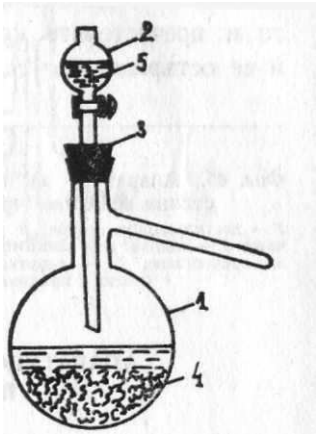

Fig.1. Hydrogen sulfide (carbon dioxide) obtaining installation:

1— distillation flask; *2* — separating funnel; *3* — plug; *4* — iron sulfide or marble; *5* — sulfuric acid (hydrochloric acid)

$$FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S \quad (1)$$

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + CO_2 + H_2O \quad (2)$$

The separating funnel is filled with sulfuric acid. If gas is needed the funnel tap is opened and the sulfuric acid seeps into the flask. As a result of the chemical reaction, a particular kind of gas is obtained, which is then led through a plastic tube, into the chamber where the laboratory animal, usually a mouse or a rat, is placed.

Carbon oxide can be obtained in the same installation, in the following way, described by Haas (4):

H_3PO_4 is poured in a round bottom flask, up to 2/3 of its volume. The flask is then heated up to 80 °C in hot water. After that formic acid is oozed through the separating funnel, into the flask. The following chemical reaction happens in the flask (equation 3):

$$HCOOH \rightarrow H_2O + CO \quad (3)$$

Oxalic acid can be used in the same installation, but in that case the obtained substance will be a mixture of carbon oxide and carbon dioxide (equation 4).

$$H_2C_2O_4 \rightarrow H_2O + CO + CO_2 \quad (4)$$

If manganese dioxide in put in the flask and hydrochloric acid in the separating funnel, the result of the reaction will be chlorine (equation 5) (5):

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

With a few changes the installation can be used for obtaining other toxic gases as well.

Conclusions:

The installation can be used for carrying out experiments to demonstrate chemical theory in practice in chemistry and toxicology lessons, in emergency care seminars or in other medical subjects. It gives a clear visual idea of what the real symptoms of intoxication are. The installation was successfully used in the development of the dissertation of one of the authors (2). A serious

downside of the installation is the fact that when used, it caused laboratory animals' suffering and death and that is why it can only be rarely used.

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