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ACCIDENTS AND EFFECTIVE PRECAUTIONS IN CHEMISTRY LABORATORIES IN NIGERIAN SCHOOLS

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ABSTRACT

Accidents frequently occur in the process of teaching and learning in schools. Most of these accidents are common in science laboratories. This paper intends to create proper awareness of the nature and dangers of the materials in the Chemistry laboratory, the sources of accidents in Chemistry laboratory, effective precautions in chemistry laboratory, and recommendations on how to use the laboratory in order to avoid accidents.

INTRODUCTION

A laboratory is a place, usually a room, where scientific experiments are performed by the use of pieces of apparatus and chemical reagents (Ojokuku, 2001). He went further to say that laboratory apparatus is either made of glass, porcelain, plastic or metal. Chemistry laboratory is a place where chemicals and chemical apparatus are kept and used for experimental works. The accidents associated with chemistry laboratory result from different properties possessed by the chemicals. Some of these chemicals are corrosive, poisonous or inflammable. Some can seriously affect the skin, the nerve cells or cause serious cancer. Apart from chemicals, physical accidents can also occurs in a chemistry laboratory. According to Abdullahi (2005), most of the accidents that are physical in the chemistry laboratories are as a result of ignorance and carelessness. He went further to cite the cases of broken glass ware, hot apparatus, burning gas, electric shock, etc. as types of physical accidents frequently found in chemistry laboratories. Hence, in order to effectively prevent these accidents, a lot of precautionary measures has to be adopted by the various teachers of chemistry in our schools.

Sources of Accidents in Chemistry Laboratories:

Accidents cannot be prevented effectively except the sources of the accident is known. Steere (2007), stressed that people in the laboratory should be able to identify chemicals available to them, because chemical hazards occur during measuring of samples, using chemicals in unlabelled bottles, tasting of chemicals, opening of containers of volatile chemicals, etc. He asserted that in chemistry laboratories, chemicals should be classified and labelled according to their effects and hazardous nature. In the same view, Shelley (2008), insisted that chemicals in laboratories should be classified as poisonous and flammable liquids.

Poisonous Chemicals:- All chemicals are regarded as poisonous to human life. Some of them are harmful when in excess. There is a distinct difference between relatively safe and hazardous level of exposure of human being to any chemical. The threshold limit value of toxic gases, vapour and dust showed the average concentration the users can be exposed to the substance without adverse effect. The threshold limit value of chemicals is used as a guide for the control of hazardous materials considered acceptable by the people working in chemistry laboratories. In a study conducted in 2007, the threshold value limits of a number of laboratory chemicals are shown below:

Threshold Limit Value of Common Chemical Substances

Substances	Threshold Limit Value in mg^3
Ammonia	18
Benzene	80
Bromine	0.7
Chlorine	3
Hydrogen chloride	7
Iodine	1

Mercury	0.5
Tetrachloromethane	65
Sulphur (iv) oxide	13
Ozone	0.2

Source: Husband and Themes (1999).

From the above table, it shows that substances like benzene and tetrachloromethane are cumulative poison. Care must be taken in using them because frequent and careless usage may cause laboratory accidents as they are explosives. Mercury has a low threshold limit value. This is significant when compared to the wide use of mercury in all laboratory activities. Mercury vapour forms less than 0.5mg3 which is sufficient to contaminate the air in the laboratory. Abdullahi (2005), opined that volatility and solubility of substances help to determine the potential hazards associated with the substance. He maintained that large soluble substances like benzene are dangerous and harmful to the body. Most of the organic solvents dissolve the protective secretions of the skin, and consistent usage may develop allergic reactions or cancer.

Flammable Liquids:- Flammable liquids used in chemistry laboratories are another sources of accidents. Flammable liquids are extremely very dangerous and must be handled with care. Some of the flammable liquids are methanol, benzene, petroleum fractions etc. These liquids should be kept in a well stoppered metal glass or plastic containers and clearly marked inflammable. The containers should be kept in cool places, as hot places may cause explosion and combustion. Flammable liquids can cause fire outbreak, skin burn, etc. in the laboratory. Ketz (2004), warned that exposure of these flammable liquids to light in our laboratories may result in severe burns and fire outbreak, and must therefore be kept away from light.

Movement of Bulk Chemicals:- The movement of bulk chemicals is another source that can cause physical accident in our chemistry laboratory. The movement of chemicals from the store to the laboratory, and from the shelves to the tables etc. can constitute a hazard. It may

result to the breaking of bottles, or containers and thereby exposing the carrier to harmful effect of the contents of the bottle. The physical nature of Winchester bottles mostly used in chemistry laboratories for storing chemicals, makes it easier to slip out of the hand and break on the floor, if the thickness of the glass is not sufficient to bear the weight of the content. Chlad and Hardy (2006), pointed out that Winchester bottles are one of the major causes of physical accidents in the chemistry laboratory. They suggested that Winchester bottles should be kept on the lower shelves or on the floor in the laboratory store room, so as to avoid accidents in moving and retrieving them.

Other Dangerous Chemicals:- These are known to be harmful to health especially after many years of exposure to them. Ketz (2004), maintained that many substances kept in the chemistry laboratories are known to cause cancer to human beings many years after exposure to them. He mentioned such chemicals as naphthalene-2-amine which can cause tumour of the bladder, chromates, nitronaphthalene, nitoamine, asbestors, chloroethane, etc.

Effective Safety Precautions in Chemistry Laboratories

Most accidents that occur in chemistry laboratories can be avoided. This is because most of these accidents are due to ignorance or carelessness. According to Baurerle (2008), proper enlightenment of the nature and dangers associated with laboratory materials and strict adherence to the rules and regulations governing the use of the laboratories will help in minimizing, if not total eradication of the accidents. Other precautionary measures include:

Use of Fume Cupboard:- Chlad and Hardy (2006), stated that chemical reactions or processes which produce harmful gases or vapour are best carried out in fume cupboard. Chemicals such as benzene, phenylamine, and other liquids that are toxic which can be used in any chemical experiment must be used inside a fume cupboard. The fume cupboard should be cleaned regularly. It must be covered with the safety glass not ordinary glass. All explosive reactions are better carried out in the fume cupboard. The fume cupboard should not be used for storage purposes.

Laboratory Rules and Regulations:- Proper and careful adherence to laboratory rules and regulations is another effective precautionary measure. According to Bremmer (2001), students and teachers should avoid touching or stopping the centrifuge machine while in

motion. Cracked and damaged test tubes should not be used for experiments. Safety goggles or screens should be worn in case of explosions. When using strong acids, alkalis, and other dangerous substances, hand gloves should be worn. He concluded that the wearing of rubber gloves for long period of time must be avoided, as this will cause a serious infection to the skin.

Proper Storage of Poisonous and Dangerous Chemicals

The contents of poisonous and dangerous containers must be checked regularly. Experiment involving poisonous and dangerous substances should not be carried out in an open bench. High volatile chemical with low threshold limit value should not be heated in an open laboratory. Dangerous substances, for laboratory experiments such as cyanides must be kept under control in a locked cupboard.

Labelling of Chemical Containers:- Explosive, poisons and other dangerous chemicals have to be labeled. Labeling of containers helps the users of laboratories to know the type of substances in such containers. It also allows the users to know how dangerous the content of the container is. If the bottles and other containers are not properly labeled, accidents may likely occur.

Conclusion

Although we encounter a lot of accidents in the laboratory, effective safety precautions are what we need to overcome some of them. All laboratory users must therefore adhere to the rules and regulations governing the use of the laboratories. We must be careful in handling both chemicals and equipment in the laboratories.

Finally, all chemistry teachers must do their best to make sure that their chemistry laboratories are very safe for teaching and learning.

Recommendations

Most Nigerian schools lack a lot of safety precautionary instruments in their laboratories. It is based on this short coming that the following recommendations are made:

- Proper labelling of chemicals should be done in order to avoid the wrong use of chemicals during experiments.
- Poisonous and dangerous chemicals should be properly covered. Any spill on the bench, table of floor should be cleaned immediately.
- Students should be warned not to eat or taste anything in the laboratory, unless when asked to do so.
- Bulk supplies of flammable liquids should be kept in a solvent store away from the main building.

Finally, every chemistry teachers should make out adequate time to teach the students laboratory apparatus, their uses, accidents, causes of accidents in the laboratory, and effective safety precautions in the laboratory.

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