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Environmental Chemistry

Safety in the Chemistry Laboratory

University of Banja Luka, Banja Luka, Bosnia and Hercegovina

Banja Luka, August 25–29,

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Summer school for students in Bosnia and Herzegovina focused on environmental chemistry

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WP4: CHEMISTRY GAMES FOR STUDENTS

Activity: Summer school for students in in Bosnia and Herzegovina focused on environmental chemistry

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RULES OF WORK AND SAFETY IN THE CHEMISTRY LABORATORY

Safety in the Chemistry Laboratory

Working in a chemistry laboratory involves performing chemical reactions and operations using chemicals that can be toxic, corrosive, and often flammable or explosive, while experiments are mostly conducted using glassware and laboratory equipment. Because of this, there is a constant risk of poisoning, fire, explosions, and other serious injuries, which can be significantly reduced if safety measures and laboratory behavior rules are known and applied. Below are the most important rules for working in an organic chemistry laboratory, and it is mandatory for everyone present to strictly follow them:

- Wearing a laboratory coat is mandatory, and when required, protective gloves and safety goggles must also be used.
- Before starting work, you must inform the assistant or another responsible person about any chemical allergies or other health problems.
- Eating, drinking, and smoking in the laboratory are strictly prohibited.
- Working alone in the laboratory is strictly forbidden.
- Before starting work, check and prepare your workspace. Electrical and water installations must be at a safe distance, and all flammable substances and unnecessary items must be removed to their designated places.
- Check the cleanliness and integrity of all glassware and equipment before starting work. Contamination may lead to unwanted reactions, and cracked glassware may break when heated.
- Experiments involving toxic and flammable substances must be conducted in a fume hood with proper ventilation. Used glassware must first be rinsed in the fume hood.
- Always follow the experimental instructions, and any modifications of procedures are forbidden without consulting the responsible person.
- Leaving the laboratory during experiments is prohibited.
- You must remain present by your apparatus.
- Before leaving the laboratory, restore the workplace to its original condition.
- Leaving electric devices or lit burners unattended is strictly forbidden.
- In case of an incident, immediately notify the assistant or another responsible person.

Handling Chemicals

- Smelling chemicals and mouth pipetting are forbidden. Always use a mechanical or bulb pipette.
- Use only chemicals from properly labeled containers or reagent bottles. Always use clean utensils to take chemicals.
- Do not measure different chemicals with the same pipette or container. Never lift bottles by the stopper.
- Chemicals that have been poured out must never be returned to the reagent bottles.
- After measuring a chemical, tightly close the reagent bottle and return it to its proper place.
- In case of chemical spills, neutralize and remove them immediately. Consult laboratory staff on the proper removal procedure.
- Before starting work, familiarize yourself in detail with the properties of the chemicals you are using.
- Some chemicals require special precautions. Original packaging always contains warning labels represented by internationally recognized symbols.

Disposal of Chemical Waste

Used organic solvents must never be poured into the sewage system, as they are usually immiscible with water and highly flammable. After use, solvents are collected in designated containers. Waste solvents are destroyed by incineration or, if possible, recovered by distillation.

Water-soluble chemicals can be discharged into the sewage system under certain conditions. Acidic and basic solutions require proper neutralization before disposal.

Solid chemical waste must also be collected in designated containers. Certain toxic chemicals can be decomposed using oxidizing agents.

First Aid

Injuries that may occur in a chemistry laboratory can be classified as mechanical, thermal, electrical, or chemical. This section provides basic instructions for responding to such injuries. First aid must be provided immediately, and then a physician should be consulted.

Mechanical injuries most commonly occur when handling glassware and usually involve cuts with bleeding. The wound should be disinfected with an aqueous ethanol solution or iodine tincture. For deeper cuts, rinse thoroughly, check for glass fragments, disinfect, and cover with sterile gauze. Severe bleeding must be stopped using a pressure bandage, rubber tubing, or cloth, and the injured person should be taken to the hospital as quickly as possible.

Thermal injuries result from exposure to open flames, hot glassware, or spills of hot water, oil, or boiling solutions. If the burn area is covered with clothing, do not remove it; carefully cut it away with sterile scissors. Clean the burn with diluted alcohol, then apply petroleum jelly, burn cream, linseed, or olive oil. Pain can be relieved with cold compresses. Third- and fourth-degree burns require immediate transport to a hospital.

Electrical injuries occur from electric shocks and may cause muscle stiffness, cardiac, or respiratory arrest. First, turn off the electrical source. The person giving first aid must be insulated. Keep the injured person warm and hydrated, and apply artificial respiration if necessary.

Chemical injuries:

Acid burns: Rinse immediately with plenty of cold water, then apply a saturated aqueous $NaHCO_3$ solution. Rinse afterward with diluted alcohol or 3% $KMnO_4$ solution. For HNO_3 burns, saturated picric acid solution can be used. For H_2SO_4 burns, rinse with water, then dilute NaOH solution. For HF burns, rinse with water and apply a paste of glycerol and MgO. For eye contact, rinse thoroughly with water, then with 3% $NaHCO_3$ solution, and afterward instill a few drops of 2% ethyl p-aminobenzoate in olive oil.

Base burns: Treat as for acids, but instead of $NaHCO_3$ use an H_3BO_3 solution.

Organic solvent spills: First rinse with a solvent in which the compound is miscible (usually ethanol or acetone), then wash with soap and water, and apply burn cream. Never use chlorinated or highly toxic solvents for washing.

Inhalation or ingestion of chemicals: Immediately take the victim out to fresh air, and induce vomiting if possible.

Fire Extinguishing Procedures and Equipment

In the event of a fire, all individuals not participating in firefighting must leave the laboratory.
Immediately switch off all gas and electrical lines, and remove all flammable substances as far as possible from the fire source.
Water must not be used to extinguish fires caused by organic solvents or oils.
Small fires can be extinguished by covering them with a cloth or sand.
Large fires are extinguished using a CO_2 fire extinguisher, which must be kept in a visible and easily accessible place in the laboratory.
If clothing catches fire, cover the person with a cloth or douse them with plenty of water. If no such means are available, the person should roll on the floor.