

The Faculty of Medicine Mansoura University

HANDLING HAZARDOUS CHEMICALS

Introduction

Laboratory operations present special hazards that may not exist in other types of work facilities.

Be aware that all chemicals are hazardous to some degree, and protect yourself from accidental skin, eye, and respiratory contacts.

Know the hazards of materials you are working with. MSDS is an important source of information.

مقدمه

تمثل العمليات المختبرية مخاطر خاصة قد لا توجد في أنواع أخرى من مرافق العمل. اعلم أن جميع المواد الكيميائية خطرة إلى حد ما ، واحمي نفسك من ملامسات الجلد والعين والجهاز التنفسي العرضي. تعرف على مخاطر المواد التي تعمل بها. MSDS هي مصدر مهم للمعلومات.

Chemical Hygiene

Hazard Categories



- Reactives
- Peroxide Formers
- Corrosives
- Flammables & Combustibles
- Compressed Gases
- Cryogenics
- Toxics

Many chemicals fit into more than one category

تنظيف الكيماويات

مستويات الخطر

مواد متفاعله

مركبات فوق أكسيد

مواد تسبب تآكل

مواد قابله للاشتعال

مواد مسرطنه

مواد سامه

Properties of Hazardous Chemicals

Flammability:

Is a measure of how easily a gas, liquid, or solid will ignite.

Flash Point

Volatility: measured by the boiling point of the material. (VP = Atm. Pressure.)

Example of Flammable Chemicals: Acetone – Ethyl Ether – Ethyl Alcohol

خواص المواد الكيميائية الخطره

القابلية للاشتعال:

هو مقياس لمدى سهولة اشتعال الغاز أو السائل أو الصلب.

نقطة الوميض

التقلبات: تقاس بنقطة غليان المادة. (= VP ضغط أجهزة الضغط)

مثال على مواد كيميائية قابلة للاشتعال: أسيتون - إيثيل إيثر - كحول إيثيل

Chemical Hygiene - Flammables



Flammable and combustible chemicals found in laboratories are capable of causing explosion and fire.

Keep combustible materials and sources of ignition away from flammable and combustible chemicals.

Some examples are xylene, ethyl ether, and acetone.

Storage

Never near acids

Storage area cool – adequate ventilation

Avoid storage in conventional refrigerators. Ex-proof ref. is ok

Spill clean up materials – fire fighting materials.

No-smoking

Classified into categories based on the F. P. (Class 1A , 1B, 1C, II and III)

التخزين

لا تضعها أبدا بالقرب من الأحماض

منطقة التخزين باردة

تهوية كافية

تجنب التخزين في الثلجات التقليدية.

تنظيف الانسكاب –

مواد مكافحة الحرائق.

ممنوع التدخين

تصنيف المواد القابلة للاشتعال الى فئات على أساس فلاش بوينت)

الفئة 1 A ، 1B ، 1C ، او III

Handling

Gloves and Safety goggles.

Dispensing under fume hood or in approved storage room (ventilation).

Elimination of all ignition sources.

Proper grounding when transferring.

Open flames or hot plates should not be used to directly heat flammable liquids.

Do not use water to clean up spills.

Do not dispose of to sink or drain.

المناولة والتداول والنقل

القفازات ونظارات السلامة

.التوزيع تحت غطاء الدخان أو في غرفة التخزين المعتمدة (التهوية)

.القضاء على جميع مصادر الاشتعال

.التأريض المناسب عند النقل

.لا ينبغي استخدام اللمب المكشوف أو الألواح الساخنة لتسخين السوائل القابلة للاشتعال مباشرة

.لا تستخدم الماء لتنظيف الانسكابات

.لا تتخلص منه في الحوض أو التصريف.



B - Corrosive

Corrosive chemicals can burn, irritate, or destructively attack living tissue.

When inhaled or ingested, lung and stomach tissue are affected.

Can be either Acidic (low pH) or basic (high pH).

Examples: Sulfuric Acid, Hydrochloric Acid, Nitric Acid, Sodium Hydroxide, Ammonium Hydroxide).



ب- مادة مسببة للتآكل

المواد الكيميائية المسببة للتآكل يمكن أن تحرق ، أو تهيج ، أو تهاجم بقايا الحيوانات بشكل مدمر

. عند الاستنشاق أو الابتلاع ، تتأثر أنسجة الرئة والمعدة

. يمكن أن تكون إما حمضية (درجة حموضة منخفضة) أو قاعدية (درجة حموضة عالية)

. أمثلة: حمض الكبريتيك ، حمض الهيدروكلوريك ، حمض النيتريك ، هيدروكسيد الصوديوم ، هيدروكسيد الأمونيوم).

Chemical Hygiene - Corrosives



Corrosive chemicals react with metals, plastics, and living tissues. They burn skin and, if inhaled, can burn the nose, throat and lungs.

Included in this group are acids if the pH is <3 , bases if the pH is >12 , dehydrating agents, non-metal halides, halogens, strong oxidizers, and reducing agents.

Corrosives - Personal Protection



Wear chemical eye protection, chemical-resistant gloves, and a lab coat.

If splashing may occur, wear splash goggles, a face shield, and a chemical-resistant apron.

Corrosives - Acids



Contact injuries from acids range from irritation to tissue disruption.

Adding water to highly concentrated acid can result in a violent exothermic reaction that may result in serious injury.

Store acids and bases separately – accidental combination could generate a huge amount of heat and energy, possibly resulting in an explosion.

Corrosives - General Guidelines



- Label storage cabinets with the words ***"CORROSIVE & DANGER."***
- Store corrosives in secondary containers in well-vented areas away from incompatible chemicals.
- Keep from heat sources to avoid producing fumes. Direct contact with fumes is hazardous.
- Promptly neutralize (pH 6-8) any spilled material.

Storage

Segregate acids from bases.

Segregate corrosive materials from both organic and flammable materials.

Store near the floor.

Store in cool, dry, and well ventilated areas. Away from sunlight.

Handling

PPE: Apron, rubber gloves, and goggle, face shield.

Handled in fume hoods.

**Always add acids to water
never water to acids.**

**Transported in unbreakable
containers.**



C- Reactivity

1. Explosives.
2. Oxidizers
3. Peroxides



Reactives

Reactive Chemicals

can produce a broad range of reactions which can cause hazardous conditions.



For example:

Benzoyl Peroxide

Sodium Amide, 95%

Sodium Hydride

Such chemicals may:

- React with water or air to form hazardous gases
- Spontaneously combust in air
- Explode if they dry out or come in contact with metals
- Give off hazardous gases during a fire

Reactives - Unstable Chemicals

Unstable chemicals readily undergo violent change without detonating.



Pyrophorics ignite on contact with air. Use and store in inert environments. Example - phosphorus.

Polymerizables can undergo a violent reaction with itself to form polymers. Example - divinyl benzene.

Oxidizers can initiate or aid combustion in other materials. Keep away from organic materials, flammable materials and reducers. Example - nitric acid and chlorine.

Reactives - Water-reactive Chemicals

Such chemical react violently with water or moist air and generate corrosive gases.



- Keep away from moisture and water.
- Wear protective clothing, gloves, and face shield.
- Use in a fume hood.
- Examples - sulfuric acid and phosphorus halides.

Reactives - Water-reactive Chemicals

Some chemical form flammable gases if mixed with water.



- Keep away from moisture and water.
- Provide ventilation to disperse flammable gases.
- Alkaline metals and alkaline metal hydrides are examples.

Reactives - Water-reactive Chemicals

Some chemical react with water to produce gases that are acutely toxic to human health.



- **Keep away from moisture!!**
- **Do not use water to fight fire.**
- Use only with adequate ventilation.
- Keep containers tightly sealed.
- Alkaline metal phosphides and phosphorus halides are examples.

Reactives - Cyanides & Sulfides

Cyanides and sulfides are acutely toxic to human health.

- **Do not store with acids and oxidizers!**
- **Keep sulfide salts from contact with moisture and other reactive chemicals.**
- Use only in well-ventilated areas - these chemicals are severe inhalation hazards.
- Prevent skin contact.
- Metal cyanide salts, organic cyanide compounds, mercaptans, metal sulfide salts and organic sulfides are examples.



Explosives

Chemicals that cause a sudden, almost instantaneous release of large or small amounts of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Examples: Acetylene, Hydrogen, Ammonia, Nitrogen containing compounds, Halogens, Perchlorates.

Storage & Handling

Avoid mixing flammable chemicals with oxidants.

Avoid flammable gas leaks.

Avoid explosive peroxide decomposition products from building up in solvent containers during storage.

Avoid distilling ether unless free from peroxides.

Oxidizers

Chemicals provide oxygen.

Can explode violently when shocked or heated because they possess varying degrees of chemical instability.

Explosively unpredictable, represent a particularly hazardous safety threat.

Examples: Peroxides, Hyperperoxides, Peroxyesters.

**Can react violently when in contact with organics.
(nitric acid, chromic acid, and permanganates.**

Peroxides

They can react with oxygen from the air, forming unstable peroxides.

Can occur under conditions of normal storage.

The accumulated peroxides can then violently explode when exposed to shock, friction, or heat.

Examples: Aldehydes, ketones, ethers,

Chemical Hygiene -Peroxide Formers

Peroxide formers react with oxygen to form peroxides.

Peroxides can be dangerous because subjecting them to heat, impact or shock can cause them to explode.

Special attention should be paid to expiration dates. Use peroxide inhibitors and test for peroxide formation before use.



Peroxide Formers

- Some materials form peroxides without the container being opened. Maximum storage time is 3 months.
- Some materials form peroxides during distillation or evaporation.
- Common examples are THF and ethyl ether. Test these for peroxide formation before use and dispose of after one year.
- Some materials can form peroxide polymers.



Storage and Handling

Discard opened containers of peroxidizable compounds after one month.

Discard unopened containers after 12 months.

Order ether in small quantities.

Include the date of purchase on containers.

Keep away from heat, light, and ignition sources.

Continue

Before opening glass bottles, look for the presence of solid crystals or viscous liquid at the bottom of the glass.

Avoid friction, grinding, and all forms of impact while working with oxidizers.

Avoid mixing oxidizing agents with other chemicals during disposal procedures.

Detect the presence of peroxides using the special stripes.

D- Toxicity

Ability of a substance to cause damage to living tissue, impairment of the central nervous system, severe illness, death when ingested inhaled, or absorbed through the skin.

LD50 – LC50

Inhalation: TLV's (TWA OR STEL)

Absorption: Skin notation.

Acute – Chronic

Chemical Hygiene - Toxic Chemicals



To understand the harmful effects of exposure to some chemicals, a brief discussion of the basic principles of toxicology, the science of poisons, follow.

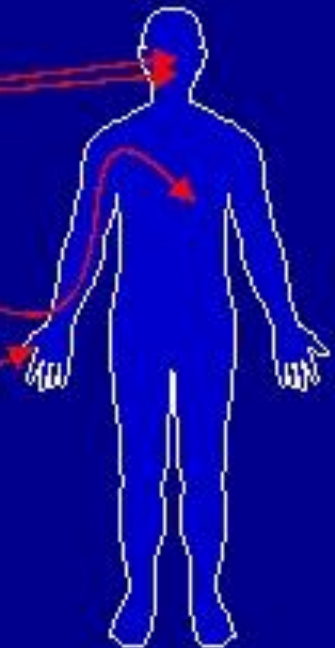
Toxicologists investigate poisons and study how they enter the human body, what happens to them once they enter the body, and what effect they have on the body.

Toxic Chemicals

Once an individual is exposed to a chemical, a variety of events may occur.

 **Chemical enters bloodstream** by absorption, inhalation, or ingestion. The chemical may then produce toxic effects involving various parts of the body.

 **Chemical does not enter the body** but there is a local effect at the site of contact.



Toxic Chemicals

Dose

Any chemical is toxic at a high enough dose.

The dose needed to cause a harmful effect decreases as the toxicity increases.

Approximate Human Lethal Dose (50%) for Various Chemicals

Chemical	160 lb. Individual
Sugar	4.5 pounds
Salt	0.5 pounds
Arsenic	1-2 teaspoons
Cyanide Salts	½ teaspoon
Dioxin	speck

As Paracelsus said in 1567, it's the dose that makes the poison.

Toxic Chemicals

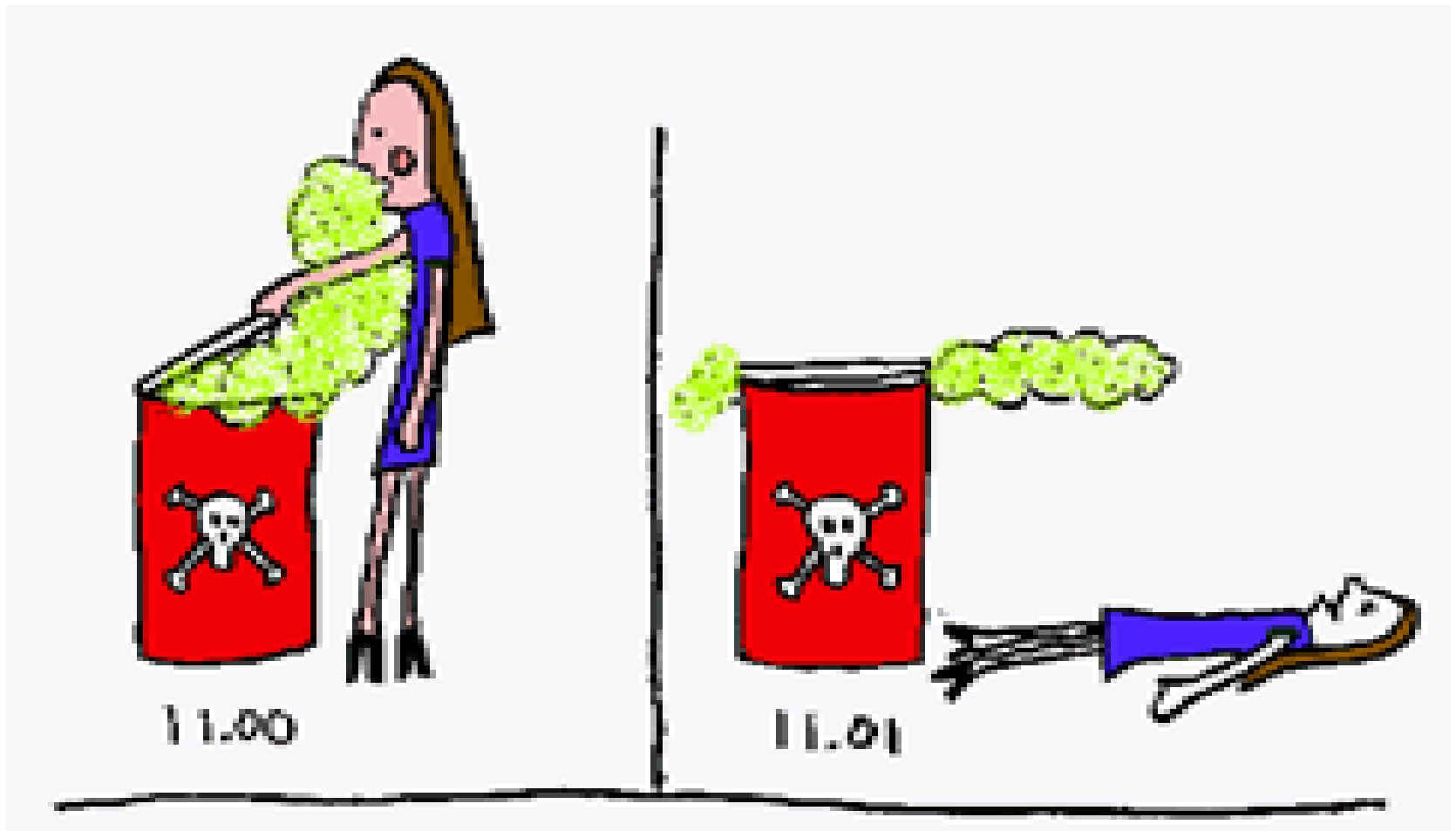
Highly toxic chemicals have -

Oral LD50 \leq 50 mg Skin LD50 \leq 200 mg LC50 \leq 200 ppm

PROBABLE ORAL LETHAL DOSE (Human)

Toxicity Rating	Dose	For a 70-kg (154 lb.) Person
Extremely Toxic	<5 mg/kg	<0.35 grams
Highly Toxic	5-50 mg/kg	0.35 to 3.5 grams
Moderately Toxic	50-500 mg/kg	3.5 to 35 grams
Slightly Toxic	0.5-5 gm/kg	35 to 350 grams
Practically Non-Toxic	Above 5 gm/kg	>350 grams

Acute Toxicity



E- Poisons

A poisons compound is a substance that causes death or serious injury in the event that relatively small amount are inhaled, ingested, or have contacted the skin.

Storage and Handling

Treat with extreme caution. Wear lab coats, gloves, and safety glasses and work in a well ventilated fume hoods.

Wash hands frequently.





Do not keep too much
chemicals

Return excessive chemicals
to CLS

PT



Label and close the chemical containers properly



A rusty surface indicates containers are not closed properly

PT

Flammable storage



Store chemicals in:

Acid/corrosive
storage cabinet



Under fume hood
cabinet



Do not store solvents/corrosives high on shelves

PT



Use secondary containment to transport or store large volume of flammables/ corrosives

PT



Conduct work capable of causing an explosion behind protective shields

PT

Few tips for overnight & unattended operation:

Provide control to prevent the release of hazardous substance in the event of interruption in utility services such as electricity, cooling water, & gas

Leave the lab light on

Post signs to identify nature of experiment & hazardous in use



Flammable storage refrigerator



Explosion proof refrigerator

Store flammable chemicals in flammable storage cabinet or explosion-proof/flammable storage refrigerator

A photograph of a laboratory aisle. On a metal cart, there are several large metal drums (one silver, one red), a red plastic bin, and other containers. On a shelf above, there are glass beakers and bottles. The text "Do not store flammable chemicals along path of egress or in aisle" is overlaid in red. The letters "PT" are in the bottom right corner.

Do not store flammable chemicals
along path of egress or in aisle

PT

Cat. 5/Cl. 1/Div. 2

Test for peroxides regularly

Tetrahydrofuran

Fisher
ChemAlert®
Guide

UV Cutoff 210nm

WARNING: MAY FORM EXPLOSIVE PEROXIDES. BUILDUP CAN CREATE A SAFETY HAZARD. STORE IN A COOL DARK PLACE AT ALL TIMES. HARMFUL IF SWALLOWED. IRRITATION OF EYES, SKIN OR MUCOUS MEMBRANES. CAUSES IRRITATION OF THE RESPIRATORY SYSTEM. DEPRESSANT. MAY BE HARMFUL IF SWALLOWED.

THIS CHEMICAL HAS A LIMITED SHELF LIFE

Received on Veronica Opened on 28 Nov 1997

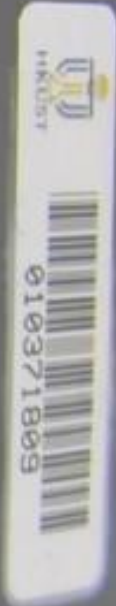
PEROXIDE TEST RECORD

Test Date: <u>28 Nov 97</u>	Peroxide: <u>Y/N</u>	By: <u>Veronica</u>
Test Date: <u>3-12-98</u>	Peroxide: <u>Y/N</u>	By: <u>K. SEE TO</u>
Test Date: <u>12-5-99</u>	Peroxide: <u>N</u>	By: <u>K. SEE TO</u>

SAFETY CODE



NFPA
CODE



Scientific

R

STORAGE
CODE
RED

PT

Glove box

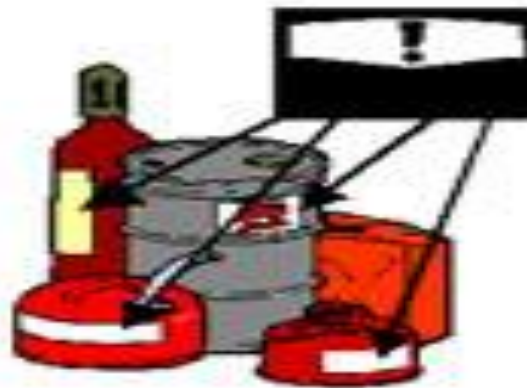


Fume hood



Handle toxic chemicals, carcinogens, alkaline metals & hydrides, etc. in designated work areas PT

HEALTH	*	2
FLAMMABILITY		3
REACTIVITY		0
PERSONAL PROTECTION		H





Chemical Spill?
934-2487
5 pm to 8 am & weekends
934-3411
<http://www.healthsafe.usb.edu>

