SOP No. 002/SF ITB/2015

PANDUAN KESELAMATAN KERJA
DI LABORATORIUM KIMIA
SEKOLAH FARMASI
INSTITUT TEKNOLOGI BANDUNG

SAFETY GUIDANCE
IN CHEMISTRY LABORATORIES
SCHOOL OF PHARMACY
BANDUNG INSTITUTE OF TECHNOLOGY
(Update Version 04.02.2015)

Sekolah Farmasi
INSTITUT TEKNOLOGI BANDUNG
2015

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SAFETY GUIDANCE IN CHEMISTRY LABORATORIES SCHOOL OF PHARMACY BANDUNG INSTITUTE OF TECHNOLOGY (Update Version 04.02.2015)

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Safety Awareness

Safety matters in the chemist's professional work are regulated by numerous laws, ordinances, directives and guidelines. However, **safety awareness is based on solid professional knowledge** and hence can and must be learned and acquired just like any other professional knowledge.

The Facts

- **85% of workplace accidents** in laboratories and production plants were by **human errors.**
- Ignorance of safety-relevant properties of substances or lack of insight into the type of reactions performed often plays a role in this.
- **Habituation is contradictive to consciously safe work**: Persons who have long-term experience tend to neglect safety precautions and lost the initial respect for a potentially hazardous method.
- Consequently and regularly attend all safety briefings offered is the best prevention.

Important goal of academic training of chemists/pharmacist:

- be proficient in safe and secure handling of chemicals
- be able to protect both themselves and their colleagues and employees from dangers,
- act responsibly towards the environment and the general public,
- identify possible dangers in the use of chemical products by consumers and prevent these dangers by providing proper instructions.

Important Conduct and Behavior in Laboratory

1. Clothes in Laboratory

Put on / wear:

- **Goggle**
- **Overall (Lab. Coat)** made of cotton, **no Polyester fiber**, in the case of fire, the fiber will melt down and cause serious injury (The best way: complete clothes are made of cotton)
- Closed and protecting **work shoe**
- **Glove**, especially if working with dangerous chemicals
- **No contact lens**, esp. soft contact lens. Inclusion of solvents could cause serious eye damages
- **No short trousers**
- **But:** The lab coat must not be worn outside the lab (lecture rooms, libraries, cafeterias etc.)

Figure 1. Wearing lab. coat prior lab. works and removing lab. coat when finish with lab. works

2. Behaviour / Conduct in Laboratory

- Leave bag and jacket in locker
- Do not touch **grip** or **switch** with glove
- Keep emergency exit clear
- Before leave the laboratory, thoroughly wash the hands
- No eating, drinking or smoking
- Hold/touch **grip** or **switch** only **without glove**

Figure 2.

Figure 3.

Figure 2 and 3. Holding grips and touching switches only without glove

Note:

- ✓ Following completion of the lab work, the hands should be washed thoroughly with water and detergents gentle on the skin.
- ✓ For hands came into contact with chemicals or washed frequently, regeneration-promoting skin cream is suggested.
- ✓ Due to danger of contamination, food and drink may **be neither stored nor consumed** in Lab.
- ✓ **Food and drink** must **not be stored** in lab vessels or chemicals containers.
- ✓ **Neither** may **chemicals be stored** in vessels usually used **for holding food and drink.**
- ✓ **Smoking is not permitted in a laboratory.**

3. Transfer of Chemicals

- Work in a fume hood (Hazardous Chemical)
- Pouring out / Decanting of liquid
  - ✓ Keep Etiquette position in upside position so that can always be clearly red. This ensures also that adhering drops cannot damage the label when running down the outside of the bottle.
  - ✓ Do not put Stopper with under side on work surface
  - ✓ The adherent drop can be removed with the stopper of the bottle after decanting
  - ✓ Use funnel

- Do not transfer or store Flammable substances near thermal sources or electronic instruments
- Do not put low boiling substances under direct sunlight
- Take Solid substances with spatula or spoon, if the quantity is large, use powder funnel

Attention! When Pouring out / Decanting of Chemicals

- Any decanting of chemicals may cause danger of:
  - ✓ Spilling, also upon skin and clothing
  - ✓ Inhalation of vapours or dusts
  - ✓ Formation of ignitable mixtures.

Figure 4

Figure 5.

Figure 6.

Figure 7

Figure 8.

Figure 4 to 8 Show illustrations of correct method when pouring safe (non-toxic) liquid

- Due to possible change/degradation under the influence of light, the substances must be stored in opaque containers
- Especially in the case of radical/peroxide forming substances

4. Working under low Pressure

- When distilling (with Rotary Evaporator or Apparatus) solvents, sucking away precipitate, or drying substances, make sure that:

  ✓ Equipment and glass must be in flawless condition. **Never** use flask **with crack**, implosion danger!
  ✓ work with greased “Schliffen”
  ✓ use **only round vessel**, exception: suck flask (no high vacuum), Exsiccator (should be coated with adhesive plastic)
  ✓ the apparatus is coated with adhesive plastic

Figure 9. Use only round flask when working/evaporating liquid with vacuum

Figure 10.

Figure 11.

Figure 10. and 11. Vacuum glass apparatus covered with plastic

5. Transport of Chemicals

When transporting the chemicals, make sure that:

- Transport only in plastic bucket or equivalent holder/container
- Do not bring bottles/flask by holding them in the neck or top
- Never use food bottles/container
- Put on laboratory coat/overall
- Stick correct etiquette with adhesive film
- Get information on chemicals (toxicity, disposal, physicochemical properties)

Figure 12.

Figure 13.

Figure 14.

Figure 12 to 14. Show illustration of correct method to transport chemical

6. Dangerous substances or dangerous preparations

They shall be understood to mean substances or preparations which are deemed to be:

- explosive,
- oxidising,
- extremely flammable,
- highly flammable,
- flammable,
- very toxic,
- toxic,
- harmful to health,
- corrosive,
- irritant,
- sensitising,
- carcinogenic,
- toxic for reproduction,
- mutagenic or

- hazardous to the environment, excluding the hazardous properties of ionising rays.

- **Physico-chemical properties:**

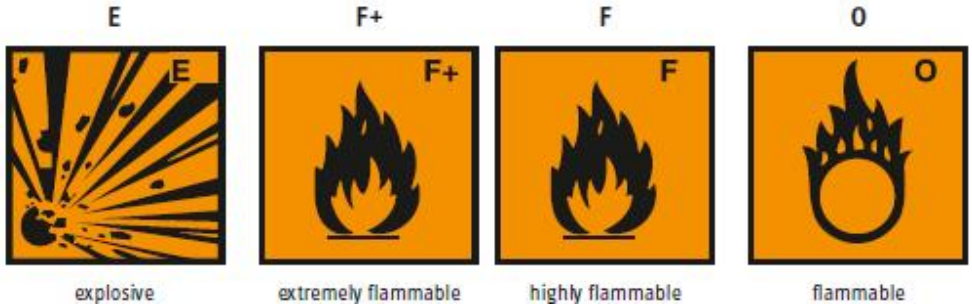

Figure 15. Symbols of hazards due to physico-chemical properties

- **Toxic properties :**

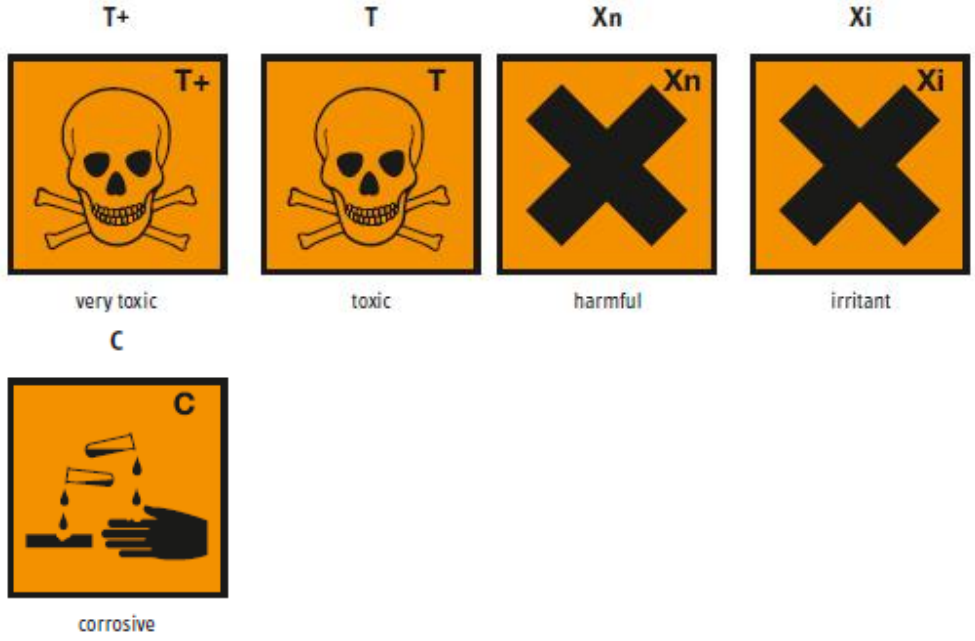

Figure 16. Symbols of hazards due to toxic properties

- **Environmental Toxicity:**

Figure 17. Symbols of hazards due to environmental toxicities

Criteria of Very Toxic Substances:

- LD50 oral, rat: ≤ 25 mg/kg
- LD50 dermal, rat or rabbit: ≤ 50 mg/kg
- LC50 inhalative, rat, for aerosols/dusts: ≤ 0.25 mg/l
- LC50 inhalative, rat, for gases/vapours: ≤ 0.50 mg/l
- Examples include: Hydrogen sulphide, hydrogen cyanide, dimethyl sulphate, phosgene, nitrobenzene and acrolein.

Criteria of Toxic Substances:

- LD50 oral, rat: 25< LD50 ≤ 200 mg/kg
- LD50 dermal, rat or rabbit: 50 < LD50 ≤ 400 mg/kg
- LC50 inhalative, rat, for aerosols/dusts: 0.25< LC50 ≤ 1 mg/l
- LC50 inhalative, rat, for gases/vapours: 0.50< LC50 ≤ 2 mg/l
- Examples include: carbon disulphide, methanol, acetonitrile, benzene, phenol, carbon tetrachloride and chlorine.

Criteria of Harmful Substances:

- LD50 oral, rat:< LD50 ≤ 2000 mg/kg
- LD50 dermal, rat or rabbit: 400 < LD50 ≤ 2000 mg/kg
- LC50 inhalative, rat, for aerosols/dusts: 1 < LC50 ≤ 5 mg/l
- LC50 inhalative, rat, for gases/vapours: 2 < LC50 ≤ 20 mg/l
- Examples include: toluene, xylene, pyridine, n-hexane, nitromethane, chloroform and iodine.

7. R and S Phrases (Indicators of Special Dangers and Safety advices)

Source: **Safety in University Chemistry Courses,** An Introduction for Students, Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin, 2009, pp. 124 - 130

Indicators of special dangers (R phrases)

R1 Explosive when dry
R2 Risk of explosion by shock, friction, fire or other sources of ignition
R3 Extreme risk of explosion by shock, friction, fire or other sources of ignition
R4 Forms very sensitive explosive metallic compounds
R5 Heating may cause an explosion
R6 Explosive with or without contact with air
R7 May cause fire
R8 Contact with combustible material may cause fire
R9 Explosive when mixed with combustible material
R10 Flammable
R11 Highly flammable
R12 Extremely flammable
R14 Reacts violently with water
R15 Contact with water liberates extremely flammable gases
R16 Explosive when mixed with oxidizing substances
R17 Spontaneously flammable in air
R18 In use, may form flammable/explosive vapour-air mixture
R19 May form explosive peroxides
R20 Harmful by inhalation
R21 Harmful in contact with skin
R22 Harmful if swallowed
R23 Toxic by inhalation
R24 Toxic in contact with skin
R25 Toxic if swallowed
R26 Very toxic by inhalation
R27 Very toxic in contact with skin
R28 Very toxic if swallowed
R29 Contact with water liberates toxic gas.
R30 Can become highly flammable in use
R31 Contact with acids liberates toxic gas
R32 Contact with acids liberates very toxic gas
R33 Danger of cumulative effects
R34 Causes burns
R35 Causes severe burns
R36 Irritating to eyes
R37 Irritating to respiratory system
R38 Irritating to skin
R39 Danger of very serious irreversible effects

R40 Limited evidence of a carcinogenic effect
R41 Risk of serious damage to eyes
R42 May cause sensitisation by inhalation
R43 May cause sensitisation by skin contact
R44 Risk of explosion if heated under confinement
R45 May cause cancer
R46 May cause heritable genetic damage
R48 Danger of serious damage to health by prolonged exposure
R49 May cause cancer by inhalation
R50 Very toxic to aquatic organisms
R51 Toxic to aquatic organisms
R52 Harmful to aquatic organisms
R53 May cause long-term adverse effects in the aquatic environment
R54 Toxic to flora
R55 Toxic to fauna
R56 Toxic to soil organisms
R57 Toxic to bees
R58 May cause long-term adverse effects in the environment
R59 Dangerous for the ozone layer
R60 May impair fertility
R61 May cause harm to the unborn child
R62 Possible risk of impaired fertility
R63 Possible risk of harm to the unborn child
R64 May cause harm to breast-fed babies
R65 Harmful: may cause lung damage if swallowed
R66 Repeated exposure may cause skin dryness or cracking
R67 Vapours may cause drowsiness and dizziness
R68 Possible risk of irreversible effects

Combinations of R phrases
R14/15 Reacts violently with water, liberating extremely flammable gases
R15/29 Contact with water liberates toxic, extremely flammable gases
R20/21 Harmful by inhalation and in contact with skin
R20/22 Harmful by inhalation and if swallowed
R20/21/22 Harmful by inhalation, in contact with skin and if swallowed
R21/22 Harmful in contact with skin and if swallowed
R23/24 Toxic by inhalation and inn contact with skin
R23/25 Toxic by inhalation and if swallowed
R23/24/25 Toxic by inhalation, in contact with skin and if swallowed
R24/25 Toxic in contact with skin and if swallowed
R26/27 Very toxic by inhalation and in contact with skin
R26/28 Very toxic by inhalation and if swallowed
R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed
R27/28 Very toxic in contact with skin and if swallowed
R36/37 Irritating to eyes and respiratory system
R36/38 Irritating to eyes and skin

R36/37/38 Irritating to eyes, respiratory system and skin
R37/38 Irritating to respiratory system and skin
R39/23 Toxic: danger of very serious irreversible effects through inhalation
R39/24 Toxic: danger of very serious irreversible effects in contact with skin
R39/25 Toxic: danger of very serious irreversible effects if swallowed
R39/23/24 Toxic: danger of very serious irreversible effects through inhalation and in contact with skin
R39/23/25 Toxic: danger of very serious irreversible effects through inhalation and if swallowed
R39/24/25 Toxic: danger of very serious irreversible effects in contact with skin and if swallowed
R39/23/24/25 Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
R39/26 Very Toxic: danger of very serious irreversible effects through inhalation
R39/27 Very Toxic: danger of very serious irreversible effects in contact with skin
R39/28 Very Toxic: danger of very serious irreversible effects if swallowed
R39/26/27 Very Toxic: danger of very serious irreversible effects through inhalation and in contact with skin
R39/26/28 Very Toxic: danger of very serious irreversible effects through inhalation and if swallowed
R39/27/28 Very Toxic: danger of very serious irreversible effects in contact with skin and if swallowed
R39/26/27/28 Very Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
R42/43 May cause sensitization by inhalation and skin contact
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation
R48/21 Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R48/22 Harmful: danger of serious damage to health by prolonged exposure if swallowed
R48/20/21 Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/20/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/21/22 Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/20/21/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation
R48/24 Toxic: danger of serious damage to health by prolonged exposure in contact with skin
R48/25 Toxic: danger of serious damage to health by prolonged exposure if swallowed
R48/23/24 Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin

R48/23/25 Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/24/25 Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/23/24/25 Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R68/20 Harmful: possible risk of irreversible effects through inhalation
R68/21 Harmful: possible risk of irreversible effects in contact with skin
R68/22 Harmful: possible risk of irreversible effects if swallowed
R68/20/21 Harmful: possible risk of irreversible effects through inhalation and in contact with skin
R68/20/22 Harmful: possible risk of irreversible effects through inhalation and if swallowed
R68/21/22 Harmful: possible risk of irreversible effects in contact with skin and if swallowed
R68/20/21/22 Harmful possible risk of irreversible effects through inhalation, in contact with skin and if swallowed

Safety advice (S phrases)

(S1) Keep locked up
(S2) Keep out of the reach of children
S3 Keep in a cool place
S4 Keep away from living quarters
S5 Keep contents under ... (appropriate liquid to be specified by the manufacturer)
S6 Keep under ... (inert gas to be specified by the manufacturer)
S7 Keep container tightly closed
S8 Keep container dry
S9 Keep container in a well-ventilated place
S12 Do not keep the container sealed
S13 Keep away from food, drink and animal foodstuffs
S14 Keep away from ... (incompatible materials to be indicated by the manufacturer)
S15 Keep away from heat
S16 Keep away from sources of ignition – No smoking
S17 Keep away from combustible material
S18 Handle and open container with care
S20 When using do not eat or drink
S21 When using do not smoke
S22 Do not breathe dust

S23 Do not breathe gas/fumes/vapour/ spray (appropriate wording to be specified by the manufacturer)
S24 Avoid contact with skin
S25 Avoid contact with eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S27 Take off immediately all contaminated clothing
S28 After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer)
S29 Do not empty into drains
S30 Never add water to this product
S33 Take precautionary measures against static discharges
S35 This material and its container must be disposed of in a safe way
S36 Wear suitable protective clothing
S37 Wear suitable gloves
S38 In case of insufficient ventilation wear suitable respiratory equipment
S39 Wear eye/face protection
S40 To clean the floor and all objects contaminated by this material use (to be specified by the manufacturer)
S41 In case of fire and/or explosion do not breathe fumes
S42 During fumigation/spraying wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer)
S43 In case of fire use ... (indicate in the space the precise type of fire-fighting equipment. If water increases the risk add - Never use water)
S45 In case of accident or if you feel unwell seek medical advice immediately (show the label where possible)
S46 If swallowed, seek medical advice immediately and show this container or label
S47 Keep at temperature not exceeding ... °C (to be specified by the manufacturer)
S48 Keep wet with ... (appropriate material to be specified by the manufacturer)
S49 Keep only in the original container
S50 Do not mix with ... (to be specified by the manufacturer)
S51 Use only in well-ventilated areas
S52 Not recommended for interior use on large surface areas
S53 Avoid exposure - obtain special instructions before use
S56 Dispose of this material and its container at hazardous or special waste collection point
S57 Use appropriate containment to avoid environmental contamination
S59 Refer to manufacturer/supplier for information on recovery/recycling
S60 This material and its container must be disposed of as hazardous waste
S61 Avoid release to the environment. Refer to special instructions/safety data sheet
S62 If swallowed, do not induce vomiting seek medical advice immediately and show this container or label
S63 In case of accident by inhalation: remove casualty to fresh air and keep at rest
S64 If swallowed, rinse mouth with water (only if the person is conscious)

Combinations of S phrases

(S1/2) Keep locked up and out of the reach of children
S3/7 Keep container tightly closed in a cool place
S3/7/9 Keep container tightly closed in a cool, well-ventilated place
S3/9/14 Keep in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer)
S3/9/14/49 Keep only in the original container in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer)
S3/9/49 Keep only in the original container in a cool, well-ventilated place
S3/14 Keep in a cool place away from... (incompatible materials to be indicated by the manufacturer)
S7/8 Keep container tightly closed and dry
S7/9 Keep container tightly closed and in a well-ventilated place
S7/47 Keep container tightly closed and at temperature not exceeding ... °C (to be specified by the manufacturer)
S20/21 When using do not eat, drink or smoke
S24/25 Avoid contact with skin and eyes
S27/28 After contact with skin, take off immediately all contaminated clothing, and wash immediately with plenty of ... (to be specified by the manufacturer)
S29/35 Do not empty into drains; dispose of this material and its container in a safe way
S29/56 Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point
S36/37 Wear suitable protective clothing and gloves
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection
S36/39 Wear suitable protective clothing and eye/face protection
S37/39 Wear suitable gloves and eye/ face protection
S47/49 Keep only in the original container at temperature not exceeding ... °C (to be specified by the manufacturer)

Example of R and S phrases Application: Ethyl Chloride

Directive **67/548/EC (31th amendment):**
F+; R12|Carc.Cat.3; R40|R52/53; S9-16-33-36/37-61
Informations about hazard and risk:

- **F+; R12 :highly flammable**
- **Carc.Cat.3 :carcinogenic cat. 3**
- **R40 :Irreversible damage possible**
- **R52/53 :Toxic for aquatic environment**

Information about safety suggestion:

- **S9 :Store in gut air circulated room**
- **S16 :Keep away from thermal/flame sources, no smoking**
- **S33 :Protect from electrostatic charge**
- **S36/37 :If working with these substances put on protecting overall and glove**
- **S61 :Prevent emission to the environment**

8. Extremely or Highly Flammable Liquid

Table 1. Characteristics of extremely and highly flammable liquid

Indication of danger	R phrase	Hazard symbol	Flash point	Boiling point	Example
Extremely flammable	R 12	F+	< 0 °C	≤ 35 °C	acetaldehyde
Highly flammable	R 11	F	< 21 °C	56 - 57 °C	acetone
Flammable	R 10	-	21 °C ≤ FP ≤ 55 °C	98 to 100 °C	butan-2-ol

Source: **Safety in University Chemistry Courses,** An Introduction for Students, Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin, 2009, pp. 44.

When working with **Extremely or Highly Flammable Liquid**, make sure that:

- Liquid volume max 1 l
- Keep closed the bottle
- Keep away from heat source and flame
- **Do not be stored in refrigerator/freezer!**

Note: Leakiness of bottle/container resulted in an explosive vapour-air mixture which **can be ignited by the switching spark** of the thermostat of the refrigerator/freezer, resulting in a severe explosion followed by fire and considerable damage to property.

9. Self-igniting substances

- Spontaneously ignite upon contact with air and/or water
- Another sources for laboratory fires or explosions.
- **Alkali metals and their hydrides and white phosphorus** are particularly common in lab. Practice

10. Potentially explosive substances and mixtures

- Substances or mixtures of substances reacting violently upon exposure to thermal energy (heat, flames) or mechanical energy (friction, shock) and hence release high energy and form high pressure result in very fast propagation of shock waves.
- Nitroso and nitro compounds, highly nitrated aromatic compounds (TNT, Picric Acid), esters of nitric acid (GTN)
- Compounds with N-N bonds (azo and diazo compounds, hydrazoic acid, azides)
- Fulminates (HCNO), NCl3, ICl3 and acetylides,

- Peroxidic compounds (peroxy acids, peroxy esters, peroxides, hydroperoxides).

11. Working with peroxide forming substances

Attention! When During storage comes in contact with air, ether could form explosive peroxide. This could be concentrated, e.g. by distillation. To prevent explosion, pay attention the following information:

- Store in a brown bottle, protect solvent from sun light exposure
- Always full, this to minimize contact with air
- Add KOH. KOH and peroxide form non soluble salt and hence can be separated from solvent
- Purified by Chromatography (Al-oxide), separation of peroxide
- Prior use, tested with peroxide test kit

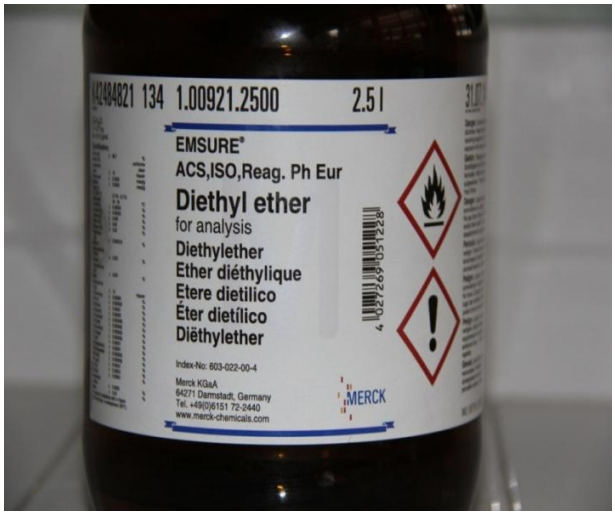

Figure 18.

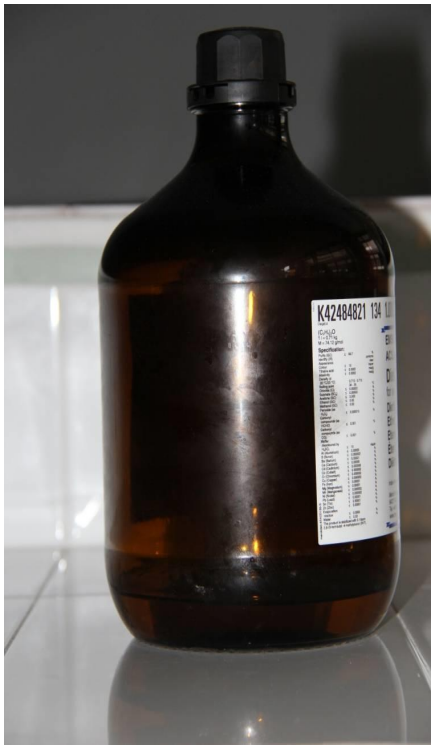

Figure 19

Figure 18 and 19 Example of solvent able to form peroxide, especially when the bottle is not full

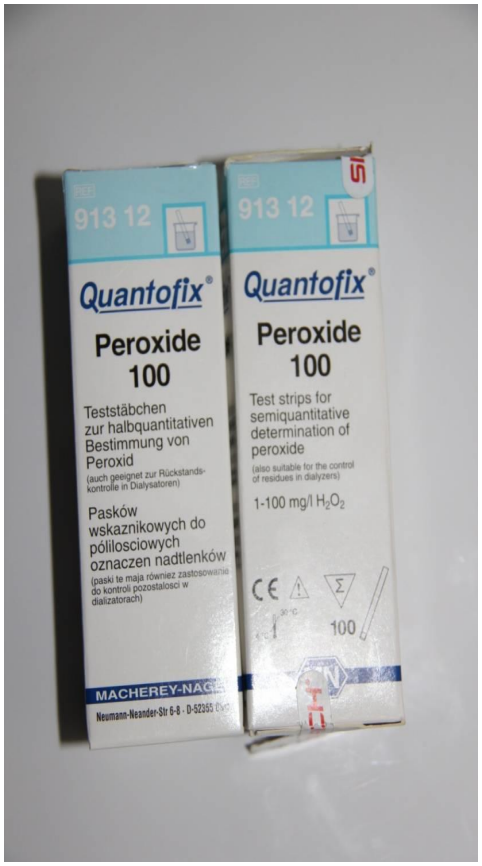

Figure 20.

Figure 21.

Figure 22

Figure 20 to 22 Detection of peroxide in solvent using peroxide kit test

Figure 23. Potassium hydroxide is suggested to be added into peroxide forming solvent when this solvent will be stored for a long time

12. Working with Carcinogenic, Mutagenic, and Reproduction toxic Substances (CMR)

When working with CMR substances, pay attention to the following information:

- If possible do not use (e.g. Benzene substituted by Toluene)
- Protection: lab. Overall and masker
- Working only on fume hood
- Do not leave the work place
- Correct disposal

13. Cleaning and Disposal

When disposing chemicals or cleaning apparatus, make sure that:

- Dispose chemicals according to SOP
- Never dispose organic substances into lab. Sink
- Calculate exactly the chemicals needed

- In the case of organic liquid: collect in a special container
- Solid substances must be collected separately
- When cleaning glassware, there is danger of contamination with more or less unknown substances, e. g. by-products of a synthesis
- Safe and expedient cleaning must be done
- Immediately clean contaminated vessels or other equipment. Do not allow residues to stand in vessels for a long time.
- When cleaning, wear protective gloves and goggles. Beware of glass breakage and injury by cutting during mechanical cleaning. Remove grease using a paper towel and PE/Acetone if required.
- Flush residual chemicals from the vessels using suitable and non-toxic solvents (e. g. acetone, ethanol). Dispose of the rinsing fluid as special waste (See SOP)
- Do not put on with solvents rinsed equipment into the drying cabinet (oven) for drying
- Aggressive/corrosive cleaning agents (e. g. concentrated nitric acid, concentrated sulphuric acid) may only be applied if other cleaning agents have been found ineffective.
- Dichromate-sulphuric acid may only be applied exceptionally. Before usage, make sure that the residual contents of the vessels cannot lead to hazardous reactions with the cleaning agent.
- Only after pre-cleaning as described, cleaning with commercially available detergents is performed.

14. Treatment prior disposal

Prior disposal, the following treatments should be carried out:

- **Strong Acid and Base, Chlorosulfonic acid:**
  - ✓ Added drop wise into excess of ice water, neutralized, dispose into sink

- **Anhydride of Carboxylic acid, Chloride of Carboxylic acid, Phosphoroxychloride, Thionylchloride, Phenylisocyanate**:
  - ✓ Added drop wise into excess of ice water or 10% NaOH, neutralized, collect in special container (B1, See SOP)

- **Alkali metals:**
  - ✓ Cut into small pieces, under stirring fed into a
  - ✓ suitable alcohol (ethanol for sodium, isopropanol
  - ✓ for potassium) , after completely dissolved, diluted with water, disposed into special canister (B2, See SOP)

- **Thiol, Sulphide:**
  - ✓ Oxidized with excess of 15% Na-hipoklorite solution, disposed into special canister (B2, See SOP)

- **Bromine/Iodine:**
  - ✓ Neutralized/reduced with Na-Thiosulfate, disposed into lab. Sink

- **Mercury:**
  - ✓ Mercury residues (from experiments, remnants of destroyed thermometers, etc.) are collected in a special container.
  - ✓ Inaccessible small droplets of mercury are sprinkled with special adsorbent e.g. **Mercurisorb-ROTH® (Contains Ag-Nitrate and Si-dioxide)** or equivalent and processed according to instructions.

- **Peroxides:**
  - ✓ In small amount (aqueous and acidic sol.) is reduced with Fe(II), Zn(II), Sn(II) salt or bisulphite, neutralized and disposed into special canister (D or E, See SOP)

- **Dimethylsulphate**
  - ✓ Added drop wise into cold ammonia, neutralized and disposed into special canister (B2, See SOP)

- **Cyanide:**
  - ✓ Oxidized with excess of 15% Na-hypochlorite solution, disposed into special canister (B2, See SOP)

15. First Aid in case of chemical accidents

In the case of accidents, pay attention to the following conducts:

- Rescue injured or poisoned persons from the danger zone, paying attention to self-protection.
- The place for fist aid should be selected so that immediate transport off to the hospital is possible and no further helpers need to enter the danger zone.
- The First Aider must protect himself/herself if required (protective gloves, acid protection suit, respiratory protection etc.)
- Call **Emergency Department of Hospital (e.g. Borromeus or Hasan Sadikin Hospitals):** Notify emergency medical services and stated in the emergency call the following information:
  - ✓ **WHERE** has it happened?
  - ✓ **WHAT** has happened?
  - ✓ **HOW MANY** people affected/ injured?
  - ✓ **WHICH** kinds of injury?
  - ✓ **WAIT** for further enquiry!
- **Organize the transport to hospital**
  - ✓ Direct the crew of the ambulance car before the building and into it.
  - ✓ Clear transport routes for affected/injured persons.

- **Make a Report of Any Accident**
  - ✓ All accidents must be reported to the lab head.
  - ✓ Students in courses report to their assistant in charge.
  - ✓ If any persons have been injured, the lab head must immediately complete an accident report and send it to the responsible insurance provider.

- **Facilitate fresh air supply**
  - ✓ Open constraining clothing.
  - ✓ Remove contaminated clothing, **Rinse exposed skin with plenty of water (Lab. Shower)**

Figure 24. Lab shower, it should be in good condition and can work properly

- **If chemicals have got into contact with the eyes:**
  - ✓ Rinse eyes with water using an eye shower for at least 10 minutes, holding open the lid with thumb and forefinger.

Source: Emergency safety showers for industry and Laboratory, Catalog, B-Safety® Professional Safety Solution, www.b-safety.com

Figure 25. Eye shower, very useful first aid in the case of eye contamination with chemicals

Attention:

- ✓ Do not allow injured persons to cool out.
- ✓ If possible, place injured persons on stretchers or blankets and cover them.

Literature

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