

Guidelines for Disposal of Hazardous Wastes

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I. Introduction to hazardous waste disposal / treatment

Hazardous waste is dangerous which is potentially harmful to human health or the environment. Institute of Chinese Medical Sciences (ICMS) laboratory has established a management method to manage hazardous wastes. Lab users and related waste handling personnel should read this guideline to understand the control of the hazardous wastes.

II. Safety precautions in handling the hazardous waste

The following safety precautions provide important information intended to prevent personal injury to the operator and others, and property damage.

- Always wear appropriate personal protective equipment (e.g. goggles, gloves and laboratory coat) when handling hazardous waste.
- For handling the waste that-vaporizes, the person who opens the waste container should make sure good ventilation is operating. The transferring of waste to chemical waste container should be done inside a fume hood or under an elephant trunk. If there is fume hood or elephant in the waste store room, it is necessary to wear respirator (e.g. 3M 6003 filter) when pouring solvent liquid into 60L barrel.
- Always wear gloves and use a trolley to transport the hazardous waste bottles/boxes.
- A label must be attached to the items and indicate its nature for the purpose of safe collection, storage or transportation. The label should be securely attached to a suitable part of the container which allows an easy-to-read, and not obstructed or obscured by any part/fitting of the container. Any old labels on the containers should be completely removed or obliterated. These labels are available upon request from the laboratory technician office.
- The waste to be picked up should never be stored outside the laboratory as this increases the risk to personnel or the environment.
- If there is doubt on the integrity of the container, it should not be used. Consult the laboratory technician first.
- No mixing of incompatible wastes should be stored together.
- A funnel (Fig. 10, Appendix IV) should be used to avoid spillage when pouring liquid chemical into a barrel.
- It is not encouraged to put too many liquid waste containers in the fume hood. The maximum quantities of waste containers are two (2.5L each) in each fume hood.

III. Type of waste and the responsibility of the laboratory users

A. General Hazardous Waste (see step A in appendix III).

A.1 Organic Solvent Waste

The most commonly used organic solvents are listed in Appendix I. The organic solvent waste is collected in a 60L plastic barrel with a secondary container. If the organic solvent waste is not listed in Appendix I, inform and consult the laboratory technician.

On the 7 floor, the 60L labeled plastic barrel (Fig. 1, Fig. 7Appendix IV) is located at laboratory area under an elephant trunk. Make sure the elephant trunk is in operation when discarding the solvent inside. The barrel should not exceed 70%. Please stop using the 70%-filled container and inform the laboratory technician when it reaches the said limit of fullness.

On the 6 floor, the 60L labeled plastic barrel is stored at the waste room. In daily operation, users can discard the organic solvent waste into a 4L glass bottle (Fig. 2, Appendix IV) labeled organic solvent waste in the fume hood(s) located in each laboratory. The corresponding group should check the bottle regularly to avoid any spills or leaks. Users should also be aware of the limit of the bottle. When the bottle is full, please use another one and inform the laboratory technician. If the expected wastes exceeded the volume of the 4L waste bottle, prepare a bigger container which has the capacity to contain the waste in the fume hood. Then transport the waste bottle into the waste room and pour into the 60L plastic barrel located at store room. Only trained and authorized users can access the waste store room.

A.2 Organic Solvent and Solid Waste Mixture

Chromatographic column extraction usually yields high amount of organic mixture. User should filter out the organic solvent as much as possible from the mixture in the fume hood.

The filtered/extracted organic solvent should be treated as 1.1 Organic Solvent Waste.

The moist residue (in which the portion of the organic solid is more than that of the solvent), should be placed in a wide-mouth container inside the fume hood to allow the organic solvent to be vaporized. The users should repack the residue into a container capable of carrying the solvent. Seal and label with the date of packing and the name of the waste on the container in the fume hood and deliver to the waste store room.

Inform the laboratory technician who will attach a MSDS for CS colleague to arrange for waste collection.

A.3 Acid and Base Wastes

Strong acids such as hydrochloric acid, sulfuric acid and nitric acid, and strong base such as sodium/potassium hydroxides are frequently used in the laboratories. Due to the tolerance of the waste water treatment facility in the N22 building, the pH of any aqueous waste into the sink should be controlled in the range from pH 6 to pH 8. Any strong acid/base waste which is over such range must be first diluted in large amount of water, this is to dilute the acid/base to a 5% (by weight) concentration or less (add acid to water, NOT water to acid), and then neutralize it to the controlled pH with sodium/potassium hydroxide for strong acid and with hydrochloric acid for strong base. Remember, neutralization will generate heat, and thus the neutralizing agent should be added slowly. The neutralized product can subsequently be discarded into the laboratory sink.

Organic solvent alkanoic acids with 5 or fewer carbon atoms, such as formic acid, acetic acid, butyric acid, isobutyric acid, propionic acid, are considered safe carboxyl acids. If they are in quantities up to about 10g or 100ml at a time, it can be disposed down the drain while flushing with excess water. However, if larger volumes, consult the laboratory technician.

Moreover, personnel must wear adequate personal protective equipment (PPE) when carrying out the operation under the fume hood. The acid/base waste should be poured slowly into large amount of water for dilution (not adding water into the strong acid/base). Pouring of liquid slowly and gently to avoid spilling and aggressive chemical reaction.

A.4 Biohazard Waste

This waste is mainly the toxic substances generated from western blotting experiment and RNA extraction experiment. The most common used chemicals are listed in Appendix II. If the organic solvent waste is not listed in Appendix I, inform and consult the laboratory technician.

The collecting bottle is a glass bottles with a secondary container labeled "Biohazard Waste" or "Western blot waste" (Fig. 3 & Fig. 4, Appendix IV). It should be put either in the fume hood or under elephant trunk. Make sure the fume hood or elephant trunk is in operation when discarding the waste. The total volume of the bottle should not exceed 85% fullness. Please stop using the container and inform the laboratory technician when it reaches the said limit of fullness.

A.5 Neurtoxin Waste

This waste is mainly the toxic substances generated from neurotoxin experiment. The collecting bottle is a 4L glass bottles (Fig. 5, Appendix IV) with a secondary container labeled "Neurotoxin Waste". The neurtoxin waste should only be aqueous solution. Never discard solvent or dry power. The total volume of the bottle should not exceed 85% fullness. Please stop using the container and inform the laboratory technician when it reaches the said limit of fullness.

A.6 Waste Oil

Waste oil includes vacuum pump oil and flushing oil generated by machine's vacuum pump. The collecting bottle is a glass bottles (Fig. 6, Appendix IV) with a secondary container labeled "Waste Oil". The total volume of the bottle should not exceed 85%. Please stop using the container and inform the laboratory technician when it reaches the said limit of fullness.

A.7 Animal Carcasses

It is collected in an autoclavable biohazardous bag (red) (Fig. 9, Appendix IV) during experiment and then transferred to a freezer (Fig. 7, Appendix IV) labeled "Animal Carcasses" in the same day.

A.8 Used Needles

It is collected in a yellow waste needle container (Fig. 8, Appendix IV) labeled "Medical Waste". Never discard the needles in rubbish bin or broken glass box which may injured the cleaner when collecting rubbish. To avoid too full to close the cap, please do not fill in

any more when it is above 75% full. Please stop using the container and inform the laboratory technician when it reaches the said limit of fullness.

A.9 Oxidative Substances

Please refer to our Peroxide Handling guideline.

At the same time, the total volume of the bottle should not exceed 85% fullness. Please stop using the container and inform the laboratory technician when it reaches the said limit of fullness.

A.10 Empty Chemical Bottles

The chemical bottles should also be collected before for chemical waste disposal.

- I. User should make sure only very little subsides inside the bottles. Then raise the bottle with water to briefly clean the residue. Empty the bottle again to make sure only little water subsides inside the bottles.
- II. Close the vessel and put the bottle in the “Empty chemical bottle collection area”

A.11 Wastes Containing Metals

Any wastes containing metals should be handled separately from the aforementioned wastes that liquid should be placed in the suitable glass container(s) and packed into a carton box with label clearly stated content, reporter and handling date. The reporting person must inform the laboratory technicians the existence of the waste, and must report the concentration and volume of the metals, and submit all the MSDS documents.

Laboratory technicians will then arrange waste collection accordingly.

There is a collection site box for used battery near the elevator.

B. Biologically contaminated Wastes

B.1 Tissue culture waste (BSL I)

This kind of waste is generated in cell culture (BSL I) experiment, primary culture from a source known to NOT contain infectious agents, etc. All the liquid waste should be collected in a glass bottle for autoclave. The total volume of the bottle should not exceed 85% fullness. Please stop using the container and change to another empty container when it reaches the said limit of fullness. Inform the laboratory technician for further action.

B.2 Tissue culture waste (BSL 2)

This waste is mainly generated in cell culture (BSL 2) experiments, animal experiments, primary culture from a source known to be infected (not BSL 3 or above), etc. Those items include gloves, papers or consumables contaminated with body fluids, tissues, tissue culture substances, etc.

Liquid waste

All the liquid waste should be collected for disinfection, either treated by autoclave or bleaching solution.

For autoclave treatment, all the liquid waste should be kept in an autoclavable bottle, labeled glass bottle. The total volume of the bottle should not exceed 85% fullness. Please stop using the container and change to another empty container when it reaches the said limit of fullness. Inform the laboratory technician for further action.

For the way of disinfecting by bleach solution, all the cell culture liquid wastes should be poured to a container which contain bleach liquid. The final concentration of the bleaching solution should be brought to 10% after it is full and treated for at least 45 minutes. Before the bleaching solution is drained to laboratory drain, the pH of bleaching waste into the sink should be controlled in the range from pH 6 to pH 8 due to the tolerance of the waste water treatment facility in the N22 building. Bleach wastes should be neutralized by sodium disulfate (2 gram of sodium disulfate will neutralize 2500 ml 10% bleach solution)

Solid waste

All the solid waste in viruses culturing should be disinfected by bleach solution before it is disposed. To disinfect and neutralize the waste, follow the method of disinfecting by bleach solution mentioned in liquid waste of Tissue culture waste (BSL 2).

When syringe needle is used during the experiment, it should also be disinfected by bleach solution before discarding into the sharp box.

B.3 Microbiology Waste (BSL I)

This kind of waste is generated in microbiology experiment. All this waste should be collected in an autoclavable biohazard bags (red). It should not be filled to exceed two-thirds of its capacity. Please stop using the bag and change to another empty autoclavable bag (red) when it reaches the said limit of fullness. Inform the laboratory technician for further action.

C. Broken Glass

Broken glass boxes are used to collect clean broken glass. It is placed in the laboratory for the safe disposal of broken glass. Please note that:

1. All broken glass has to be placed in the broken glass box (Fig. 14, Appendix IV), instead of the common rubbish bin. The biologically contaminated glass, needles and sharps must be disposed in yellow medical waste containers.
2. Do not fill in any glass in the box if the box is almost full (around 75%). Please contact the laboratory technician.
3. The box is not intended for the use of disposing chemicals or biohazardous materials. Never dispose any broken glasses contaminated with chemicals or biohazardous substances. Contact the laboratory technician if that happens.

4. For disposing the glass column longer than 0.5m, always wear proper glasses and gloves to break the column into smaller pieces by using appropriate tools. Please note that column must be cleaned and not contaminated by chemicals.
5. Keep the broken glass box in good condition. Contact the laboratory technician if any stained, wet or others dangerous chemicals appear to be contaminated.

D. Others

The procedures established in the guideline are NOT intended for use to handle the potential dangerous substances not included in this guideline. Users are advised to approach the laboratory technicians for more information concerning disposal of other potential dangerous substances.

Some more laboratory good practice information is put here for reference. Any experiment contains evaporated chemicals, toxic gases or infection biological materials should be conducted in suitable exhausted system. Our laboratory are equipped with some devices for handling these kind of hazardous gas. Please refer to the table below for more information. Kindly be noted that the exhausted flow rate of the elephant trunk is low. It is only suitable for handling the gas that is less danger, such as strong smell but non-toxic chemicals, waste collection bottles. Please refer to the equipment guideline for more details on the operation of the device.

Fume hood	Elephant trunk	Captair hood at 7/F	Class II B2 type Biosafety Cabinet
			

For the compressed gas cylinder, the laboratory technicians will contact vendor for the delivery or replacement when it is empty. Therefore, users are not necessary to use the gas cylinder unless there is other instruction by laboratory technicians.

IV. Post-processing the hazardous waste by lab helper

A. Collection

- A1 Liquid and solid wastes should be collected in closed, labeled containers whenever in laboratory area or waste store room. For waste that need to be autoclaved, the waste should be collected in the container that is autoclavable. A secondary labeled container is necessary if it is in liquid form (see step A in appendix III).
- A2 Laboratory helpers should check the fullness of the waste container regularly. They need to close the container and transport to waste store room/autoclave room by trolley when it reaches the limit of the fullness. The collected container will then be replaced to an empty one at its original location. At the same time, laboratory helper should check and ensure the label of the containers and second containers are correct and securely attached. The volume limited and checking frequency for different containers is listed below.

Container	Volume Limit	Checking frequency
60L barrel	70% fullness	Twice a week
Small waste bottle	85% fullness	Once – twice a week
Autoclavable bottle	85% fullness	Every day
Autoclavable biohazard bags (red)	Two-thirds of its capacity Or Within 3 days (choose which one reach sooner)	Every day
Used needle collection box	To avoid too full to close the cap, close it when it is almost 75% fullness	Every week
Broken glasses box	To avoid too full to close the cap, close it when it is almost 75% fullness	Every week

- A.2.1 For the 60L barrel, it is needed to record the amount of waste to be collected.
- A.2.2 For the small waste bottles that collecting organic solvent, lab helper should pour into the 60L barrel once the waste bottle is around 85% full.
- A.2.3 For the waste to be autoclaved, it should be treated by autoclave using the liquids cycle at 121°C for 20min (Remember to loosen or remove the closure on the glass bottles before placing in autoclave). After autoclaving, liquid waste should be carefully discharged to the laboratory sink, then thoroughly rinse down the sink with water. For the solid waste, leave it cool for a while, then packed the whole bag of cooled, treated solid waste in a household rubbish bag and disposed as household waste.

NOTE: Only authorized personnel are allowed to use the autoclave regarding the lab regulation should use this device. PLEASE do not autoclave liquids containing chemical or disinfectants.

- A.2.4 For the broken box disposal is done by sealing over the top of the container with sturdy tape (such as packing tape). Make sure it is properly seal to avoid breakage and damage before transporting to waste store room by trolley. Contact the laboratory technician if they are stained, wet or otherwise appear to be contaminated.

NOTE: The boxes are stored in waste store room until it reaches 5 boxes.

Inform the laboratory technician, who will then inform CS colleague for collection.

A3 The empty solvent chemical bottles

- A.3.1 The empty organic solvent is put in the ventilated area such as fume hood in order to evaporate all the remaining volatile organic solvent for at least 24 hours. Laboratory helper should check and collect it every day.
- A.3.2 Other chemical bottles are collected in the "Empty chemical bottle collection area". Laboratory helper should check and collect it every week.
- A.3.3 Laboratory helper should put all the bottles orderly in the packing boxes and transfer to the waste store room by a trolley (The empty organic solvent bottles have to be evaporated for the suggested time). The packing boxes should be labeled properly. Details for packing can be found in the part "Packing" below.
- A.3.4 When there is new chemical delivered with the packing boxes, it is suggested not to dispose the original solvent bottles packing boxes due to the fact of recycling them for packing the empty solvent bottles. The original solvent bottles packing boxes should be kept in the waste room

A4 All the wastes should be transported by trolley.

B. Packing

- B1 Before the waste is collected by the waste collectors (the company CSR), it should be well packed to avoid breakage and damage during transportation.
- B2 The glass bottles should be packed in a labeled paper box (Fig. 11, Appendix IV). The packing materials, such as paper pad, loose fill or air pad should be used in order to protect the packed items from agitation and accidental damage. After filling the packing materials, the packed item should have no empty spaces around and relatively fixed in the box. Seal the box with packing tape. NEVER PUT incompatible wastes in ONE box.

- B3 No chemical waste should adhere to the external surface of the container. The closure device should be checked to determine whether it is unlikely that it can be incorrectly or incompletely closed.
- B4 All the paper boxes, small boxes, liquid materials or fragile materials must be further stowed in a labeled big plastic container (Fig. 12, Appendix IV) for transportation.
- B5 Animal carcasses should be taken out from freezer. It will further be packed and seal in a labeled ploy-foam container (Fig. 8, Appendix IV).
- B6 All the packing should attached a clear label. The label should be securely attached to a suitable part of the container which allows the information on the label to be easily read, and not obstructed or obscured by any part/fitting of the container. .

C. Storage

- C1 Except for the animal carcasses which are stored in special labeled freezer, all the collected waste should be stored in the waste store room. Storage of incompatible waste has to be arranged in different area (see step B in appendix III).
- C2 All the waste should already be LABELED. A double check to confirm the label has securely attached to the items to indicate its nature. Any old labels on the containers should be completely removed or obliterated. Then replace by a new one.
- C3 Animal carcasses has already collected in bag or box and stored in a labeled freezer.
- C4 There is a waste room on each floor.

V. Collection and transportation by waste collectors

- 1 The collector should use a trolley to transport the items unless it is movable and easy-to-control. (see step C in appendix III)
- 2 Each container must have a clear label and attached securely.
- 3 We should let the waste collectors sign back each time after waste collection.
- 4 The waste collectors should have the laboratory emergency contact list.
- 5 The collector should wear the suitable PPE (such as goggles, protective coat, glove and protective shoes) when handling the wastes.

Appendix I

Organic Solvent Waste

The organic solvent waste is mainly generated from the extraction, isolation, purification, and detection processes of medicinal substances. The following list is the main organic solvents generated in our labs and it is not limited to all organic solvents used for special research purpose:

Acetonitrile
Methanol
Acetone
1-butanol
Chloroform
Dichloromethane
Diethyl ether anhydrous
Ethanol
Ethyl acetate
n-Hexane
n-Heptane
isooctane
2-mercaptoethanol
Methylcyclohexane andydrus
3-methyl-1-butanol
Petroleum ether
Aniline
2-propanol
Triethylamine

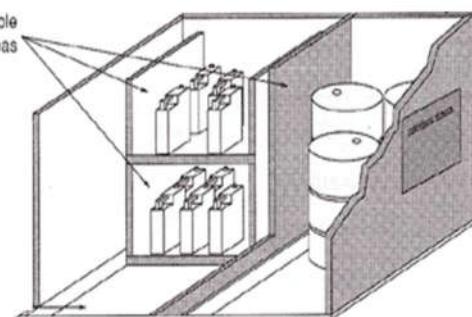
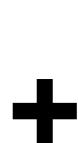
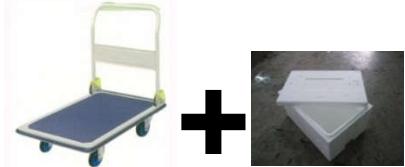
Appendix II

Biohazard Waste

The biohazard waste is mainly generated from the western blot experiment and the RNA experiment.

Polyacrylamide
N,N,N',N'-Tetramethylethylenediamine (TEMED)
Sodium dodecyl sulfate (SDS)
N , N'-methylenebisacrylamide
Amium persulfate (APS)
Tris-HCL buffer
Tween 20
Glycerol
Dithiothreitol (DTT)
Blue-bromophenol
Beta-Mercaptoethanol (As its vapors can irritate the eyes, mucous membranes, and respiratory tract, it should be filled in a sealed container before pouring into the biohazard waste bottle. Usually only small volume (~ 10ml) will be generated during experiment.)

Appendix III. The handling of the general hazardous wastes

Step A - collection		Step B - storage		Step C - transportation by the waste collectors (company CSR or San Yao Hong)
 <p>waste collected in an empty glass bottle w/ a secondary container ex: organic solvent, biohazard waste, waste oil, biologically contaminated wastes, etc</p>	→			
 <p>used needles collected in medical waste container</p>	→	 <p>Storage of incompatible wastes in different areas</p>	→	 
 <p>waste collected in bag w/ a container ex: microbiology waste, biologically contaminated solid waste</p>	→			
 <p>Organic solvent collected in a 60L plastic bottle w/ a secondary container. Only the waste listed in appendix I can be filled.</p>	→		→	
 <p>waste collected in bag w/ a container ex: animal carcass</p>	→		→	 

Appendix IV

Figure	Description (English)	Description (Chinese)	Photo
Fig. 1	Polypropylene (PP) bottle with secondary container (Organic Solvent Waste)	聚丙烯塑料桶及防漏桶 (回收有機廢液)	
Fig. 2	Glass bottle with secondary container (Organic Solvent Waste)	玻璃容器及防漏桶 (回收有機廢液)	
Fig. 3	Glass bottle with secondary container (Bio Hazard Waste)	玻璃容器及防漏桶 (回收生物危害廢液)	
Fig. 4	Glass bottle with secondary container (Western Blot Waste)	玻璃容器及防漏桶 (回收 Western Blot 廢液)	

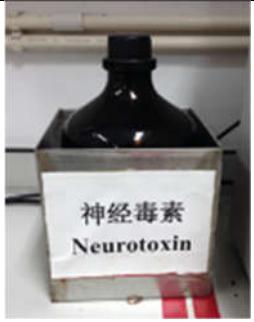
Fig. 5	Glass bottle with secondary container (Neurotoxin Waste)	玻璃容器及防漏桶 (回收神經毒素廢液)	
Fig. 6	Glass bottle with secondary container (Waste Oil)	玻璃容器及防漏桶 (回收廢機油)	
Fig. 7	Freezer (Animal Carcasses)	冰箱 (儲存動物屍體)	
Fig. 8	Needle container	玻璃及尖物收集箱	
Fig. 9	Autoclavable Biohazardous Bag	可用於高溫滅菌的生物危害物專用垃圾袋	

Fig. 10	Funnel	漏斗	
Fig. 11	Paper box	紙皮箱	
Fig. 12	Big Plastic Container	大塑料盒	
Fig. 13	Ploy-foam container	泡沫塑料(發泡膠)盒	
Fig. 14	Broken Glass Box	碎玻璃收集箱	