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File name **文件名**	**Treatment Instruction of Treating Cleaning Water from Experiment Instruments** **实验室清洗设备仪器废水处理指引**	

Approval process

审批过程

	Name **姓名**	**Title** **职务**	**Signature** **签名**	**Date** **日期**
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RIGS 研究创新和研究生部	√	U.G. Dept. 本科教学部	√	I.T.Dept. 电脑信息部	√

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1. Purpose 目的

This regulation specifies the requirements for the treatment of laboratory cleaning laboratory equipment wastewater.

本规程规定了实验室清洗实验设备废水的处理要求。

2. Scope 范围

The provisions of this document apply to the treatment of wastewater from cleaning and experimental equipment in all teaching and research laboratories of GTIIT.

本文件规定适用于广东以色列理工学院所有教学与科研实验室清洗实验设备废水的处理要求。

3. Responsibility 职责

EHS Office EHS办公室：

- Responsible for formulating this procedure and supervising the effective implementation of the requirements of this procedure;
  负责制定本规程，并监督本程序要求有效落实；
- Provide relevant guidelines and training in the laboratory to assist the laboratory in the treatment of cleaning wastewater according to requirements.
  提供相关的指引及培训于实验室，协助实验室根据要求进行清洗废水的处理。

Lab Leader 实验室负责人：

- Responsible for the collection and temporary storage of laboratory cleaning laboratory equipment wastewater in accordance with this guideline;
  负责按本指引对实验室清洗实验设备废水收集、暂存；
- Recovery and reuse of cleaning water with high concentration that can be used for recycling;
  对浓度较高，可用于循环使用的清洗水进行回收再利用；
- Wastewater containing toxic and harmful heavy metal components must be collected, and it is prohibited to be discharged into the waste water collection system;
  对含有毒有害、重金属成分的废水必须进行收集，禁止排入废水收集系统；
- For laboratory cleaning laboratory equipment with low concentration and low hazards, the cleaning wastewater is discharged into the school wastewater collection system according to the guidelines.

对于浓度较低、危害程度较低的实验室清洗实验设备清洗废水按指引排放入校内废水收集系统。

Person in charge of related equipment of operation department 运营部相关设备负责人：

- Responsible for monitoring the operation of laboratory wastewater collection and treatment equipment, timely reporting and processing of abnormal conditions to ensure the normal operation of the equipment;
  负责监督实验室废水收集和处理设备的运行情况，对异常情况进行及时汇报和处理，确保设备正常运转；
- Responsible for routine maintenance and repair of laboratory wastewater collection and treatment equipment.
  负责实验室废水收集和处理设备的日常维护和检修工作。

4. Terminology 术语

Laboratory wastewater: Wastewater from the cleaning of experimental equipment in teaching and research laboratories.
实验室废水：进行教学与科研实验室实验设备清洗所产生的废水。

5. Process 流程

5.1. Wastewater treatment principles 废水处理原则

- High-concentration waste acid and waste lye should be discharged when neutralized to neutral.
  对高浓度废酸、废碱液要经中和至中性时排放。
- For high-concentration organic solvents containing a small amount of analytes and other reagents, they should be recycled and reused.
  对于含少量被测物和其他试剂的高浓度有机溶剂应回收再用。
- The high-concentration waste liquid used for recycling should be stored centrally.
  用于回收的高浓度废液应集中储存。
- Low-concentration cleaning wastewater is discharged into the school wastewater treatment system after treatment.
  低浓度的清洗废水，经处理后排放入校内废水处理系统。

- Storage containers and storage conditions should be determined according to the nature of the wastewater. Different wastewaters are generally not allowed to be mixed, and protected from light and away from heat sources to avoid adverse chemical reactions.
  应根据废水性质确定储存容器和储存条件，不同废水一般不允许混合，避光、远离热源、以免发生不良化学反应。
- Separate collection waste water storage containers must be labelled, indicating the laboratory in which the waste water was generated, the type of waste water, and the storage time.
  单独收集废水储存容器必须贴上标签、写明产生实验室、废水种类、储存时间等。

5.2. Wastewater and wastewater treatment method if part of solid waste exists 废水及废水中若存在部分固废的处理方法

5.2.1. Treatment method for heavy metal-containing cleaning wastewater含重金属清洗废水处理方法

Waste liquids containing mercury, chromium, lead, cadmium, arsenic, phenol, and cyanide must be treated to meet standards before they can be discharged. Laboratory treatment methods are as follows:
含汞、铬、铅、镉、砷、酚、氰的废液必须经过处理达标后才能排放，实验室处理方法如下:

5.2.2. Treatment of mercury-containing waste 含汞废弃物的处理：

If metal mercury is accidentally scattered in the laboratory (such as breaking a thermometer), it must be removed in time.
若不小心将金属汞散落在实验室里(如打碎温度计)必须及时清除。
For example, use a dropper or a thin copper sheet soaked in an acidic solution of mercury nitrate, collect the copper wire and cover the beaker with water;
Mercury particles scattered on the ground should be dusted with sulfur powder to generate less toxic mercury sulfide;
Or spray with potassium permanganate solution (5: 1000 volume ratio) acidified with hydrochloric acid and clear it after 1 to 2 hours;
Or spray with 20% ferric chloride aqueous solution and dry it before removing it (but this method cannot be used on metal surfaces, it will cause corrosion).
如用滴管或用在硝酸汞的酸性溶液中浸过得薄铜片、铜丝收集与烧杯中用水覆盖；

散落在地面上的汞颗粒应撒上硫磺粉，生成毒性较小的硫化汞；

或喷上用盐酸酸化过的高锰酸钾溶液(5:1000体积比)，过1至2小时后清除；

或喷上20％三氯化铁水溶液，干后再清除(但该方法不能用于金属表面，会产生腐蚀)。

For the treatment of mercury-containing waste liquid, the waste liquid can be adjusted to pH 8-10, and excess sodium sulfide can be added to cause precipitation of mercury sulfide, and then ferrous sulfate can be added as a co-precipitating agent. The precipitation of iron sulfide can adsorb the mercury sulfide particles. Precipitate and then stand still.

对于含汞废液的处理，可先将废液调至PH8～10加入过量硫化钠，使其生成硫化汞沉淀，再加入硫酸亚铁作为共沉淀剂，生成硫化铁沉淀可将硫化汞微粒吸附沉淀，然后静止分离。

5.2.3. Disposal of leaded waste 含铅废弃物的处理：

Adjust the pH of the waste liquid to 8-10 with alkali to generate Pb (OH) 2 and Cd (OH) 2 precipitation, and then add ferrous sulfate as a co-precipitating agent. The precipitate can be mixed with other inorganic substances for sintering treatment, and the clear liquid is discharged. .

用碱将废液PH调至8～10生成Pb(OH)2和Cd(OH)2沉淀，再加入硫酸亚铁作为共沉淀剂，沉淀物可与其他无机物混合进行烧结处理，清液排放。

5.2.4. Treatment of chromium-containing waste 含铬废弃物的处理：

Adding reducing agents such as ferrous sulfate, sodium sulfite, iron filings to the chromium-containing waste liquid, reducing hexavalent chromium to trivalent chromium under acidic conditions, and then adding alkalis such as sodium hydroxide, calcium hydroxide, sodium carbonate, etc. Three prices form Cr (OH) 3 precipitation, and the clear liquid can be discharged. After the precipitate is dried, it can be roasted to make it be roasted with coal slag. After treatment, it can be landfilled.

含铬废液中加入还原剂，如硫酸亚铁、亚硫酸钠、铁屑，在酸性条件下将六价铬还原成三价铬，然后加入碱，如氢氧化钠、氢氧化钙碳酸钠等，使三价格形成Cr(OH)3沉淀，清液可排放。沉淀干燥后可用焙烧法处理，使其与煤渣一起焙烧,处理后可填埋。

5.2.5. Treatment of arsenic-containing waste 含砷废弃物的处理：

Calcium oxide is added to make the pH to 8, and calcium arsenate and calcium arsenite precipitate, which co-precipitate in the presence of Fe3 +. Or make the solution pH greater than 10, add sodium sulfide, and react with arsenic to form a difficult and low toxicity arsenic sulfide precipitate. The test for generating arsenic-containing gas was performed in a fume hood.

加入氧化钙，使PH为8，生成砷酸钙和亚砷酸钙沉淀，在Fe3+存在时共沉淀。或使溶液PH大于10，加入硫化钠，与砷反应生成难容、低毒的硫化砷沉淀。产生含砷气体的试验在通风橱中进行。

5.2.6. Treatment of phenolic waste 含酚废弃物的处理：

Low concentration phenol-containing waste liquid can be added with sodium hypochlorite or bleaching powder to oxidize phenol and carbon dioxide. High concentration can be extracted with ethyl butyrate, and repeated extraction with a small amount of sodium hydroxide solution. After adjusting the pH, it is used after re-distillation and purification.

低浓度含酚废液可加入次氯酸钠或漂白粉，使酚氧化城市和二氧化碳。高浓度可使用丁酸乙脂萃取，在用少量氢氧化钠溶液反复萃取。调解PH后，进行重蒸馏提纯后使用。

5.2.7. Treatment of cyanide-containing waste 含氰废弃物的处理：

The low concentration waste liquid can be added with sodium hydroxide to adjust the pH to more than 10, and then potassium permanganate powder (3%) can be added to decompose the cyanide. If it is high concentration, it can be treated by alkaline chlorination method, first adjust the pH to above 10 with alkali, and add sodium hypochlorite or bleaching powder. After being fully challenged, cyanide is decomposed into carbon dioxide and nitrogen, and it will be discharged for 24 hours. Cyanide-containing wastes must not be littered or mixed with acids. The volatile hydrogen cyanide gas generated is highly toxic.

低浓度废液可加入氢氧化钠调节PH为10以上，再加入高锰酸钾粉末(3%)，使氰化物分解。若是高浓度的，可使用碱性氯化法处理，先用碱调至PH为10以上，加入次氯酸钠或漂白粉。经充分叫板，氰化物分解为二氧化碳和氮气，放置24小时排放。含氰化物废物也不得乱倒或与酸混合，生成挥发性氰化氢气体有剧毒。

5.2.8. Treatment of mixed waste liquid 混合废液的处理：

The non-interacting waste liquid can be treated with iron powder. Adjust the waste liquid PH3-4. Add iron powder, stir for half an hour, adjust pH about 9 with alkali, stir for 10 minutes, add polymer coagulant to precipitate, and the supernatant can discharge the precipitate.

互不作用的废液可用铁粉处理。调节废液PH3-4.加入铁粉，搅拌半小时，用碱调节PH9左右，搅拌10分钟，加入高分子混凝剂沉淀，清液可排放沉淀物。

5.3. At present, there are treatment methods for collecting waste liquid in schools. 目前校内对于收集废液的处理方法有：

The laboratory can pretreat the wastewater from cleaning equipment and instruments before discharging it into the school's wastewater system, reducing the difficulty of processing the school's wastewater treatment station, improving the processing capacity of the school's wastewater treatment station, and effectively achieving the harmless treatment of waste liquid Claim.

The methods available for reference are not limited to the following, but the same purpose is to harmless and reduce the harm to the environment.

实验室可以在排放入校内废水系统前，先对清洗设备和仪器的废水进行预处理，降低校内废水处理站的处理难度，提高校内废水处理站的处理能力，并有效达到废液无害化处理要求。可供参考的方法不限于以下内容，但目的一致，都是为了无害化，减少对环境的危害。

5.3.1. Solvent extraction 溶剂萃取法

Wastewater with low concentration of multiple waters is extracted with volatile solvents such as n-hexane which is immiscible with water. After the solvent layer is separated, it is incinerated. Then, the solvent in the water layer was blown out by blowing air.

对含水多浓度低的废水，用与水不相混合的正已烷之类挥发性溶剂进行萃取，分离出溶剂层后，把它进行焚烧。再用吹入空气的方法，将水层中的溶剂吹出。

Wastewater such as emulsions cannot be treated by this method, but by incineration.

对形成乳浊液之类的废水，不能用此法处理，要用焚烧法处理。

5.3.2. Adsorption 吸附法

Activated carbon, diatomaceous earth, alumina, layered fabric, polypropylene, polyester flakes, urethane foam, straw shavings, sawdust and other substances that can absorb the solvent well, make it fully absorbed Agent-from incineration.
用活性炭、硅藻土、矾土、层片状织物、聚丙烯、聚酯片、氨基甲酸乙酯泡沫塑料、稻草屑及锯末之类能良好吸附溶剂的物质，使其充分吸附后，与吸附剂- -起焚烧。

5.3.3. Oxidative decomposition 氧化分解法

In the aqueous low-concentration organic waste liquid, H_2O_2, $KMnO_4$, NaOCI, H_2SO_4 + HNO_3, HNO_3 + $HCIO_4$, H_2SO_4 + $HCIO_4$, and waste chromic acid mixture are used to oxidize the waste liquid break down. Then, it is processed according to the method for treating the above-mentioned inorganic experimental waste liquid.
在含水的低浓度有机类废液中，对其易氧化分解的废液，用H_2O_2、$KMnO_4$、NaOCI、H_2SO_4+HNO_3、HNO_3+$HCIO_4$、 H_2SO_4+$HCIO_4$及废铬酸混合液等物质，将其氧化分解。然后，按上述无机类实验废液的处理方法加以处理。

5.3.4. Hydrolysis 水解法

For organic or inorganic acid esters, and some organic phosphorus compounds that are prone to hydrolysis, NaOH or $Ca(OH)_2$ can be added to hydrolyze at room temperature or under heating.
After the hydrolysis, if the waste liquid is not poisonous, it can be discharged after neutralizing and diluting it. If it contains harmful substances, dispose of them by appropriate methods such as adsorption.
对有机酸或无机酸的酯类，以及一部份有机磷化合物等容易发生水解的物质，可加入NaOH或$Ca(OH)_2$,在室温或加热下进行水解。
水解后，若废液无毒害时，把它中和、稀释后，即可排放。如果含有有害物质时，用吸附等适当的方法加以处理。

5.3.5. Biochemical treatment 生物化学处理法

Treat with activated sludge and blow in air.
For example, a dilute solution containing ethanol, acetic acid, animal and vegetable fats and oils, protein, starch and the like can be processed by this method.
用活性污泥之类东西并吹入空气进行处理。

例如，对含有乙醇、乙酸、动植物性油脂、蛋白质及淀粉等的稀溶液，可用此法进行处理。

5.4. Matters needing attention 注意事项

With the different composition of waste liquid, in the process of treatment, it is often accompanied by the generation of toxic gases and the dangers of heat generation and explosion. Therefore, it is necessary to fully understand the nature of the waste liquid before processing, and then add a small amount of medicine to be added separately. At the same time, you must operate while watching carefully.

随着废液的组成不同，在处理过程中，往往伴随着产生有毒气体以及发热、爆炸等危险。因此，处理前必须充分了解废液的性质，然后分别加入少量所需添加的药品。同时，必须边注意观察边进行操作。.

Waste liquids containing complex ions, chelates and other substances can sometimes not be completely treated by adding only one elimination drug. Therefore, appropriate measures must be taken to prevent the direct discharge of some untreated hazardous substances.

含有络离子、螯合物之类物质的废液，只加入一种消除药品有时不能把它处理完全。因此，要采取适当的措施，注意防止一部份还未处理的有害物质直接排放出去。

In the case of adding sodium hypochlorite in order to decompose cyano groups, so that free chlorine is generated, and water-soluble sulfides are generated due to the treatment of waste liquid by sulfide precipitation method, the treated wastewater is often harmful. Therefore, they must be reprocessed.

对于为了分解氰基而加入次氯酸钠，以致产生游离氯，以及由于用硫化物沉淀法处理废液而生成水溶性的硫化物等情况，其处理后的废水往往有害。因此，必须把它们加以再处理。

In the treatment of waste liquid, in order to save the medicine used in the treatment, the waste chromic acid mixed liquid can be used to decompose organic matter, and the waste acid and the waste alkali are neutralized with each other. Active use of waste liquid should be considered.

处理废液时，为了节约处理所用的药品，可将废铬酸混合液用于分解有机物，以及将废酸、废碱互相中和。要积极考虑废液的利用。

Try to make use of harmless or easy-to-handle substitutes instead of medicines such as chromic acid mixtures that will discharge harmful waste liquids.

尽量利用无害或易于处理的代用品，代替铬酸混合液之类会排出有害废液的药品。

For solvents such as methanol, ethanol, acetone, and benzene, which are used in large amounts, in principle, it should be recycled and the residues should be disposed of.

对甲醇、乙醇、丙酮及苯之类用量较大的溶剂，原则上要把它回收利用，而将其残渣加以处理。

6. Annex 附件

None无