# **Standard Operating Procedure (SOP) Title: Removing solvent using a Rotary Evaporator (Rotovap/Rotavap)**

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| Assessor: | Joshua Linfoot | | | Location of work: | MSRH 502 |
| Principal Investigator: | | | Prof Alan Spivey | | |
| Date of approval: | | 13/09/2021 | | Date for review: | 13/09/2022 |

## **Justifying the hazards:**

Use a dry-ice cooling rotary evaporator to remove volatile solvents. Use a water-cooling Rotovap (or freeze dryer) for water and other less volatile compounds.

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| Identify hazards with specific risk assessments and a College or a departmental approval process | | | |
| [Ionising radiation sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) |  | [Biological sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) (microorganisms, human/animal tissues, plants) |  |
| [Class 3R, 3B or 4 Lasers](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/lasers/SitePages/laserhome.aspx) |  | [Offsite work](http://www.imperial.ac.uk/safety/safety-by-topic/off-site-working/) |  |
| Confirm if [lone working](https://www.imperial.ac.uk/safety/safety-by-topic/lone-working/) is permitted with this SOP?  If it is permitted, describe the control measures for lone workers: | | | |

## **Preparing for the SOP:**

* **DON’T** leave apparatus and work area dirty.
* **DON’T** run rotovap without suitable cooling.
* **DON’T** use faulty or damaged equipment until it is repaired.
* **DON’T** touch control panel and cords with wet hands.
* **DO** work in a fume cupboard or a ventilated enclosure, or ensure the rotovap pump exhaust is connected to a suitable extraction to prevent hazardous fumes being released into the lab environment.
* **DO** rotovap some ethanol or methanol to rinse after highly hazardous substances.
* **DO** take special care should be take when handling coolants such as dry ice.
* **DON’T concentrate peroxides or rotovap peroxide-forming chemicals to dryness! Refer to the SOP 2.10 for details.**

## **Procedure:**

# **Before use:**

1. Check that the solvent trap is empty. If not, empty the trap into the appropriate waste container.
2. Attach a splash head (if available) to the rotary evaporator and secure it using a clip.
3. Close the tap leading to the vacuum, and switch on the power to both the vacuum and control panel.
4. Attach flask to splash head (or Rotovap neck) and secure it using a Keck clip. Adjust the position of the flask to allow 360° rotation.
5. Ensure there is some alcohol or acetone in the cold finger and carefully add dry ice to it. Familiarise yourself with the SOP for Dry Ice usage. Only do this immediately before using the rotary evaporator to prevent the build-up of ice on the cold finger and water in the solvent trap. Continuously monitor the level of dry ice throughout use and add more if it appears to be running out.
6. Alternatively, ensure there is a water supply turned on for water-cooled Rotovaps.

# **While using:**

1. Slowly increase the rotation of the flask to a reasonable speed using the control panel.
2. Slowly open the tap to the vacuum, checking on the response of the solvent with each part turn. If the bubbling of the solvent gets too vigorous then partially close the tap to prevent solvent bumping. Once regular drops of liquid are observed from the cold finger, hold the vacuum tap at that setting.
3. As the solvent level in the flask reduces, repeat step 2 to ensure that the solvent continues to evaporate at a reasonable rate.
4. If the removal of solvent requires higher temperatures, use the attached water bath. Ensure the water level is sufficient for the flask to be approximately half-immersed. Add distilled water to adjust the level. Using the control panel, set the desired temperature and closely monitor the flask content to prevent the liquid bumping. Turn off the water bath when the evaporation is over.

# **After the measurement**

1. Turn off the vacuum pump and release the vacuum by opening the vacuum tap to the external atmosphere.
2. Turn off the water bath heater (if used) and stop the rotation of the flask using the control panel.
3. Remove your flask (press the releasing button).
4. Empty the solvent trap and wash the splash head for the next user.
5. Check that the power to the control panel and vacuum pump is switched off.
6. Make sure you **leave the apparatus and the area clean**.

## **Disposal:**

If any chemical waste is produced, ensure it is disposed of via the appropriate chemical waste stream. If the equipment is to be disposed of, ensure it is decontaminated and dispose of via the ‘Waste Electrical and Electronic Equipment route ([WEEE](http://www.imperial.ac.uk/estates-facilities/buildings/services/waste-disposal/waste-disposal-forms/weee-forms/))’.

## **Personal Protective Equipment (PPE):**

Lab coat, appropriate gloves, safety glasses

## **Risk Analysis of SOP and emergency procedures:**

(In addition to [Safe Lab Practice](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/SitePages/Basic%20Laboratory%20Rules%20for%20All%20Laboratories%20in%20FoNS.aspx))

### **Always remember to include fire associated risks and control measures where appropriate**

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| Hazard | Raw risks | Current control measures | Residual risk  (Low/Med/High) |
| Hot surfaces, hot samples | Burns, fire | Use slip-resistant insulated thermal gloves for handling hot samples.  Remove all flammable substances from the area when using hotplate. | Med |
| Electrical equipment and cables | Electrocution and electrical fire | Commercial equipment, do not modify.  Ensure regular portable appliance testing (PAT).  Visual inspection of equipment and cables prior to each use.  Immediate clean of any spills.  Ensure plugs, sockets, cables and equipment positioned so as not to be at risk of ingress from liquids.  Ensure a CO2 extinguisher is available.  Ensure easy access to the power supply. | Low |
| Heavy item | Crushing injury | Equipment must be securely located on a suitable work surface.  No lifting or moving of equipment. | Low |
| Glassware and glass parts | Cuts and splinters from broken glass | Visually inspect glassware for cracks and other defects before and after use. If glassware is damaged arrange for repair or dispose of. | Low |
| Hazardous materials | Exposure via inhalation of hazardous reagents | Work with volatile reagents in the FCs or ensure exhaust is connected to local exhaust ventilation (LEV).  Ensure the equipment is cleaned before and after each use.  (Include hazards and controls of associated reagents in this or separate risk assessment) | Low |
| Dry Ice/liquid N2 | Burns | Wear appropriate PPE (protective gloves, lab coat, safety glasses or face shield, enclosed footwear) and use appropriate equipment (scoop for dry ice, appropriate pouring vessels for LN2) to prevent exposure during transfer or use of cryogens. | Low |

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| **Additional control measures to minimise residual risks** | **Implementation date** |
| For water-cooling rotovaps: switch on water recirculator at least 15-30 min in advance to allow water cooling before starting the vacuuming. Allow water to cool rotovap for at least 10-15 min after the solvent is removed before removing the solvent trap. See SOP for Thermorecirculator. |  |

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| **Who may be harmed** | |
| Staff / students | Cleaners / Engineers |
| Supporting staff | Others (specify): |

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| **Emergency procedures** – describe the response(s) required by the user and lab members |
| In the event of an incident involving the **equipment itself,** turn off the power supply, unplug and place a sign on the equipment stating it is not to be used. Arrange for repair.  **Electrical shock** - switch off power. Do not touch the affected individual until the power is definitely off. Seek immediate medical attention by calling 4444 (+44 20 7589 1000) and contacting nearby First Aider. Use a non-conductive lever to remove the individual from the electrical source (e.g. a dry wooden broom handle).  **Electrical fire** – If ignition occurs but extinction is managed in a controlled manner, ensure a SALUS report is completed at the earliest opportunity. If the fire is not controllable you must activate a fire alarm call point and evacuate. Inform Fire Safety Officers or Security where the fire is located and what it involves when they arrive at the building.  **Burns** - run site of injury under tepid water for 15 minutes if able (burn dressing available in first aid kits if location of the injury is awkward to rinse, e.g. leg) and contact a first aider. In the case of a serious burn, seek medical attention immediately.  If **contact with Dry Ice** (**Dry Ice burns**) has occurred, the aim should be to slowly raise the temperature of the affected area back to normal. The affected area should be doused with copious quantities of tepid water for at least 15 minutes. If a serious burn occurs, apply a clean lint-free sterile burn dressing to the area to protect the injury until the person can be taken to hospital to receive medical treatment.  Clear up **broken glass** using dustpan and brush, tweezers or other suitable equipment to prevent exposure to the glass then place into the appropriate waste bin (clean or contaminated glassware).  If anyone is injured while using the equipment contact first aider.  If any **cuts or exposures** to hazardous substances, ensure affected area is held under running water for at least 15 mins and the wound is encouraged to bleed, ask for first aid assistance. If water is not available use alcohol free wipe from the First Aid Kit and dress the wound. Seek further medical attention if required.  If **crushing injury** - contact first aider immediately – use an ice/cool pack (if on hand only) to reduce immediate swelling – seek medical attention if required.  (Include emergency procedures associated with the use of hazardous substances if relevant) |

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| Recommended trainings and records: |
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| List of individuals competent to demonstrate safe work practice and train others (level 1 trainers): | Names of those that have been trained and can work unsupervised (level 2) and date training completed: |
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