¹Guidelines for Working With Rotary Evaporators

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**Introduction**

A rotary evaporator is a device used in chemical laboratories for the efficient and gentle removal of solvents from samples by evaporation. The solvent is evaporated in a reduced pressure environment with the application of heat and constant rotation. The reduced pressure increases the evaporation process by decreasing the boiling point of the solvent, allowing the evaporation to be conducted at lower temperatures. Rotation of the evaporation process maintains homogeneous heating of the solvent while increasing the surface area of the evaporating solvent. Rotation also reduces the effect of ‘bumping’, the sudden burst of solvent vaporization that can scatter liquid exposed to reduced pressure.

### **Hazards**

### Rotary evaporators must only be used by trained personnel familiar with the hazards. Hazards of rotary evaporation include:

* When a vacuum exists within glassware, there is a risk of implosion with potential hazards of flying glass, spattering chemicals and fire.
* Although glass vessels are frequently used in vacuum systems, they can implode or explode violently, either spontaneously from the strain or from an accidental blow.
* Implosion and flying glass can lead to cuts and lacerations.
* The properties of compounds used must be investigated prior to evaporation or reaction. Certain compounds are explosive upon dryness (e.g. peroxides and peroxide formers such as mCPBA, Benzoyl peroxide, diethyl ether, THF, and dioxane).

### **Safety Precautions**

### The following safety precautions should be followed whenever using rotary evaporators:

* Always read the owner’s manual to ensure equipment specific safety information is being followed.
* Always wear Personal Protective Equipment (PPE) which includes safety glasses, face shield, laboratory coat, and the appropriate chemically resistant gloves.
* The rotation speed and application of vacuum should be done gradually when using a rotary evaporator.
* Do not hold onto the sample while it is revolving. A failure of the flask can result in serious lacerations to the hands.
* Only use heavy-walled, vacuum grade rubber tubing for the application of vacuum. Thin-walled rubber tubing and plastic tubing is not suitable because they collapse leaving a partially closed system.
* The length of the vacuum tubes should be as short as practicable and do not require to be secured with cable ties.
* Use quality silicone tubing for the cooling water which must be secured to the screw fittings with cable ties.
* Ensure all tubing is checked regularly and replaced when brittle.
* Because large volumes of organic solvent vapor can be generated through rotary evaporation, it is best to conduct the process in a fume hood or at a minimum under a local exhaust (i.e. “snorkel”).
* When in use, the condenser should always be cooled.
* Always clean the apparatus after use.
* Only use glassware that is free from cracks, scratches, etching marks and other imperfections.
* Only use quality, heavy walled glass or Pyrex® round bottom flasks or specially manufactured accessory flasks (e.g. beaker flask) for evaporation.
* The condenser and receiving flask should be plastic coated to restrain fragments in case of implosion. The use of plastic safety netting may also be placed around the condenser.
* Flasks with volumes of 1 liter or larger must be enclosed in tape or plastic mesh to restrain fragments in case of implosion.
* Glass dewars should be fully wound in tape or preferably enclosed in a metal container.
* The use of a safety shield in front of the rotary evaporator should be used as a further measure of safety.

### **Maintenance**

### Always read the owner’s manual to ensure equipment specific maintenance and storage items are being followed. Basic maintenance of rotary evaporators include:

* Clean housing regularly with a moist cloth (Do not use cleaning agents).
* Regularly check tube connections and replace tubes when they show signs of cracking or brittleness.
* Grease all joints on the condenser regularly.
* Clean seals regularly with water and dry with a soft cloth. Seals should be replaced if they exhibit any signs of wear and tear.
* Clean the inner surface of the heating bath if calcification or light rust spots are observed. To clean, empty the heating bath and clean accordingly. Rinse the bath thoroughly afterwards.
  + Minor calcification: Use a non-abrasive cleaning agent.
  + Stubborn calcification: Use acetic acid to remove.
  + Rust spots: Gently remove with Scotch-Brite.
* Rinse glassware with water and a mild cleaning agent. An alkaline cleaner may be used to remove particulate build-up. Remove any grease from joints.
* Clean all glass components manually.
* Check glass components regularly for imperfections, cracks, scratches, etc.

### **Waste disposal**

### Ensure all solvents are properly disposed of as hazardous waste.

### All broken or damaged glassware should be rinsed and disposed of in an appropriate broken glass container.

### Place waste coolant into a properly sealed waste container that is clearly labeled and dispose of as hazardous waste.