Rotovap

1. Definition of rotary evaporator or Rotovap

A rotary evaporator, also known as a rotovap or rotavap, is a commonly used device in chemical laboratories for the isolation and distillation of large quantities of a single sample. The principle of rotary evaporation is to distill volatile solutions by heating and increasing the surface area available for distillation. To enhance the efficiency of the process, a rotary evaporator is typically connected to a vacuum pump to create a vacuum, thereby reducing the boiling point of the solution. It is also recommended to add a condenser to collect the gases produced during distillation and prevent their emission, as these gases may be hazardous.

The principle of a rotary evaporator is that as the vacuum in the evaporating flask increases, the boiling point of the liquid inside decreases. With a sufficiently low vacuum level, even high-boiling point solvents such as water (boiling point at standard atmospheric pressure 100°C), dimethylformamide (153°C), and dimethyl sulfoxide (189°C) can be distilled. For example, by reducing the vacuum from 760 torr to 5 torr, both dimethylformamide and dimethyl sulfoxide can be made to boil at 50°C.

In most cases, rotary evaporators are used to separate low-boiling substances, such as hexane and ethyl acetate, which are liquids at room temperature and pressure. It is also possible to selectively remove specific substances from samples using a rotary evaporator.

2. Essential devices for rotary evaporator

Since the substances being processed in rotary evaporators mainly consist of chemicals and solvents, it is recommended to use chemical-resistant vacuum pumps made of polytetrafluoroethylene (PTFE). The vacuuming capacity of the pumps should be determined based on the solvent requirements, and the sizes should be selected based on the size of the sample or flask. Utilizing pumps with a vacuum controller can also provide flexibility in selection and ensure a more accurate and intelligent vacuuming procedure. Key points to consider when deciding:

a. **Pump:** Use a water-free and oil-free diaphragm vacuum pump with a low ultimate vacuum suitable for distilling high-boiling point solvents.

b. **Vacuum controller:** Utilize a vacuum controller to help maintain the vacuum level or create a vacuum curve as needed.
c. **Sealing ring:** PTFE material is commonly used for its high corrosion resistance when selecting a sealing ring.
d. **Cooling circulation system:** Ensure that the cooling system remains at least 40°C lower than the temperature of the heating pot. Generally, a cooling circulation system is necessary to ensure efficient solvent recovery and maintain a safe and odor-free laboratory environment.

Fig 1: structure of Rotovap https://www.laboao.com/

3. **How to use the rotary evaporator.**
   - Turn on the bath thermostat. The temperature will be adapted to the solvent to be extracted.
   - Place water in the condensation column.

- Switch on the water tube (tap at maximum flow).
- Place the flask containing the solution to be purified from its solvent. Secure it with a clamp. Close the tap.
- Rotate the flask. The hotter the bath, the faster it usually goes.
- Lower the flask to bring it into contact with the solution: the flask should just “lick” the bath.
- Wait for the first drops of solvent to appear in the collection flask (sometimes these vapors don't appear at all, but are condensed and drawn directly into the water pump).
- Check that the solvent has been distilled: the flask should be cold.
- Shut down the unit, taking care not to backflow water, by cutting off the water tube first: start by opening the tap (8), remove the clamp and recover the flask, close the water tube tap and switch off the unit.

4. Maintenance of rotary evaporators

Rotary evaporators are an essential part of laboratory equipment, and their proper maintenance is crucial to ensure optimum performance and prolong their service life.

Regularly inspect your equipment and check handles, pins, gaskets and other parts for any signs of wear or damage. If any problems are found, replace damaged parts immediately. Make sure the cover is tight and does not leak. This will help maintain vacuum and prevent impurities from entering the system.

Lubricate joints and articulated movements with an appropriate lubricant. This will help reduce wear and binding of moving parts. Do not use mineral oils or WD-40 as these can damage seals and other parts. Keep the equipment clean, especially the canister cover and pump gasket. A dirty or damaged gasket can be the cause of leaks. Periodically check the hoses and valves of the rotary evaporator and replace if damaged or leaking. If not used regularly, a full service should be performed every 6 months. This will include thorough cleaning, checking of moving parts and replacement of seals, hoses and valves.