

[MUSIC PLAYING]

PROFESSOR: Whether you are dealing with a solid, an oil, or a liquid, at some stage you will have to dissolve it in a solvent. Whether you need it as a solution so that you can run a reaction, or perhaps a chromatographic purification, when you're done, you will need to remove the solvent in order to isolate the pure compound. Luckily, a very useful piece of laboratory equipment, called a rotary evaporator, or rotavap was designed for just this use.

While rotavaps are very easy to use, there are a few general rules of operation that you will need to follow. This video will demonstrate the correct use of a rotavap. While rotavaps come in a variety of different styles, they are all made up of the same fundamental pieces. These are a vacuum line to reduce the pressure inside of the whole rotavap system. Remember, solvents boil at lower temperatures under reduced atmosphere.

A hot water bath, used to warm the flask containing your dissolved material. Evaporation is a cooling process, so you need to add a little heat to evaporate the solvent. A nice clean bump trap, too which you will attach your flask. This useful piece of glassware will prevent any of your material from ending up inside the rest of the rotavap.

A rotary motor that spins your flask and spreads the solvent out on the flask walls. This creates more surface area and allows for rapid evaporation of the solvent. A cooled condenser to condense the solvent vapor from your flask. And a receiver to collect the condensed solvent.

If all goes well, the solvent that starts out in your flask ends up in the receiver, while your material stays put in your flask. Rotavap operation is very simple. But there are a few guidelines that you need to follow to avoid some potentially painful mistakes.

Rule number 1, tie back your hair and avoid loose sleeves. The rotary motor on the rotavap is a potential safety hazard. Take care not to lean too close or dangle your hair, clothing, or jewelry near the motor. Otherwise, you may end up saying a painful goodbye to some precious material, maybe even your scalp.

Rule number 2, never fill your flask more than half full. When preparing to use the rotavap, you never want to fill your round-bottom flask more than half full. Even if you have a large volume of solution to concentrate, it will never save you time to overfill the flask.

It will most likely lead to an unfortunate and time-consuming problem called bumping. In other words, your material will take a trip to the bump trap. This will require you to rinse the bump trap with solvent, adding even more to the overall volume you need to concentrate.

Rule number 3, make sure there are no solids in the flask. This includes stir bars. They may seem harmless but they can also lead to bumping.

Rule number 4, always use a clean bump trap. Even when you're careful, bumping can happen. Therefore, you should always thoroughly wash the bump trap and rinse it with solvent before you use it. You never know what someone else may have left inside, and you don't want it to end up mixed with your material.

But before you attach the bump trap or your flask to the rotavap, proceed to rule number 5, cool the condenser and the receiver. Make sure that cold water is circulating through the condenser and place the receiver in an ice bath. This will ensure that minimal solvent vapor makes it out of the rotavap and into the vacuum line.

Now, you are ready to put your half-filled solid-free flask on the rotavap. Attach your flask securely to the bumper trap using a Keck clip and an adapter, if necessary.

Rule number 6, pull vacuum, just a little bit before spinning your flask. After you attach your flask, open the system up to a little bit of vacuum and start the rotary motor. If you start the spinning first without the vacuum to hold everything in place, your flask and the bump trap might end up floating in the water bath.

Rule number 7, open the vacuum line slowly to start the evaporation. Watch your flask carefully to make sure that the bubbling is under control and reduce the vacuum if it looks like it is going too fast. Opening the vacuum line too fast is another good way to get your material to bump.

When you have achieved a stable rate of evaporation, lower the flask into the hot water bath. This will prevent the flask from icing up as it cools during evaporation. And it will help the concentration to proceed at a reasonable rate.

Leave your flask on the rotavap until the sample becomes viscous and sticks to the sides of the flask. Depending on the viscosity of your material, it may even form a ring around the middle of the flask. Solid material will most likely solidify when concentration is complete.

Now, you are ready to remove your flask. To do so, turn off the rotary motor, release the vacuum, and undo the Keck clip. You can proceed to a high vacuum pump if you need to remove the small amount of solvent still in your sample.

Let's quickly recap the rotavap rules that we have learned. Rule number 1, tie back your hair and avoid loose sleeves. Rule number 2, never fill your flask more than half full. Rule number 3, no solids should be in your flask.

Rule number 4, always use a clean bump trap. Rule number 5, cool the condenser and the receiver before you attach your flask. Rule number 6, pull vacuum just a little bit before turning on the rotary motor to spin your flask. And rule number 7, open the vacuum line slowly so that you don't cause your material to bump.

Remember, this video is intended to help you prepare for lab by providing a demonstration of the proper experimental technique. It is not intended as a replacement for reading your lab manual or the supplementary material. In order to become a great experimentalist, it is important that you understand both theory and technique. Now it's your turn. Good luck.

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