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Rotary Evaporator Selection Guide

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Rotary evaporators, commonly known as rotavapors, rotavaps or rotovaps, are extremely valuable to a number of downstream applications requiring efficient distillation & solvent removal. Often combined with a vacuum pump, rotary evaporators are used to remove solvents from samples through evaporation. During this process, rotary evaporators reduce the pressure within the system to lower the solvent boiling point, rotate the sample to increase the effective surface area, and heat up the solution.

Because of this technique's distillation efficiency, most users prefer rotary evaporators over standard distillation systems. Not to mention, rotary evaporators ensure samples receive more even and consistent heating from a heated liquid without overheating the samples.

Rotary evaporation involves a multitude of sample concentration or liquid extraction techniques from solvent reclamation, chromatography fractions, solvent removal procedures, trapping of hazardous waste liquids, and separation of non-volatile solutes from volatile solvents. Which is why rotary evaporators are a vital and staple instrument to numerous research and chemical laboratories. These instruments are also common within molecular gastronomy, organic chemistry, and petrochemical industries.

Moreover, a rotary evaporator is also a popular instrument in medicinal plant research, cultivation, and extraction. This instrument paves the way for economical ethanol recovery & extraction to create butane hash oil and other concentrates.

Choosing a model with the right technical requirements & specifications to meet your application demand is necessary for achieving both effective and efficient solvent recovery. While all units are designed to distill, separate, and purify liquids, there is still a wide variety of models that overlap in features and capabilities. But before you can select the right Rotary Evaporator, you'll have to zero in on the right configuration that best fits your needs before turning your attention to performance and features.

To help you make a well-informed buying decision, Yamato Scientific has prepared this straightforward guide which contains key points and considerations to keep in mind so you can identify the best rotary evaporator system to invest in.

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ESSENTIAL ROTARY EVAPORATOR COMPONENTS

Before acquiring a rotary evaporator, it is recommended to have a basic understanding of the different rotary evaporator components to help you obtain your desired unit. To help shed some light on the manufacturer jargon that you might find in brochures and online, we have provided a detailed breakdown of each component below.

Rotary evaporator sets usually include the rotary motor, receiving flask, heating bath, condenser, and a trap ball. You can also mix and match the rotary evaporator with different systems like water circulators, solvent recovery units, and more depending on your intended use.

The rotary motor rotates the evaporation flask or vial containing the sample. You can select a unit based on your application's required rotation speed, automation preferences, and if the unit is compatible with your required condenser and water bath requirements.

A water bath is also used together with the rotary evaporator to control the temperature of the flasks as this heats the sample to keep the solvent from cooling or even freezing during the evaporation process. A recirculating chiller can be used for extra cooling capacity.

Condensers come in three different configurations – the traditional glass set where condenser is tilted diagonally, the standard glass set where condenser is set vertically, suitable for limited space, and the dry-ice vertical condenser also known as cold finger condenser, suitable for volatile or low boiling points solvents. The receiving flask located at the bottom of the condenser catches the distilling solvent after it re-condenses. The quality of the glassware set is important for equipment safety and lifespan. Possible hazards may occur from use of glassware that are low quality, with flaws or even with poorly-suited fittings.

Apart from the rotary evaporator, a vacuum source should be connected to reduce the pressure within the evaporation system, allowing samples to boil at a lower temperature. The vacuum pump is what lowers the boiling point of the product and allows operators to distill solvents using temperatures that go all the way down to room temperature or below.

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FACTORS TO TAKE INTO CONSIDERATION

When deciding on the best solution for your rotary evaporation needs, you should think about a unit with functions & features that is capable of providing the most efficient results while preserving sample integrity. Factors such as bath capacity, rotation speed, temperature range, and pressure control should be taken into consideration. To help you assess your application demands, start by answering the list of questions below:

1. What sample type do you work with?

As with any lab instrument, completely understanding the sample types that you will be working with plays a significant role when deciding on the right configuration for your rotary evaporator. Moreover, the types of solvent used greatly impact the kind of vacuum pump to use with the system. Ask yourself whether or not you need a specific unit that should be able to resist damage from the solutions being evaporated.

For acid samples, you must consider an acid-resistant system with proper coating & ventilation as this could cause corrosion. Solvents can also damage the system's rubber & plastic components.

2. What is your required rotational speed?

When looking at your speed requirements, you will most likely want a unit that will have the most efficient distillation process. While it's tempting to think that faster rotation speed will give the most efficient results, it may not always be the case. Buying a rotary evaporator with higher speed capacities than what your applications actually requires can translate to higher costs. Remember though that rotation influences evaporation rate. Faster rotation encourages quicker evaporation, as it increases surface area of the sample. Ultimately, when deciding on your speed range, it's important to base your choice on your sample requirements.

If your applications require higher speed rotation options, rotary evaporators like the Highly Functional RE801 & RE601 Rotary Evaporators & RE301 Digital Rotary Evaporator have a rotational speed control ranging from 20 to 250 rpm that will result in near-optimal evaporation performance. Yamato's RE202/212 Rotary Evaporator is the market leader in rotation speed with its 5 to 315 rpm range.

Aside from rotation speed, rotavaps also feature different rotation modes. All Yamato rotavap models are designed with forward rotation mode except for RE202/212 which features reverse rotation mode and auto inversion. Auto inversion mode is helpful in the powder drying process.

3. What is the volume of your application?

To get the most of your rotavap purchase, it's important to evaluate your application's required throughput or sample volume. Once you have an idea of what your expected throughput may be, you can determine the flask size and water bath capacity you need and find out which rotary evaporator can support these.

Generally, 2L, 3L, 5L rotary evaporators are suitable for small laboratory tests while 5L, 10L, 20L are suitable for medium-sized tests. At Yamato, you can find rotary evaporator models that can support 100ml to 2L evaporating flasks and receiving flasks.

Furthermore, don't forget to consider the space you have for your rotary evaporator. You should select a unit with the best size for your facility by considering sample size, laboratory space, accessibility and convenience altogether. Yamato Scientific is one of the first rotavap manufacturers to introduce the set inversion function thru RE202/212 Series, where glassware and bath can be set on either side, left or right, depending on installation location and user's dominant hand. RE202/212 is a switchable rotary evaporator!

4. Choose Between Manual and Automatic Lift

Rotary Evaporators with automated lifts are ideal for continuous workflow while manual lifts offer durability to withstand everyday lab use and are easy to maintain. However, manually adjusting the lift can be time consuming and are not recommended for large volume workloads.

Yamato's RE201/211 Basic Rotary Evaporators & RE202/212 Standard Rotary Evaporators offer manual lifting as a more cost-effective option while the RE301/601/801 Rotary Evaporators are constructed with a motorized lift to easily raise and lower the lift by a simple switch operation.

5. What Condenser type do you need?

The choice between condenser types largely depends on your intended use and the space you have. You can find models with available glassware configurations in diagonal or vertical orientation, or even one with a cold finger configuration.

A diagonal glass condenser is a common choice for standard distillation of samples. On the other hand, vertically set condensers are ideal for distillation of samples with relatively higher boiling points. This is also a great choice for users who have limited bench space.

You also have the option to go for a vertically set cold finger glass condenser for use with ice or dry ice for volatile or low boiling points. This vertically oriented cold finger condenser provides a cooling solution without the necessity for a constant supply of cooling water. This configuration is common for the production of tinctures, yielding a thick concentrate that is considerably pure with relatively little solvent use. Cold finger condenser is common in educational institutions where use is seasonal and where they prefer to avoid the hassle of cooling hose set-up.

At Yamato, you can choose from these 3 types of glassware configurations that are all compatible with the RE201 & RE211 Manual Rotary Evaporator, RE301 Digital Rotary Evaporators, and RE601 & RE801 Highly Functional Rotary Evaporators. RE202 & RE212 Rotary Evaporators, on the other hand, offer only two types of glassware: diagonal glass condenser and vertical glass condenser.

6. What temperature capacity range do you require?

The rotary evaporator's water bath temperature capacity should also be counted as a vital consideration for your unit's configuration. Go through your application procedures and identify the temperature you need for the water bath you're acquiring. At Yamato, you can choose from Water Baths with temperature capacities ranging from RT +5 to 95°C.

To give you an idea as to which rotary evaporator would be compatible with your temperature preferences, Yamato's RE301 Digital Rotary Evaporator and RE601/801 Highly Functional Rotary Evaporators are compatible with the BM500/510 Water Bath system with temperature capacities of RT +5°C~90°C.

On the other hand, the RE201/211 Standard Rotary Evaporator is compatible with water bath BM100, BM110, BM200, BM210, BM401, BM410, which are all capable of heating at RT +5 to 95°C. While RE202/RE212 Manual Rotary Evaporator is compatible with BM302 and BM312 water baths with a temperature range of RT+10 to 90°C.

If you are leaning towards higher temperature capacities, consider getting oil baths as these were made to withstand higher temperature ranges than water baths. Check out Yamato's BO302, BO312, BO400, BO410, and BO601 Oil Bath models, which are all capable of heating up to 180°C.

7. What additional items do you need?

a. Water Bath

As previously mentioned, a rotary evaporator is used with a water bath to keep solvents from freezing during the evaporation process. So aside from choosing the right rotary evaporator, you will also have to select a compatible water bath to come along with your purchase. Yamato offers 4L, 5L and 7L bath capacities with Ø200 to Ø240 internal dimension. Some models are designed with removable water tanks while others are flat shaped baths for convenient cleaning.

When choosing, make sure to opt for a bath that has a temperature capacity that won't exceed your solvent's boiling point. Yamato's water bath models have a maximum operating temperature of up to 90°C to 95°C.

b. Vacuum Pump

A vacuum pump allows you to lower the pressure within the rotary evaporator. The rotary evaporator's vacuum controller works together with the pump so that you can preset a specific pressure. If you're looking for vacuum pumps, Yamato recommends the ULVAC DTC and KNF N820G Diaphragm type dry vacuum pump.

c. Water Recirculating Chillers

Most consider installing chillers for better temperature accuracy and convenience purposes. The cooling water circulator keeps the water in the condenser at a stable temperature allowing ideal conditions for collecting the maximum amount of solvent. These units are more efficient in cooling and do not require constant refilling of dry ice or water and are more environment friendly. Yamato's CF301 and 800 Water Circulators (Chillers), in 4L and 16L capacity respectively, provide powerful cooling capacity. When using the CF800 model, up to 4 Rotary Evaporators can be connected.

d. Solvent Recovery Unit

The Solvent Recovery Unit collects organic solvent substances from vapor sucked in by the vacuum pump during evaporation work of rotary evaporators and prevents discharge of dangerous organic solvents into the air. Yamato's RT200 Organic Solvent Recovery Unit is designed with a hard glass condenser and a 500 ml solvent collecting flask.

e. Additional Glassware

Apart from the glassware set that comes with your initial purchase, you can also order additional evaporating flasks, receiving flasks, joints, trap balls, and other glassware. Yamato offers 100mL to 2L Evaporating and Receiving flasks. Made to order safety-coated glassware are also available.

At Yamato, you can mix and match different constant temperature baths and glassware sets with each unit so you can get a system with all the essential features for your ideal laboratory setup. If you need additional items, be sure to check out Yamato's Vacuum Pump, Chillers, and Solvent Recovery Unit that are compatible with our Rotary Evaporators.

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LOOKING BEYOND ROTARY EVAPORATOR FUNCTIONS

a. Reliable Maintenance & Availability of Replacement Parts

Maintenance of Rotary Evaporators should also play an important role in your purchasing decision. Make sure that you buy a unit that has ready and available replacement parts, so no workflow gets interrupted.

b. System Automation

Automating your rotary evaporator can help make your daily lab routines more efficient by increasing sample throughput and streamlining your workflow. It can also provide uninterrupted protocols, improve testing accuracy, reduce errors, and provide more consistent results. Also consider looking for rotary evaporators with automatic lifts, automatic distillation or continuous bath control that allows for unattended operations.

c. Safety Features

Even though evaporation is a simple operation, heating up aqueous samples, acids, and solvents still pose hazards to lab users. This is why lab safety should also be a vital consideration as with any lab instrument. You have an option to get coated glassware to ensure flasks don't shatter during operation due to extreme pressure from the vacuum pump. Most manufacturers, such as Yamato, feature advanced options like motorized lifts and auto-shutoff for sudden power outages.

Achieve efficient and productive laboratory protocols by choosing the most appropriate rotary evaporator unit for your facility. Considering the key points mentioned above can guide you when picking out the best model for your applications.

With over 130 years of experience in the industry, Yamato Scientific America is well-equipped when it comes to providing superior services and state-of-the-art products for the scientific market. All products are manufactured in compliance with stringent quality standards and international regulatory requirements.

Whether you are ready to make a purchase or still need to do more research, Yamato Scientific America is here to help. Contact us at **1-800-292-6286** or reach us at **customerservice@yamato-usa.com**.