Lab Manager 2018

LABORATORY SHAKERS RESOURCE GUIDE

Introduction

by John Buie

Mixing solutions is one of the most common laboratory tasks. Over the years, a number of automated methods for mixing have been devised, all of which remove this burden from the operator by offering a sustained and controlled stirring or shaking action for indefinite periods of time.

Laboratory shakers consist of an oscillating board on which solutions can be placed in flasks or beakers and are popular for the simultaneous agitation of multiple solutions, such as mixing the contents of microplates. Samples in a lab shaker can be agitated via a linear motion, by an orbital motion to create a vortex in the solution, or a number of other motions.

Unlike laboratory instruments that develop incrementally over time without any real innovation, the technology in lab shakers continues to advance at a faster rate. The future for lab shakers is likely to involve the development of instruments that offer alternative mixing actions for more thorough and efficient mixing, possibly mimicking further the action of the human wrist. Other innovations are likely to include instruments capable of mixing more samples simultaneously, and greater integration with other lab processes, allowing for more automation in the laboratory and less human intervention.

The Many Ways to Shake Samples

When shopping for the right shaker, there are many factors to consider; as the rock band Genesis would say, there's an "ocean of motion."

by Mike May, PhD

A few decades ago, every scientist shook samples by hand. But today's scientists can choose from a wide range of shakers that use all kinds of motions.

Going Through the Motions

Orbital motion: The most popular motion is orbital shaking, where the shaker moves in a circular orbit. Orbital shaking is often used for culture and growth of microorganisms.

Rocking motion: Rocking shakers provide a seesaw-like motion. These shakers are used in molecular biology and biochemistry labs for washing gels and membranes, and also for binding assays and hybridizations.

Hand motion: Hand-motion shakers replicate the up-and-down motion of a handshake. Scientists use hand-motion shakers for DNA extraction, among other applications.

Wrist action: Wrist-action shakers swirl the sample. Applications for these wrist-action shakers include solvent extraction and equilibration.

Reciprocating motion: Beyond hand shaking or swirling samples, you can slosh them with a reciprocating-motion shaker that goes back and forth. Troemner (Thorofare, NJ), for one, makes such shakers, which can be used in many different testing procedures.

Rotating motion: For delicate samples, some scientists prefer a rotating shakers, which gently spin samples in test tubes, flasks, or bottles.

Picking Your Motion

Given the wide range of shaker motions, how does a scientist know which kind to purchase? Here are some suggestions:

You need to know how vigorous the mixing needs to be. This will determine the type of motion required. For example, orbital, reciprocating, and wrist-action devices all can vigorously shake a sample.

The type of holder for the sample must be considered. For example, a tube roller, although giving a gentle rocking motion, is not suitable for containers with fragile gels inside, which are better placed on a rocking platform. Likewise, tubes need to be held in place while mixing or shaking to prevent them from moving around.

Questions to Ask When Buying a Lab Shaker

It all comes down to the sample

by Ryan Ackerman and Mike May, PhD

How temperature-sensitive is your sample?

The temperature sensitivity of the samples will have a direct influence on the configuration of the shaker or rocker that is ideal. Water bath units complete with heating and cooling options, as well as incubator- style shakers are available. Either unit typically comes with a choice of mechanical or digital options for temperature control.

Are your samples time- or agitation-sensitive?

Many modern shaker systems can be programmed to carry out specific shaking patterns for pre-defined periods of time, depending on the needs of the samples and process.

What sort of shaking range do you require?

Some models will shake as slow as 15 rpm for slow-speed staining applications, and go as high as 1,200 rpm.

How much space do you have?

The answer to this question might determine whether you need a shaker that sits on a benchtop or one that sits on the floor. Even various versions of benchtop and floor models offer a size range.

How large are your samples?

You should have an upper weight in mind. All shakers have weight limits for maximum performance. A triple eccentric drive can handle heavier loads than a shaker with a single eccentric drive.

BUYING TIP:
CUSTOMIZATION

Instrument customization reflects workflows that evolve or are anticipated to change over time. Examples include a larger-than-normal number of flasks or Petri dishes, the need for one shaker to accommodate two or more cell culture expansions, the ability to run two experiments side by side, or simply the need to do more with less. But this level of adaptability requires thorough communication between customer and vendor. Those requesting custom shakers must be specific about numbers and sizes. The more information provided, the better the custom product will turn out.

What are your container requirements?

Most manufacturers offer dedicated platforms that are designed to shake only a single vessel size, such as a flask. These platforms provide maximum capacity and come with clamps installed versus universal platforms that provide maximum flexibility for using different sizes of lab ware on a single platform. If you don't plan to shake things too vigorously (less than 250 revolutions per minute), adhesive mats and tapes might be enough to keep your containers in place.

Some Shaker Platforms Control Temperature and RPMs Over a Wide Range

Most of today's biology labs need to shake something, and often in a controlled environment. That's a job for a temperature controlled or incubator shaker. Where will automation fit in? Here are some predictions.

by Mike May, PhD

Incubated/refrigerated shakers are often considered more versatile than open-air orbital shakers. They offer a wide variety of temperature options including ambient, incubation, and refrigeration. The breadth of experiments and applications that require shaking need this range of temperatures.

Temperature controlled shakers are primarily used to culture various cell types, including but not limited to bacteria, insects, yeast, algae, and plant and mammalian cells. Orbital shakers operate at a wide variety of temperatures and speeds, creating the optimal environment for the particular cell line that they are growing. The reason for shaking the cells is to get more oxygen to the cell lines, and actually give them just the right amount that they need to grow at their optimal rate.

An eccentric option

In some applications, biologists shake particular cells in very specific ways. As an example specific shakers have been developed which provide the mammalian cell market with a product that shakes and incubates in a regulated CO2 environment.

Such temperature-controlled shakers provides a variety of key features, including vibration-free shaking without affecting the internal environment. In addition, users may select a specific temperature, speed, and CO2 concentration to create the desired environmental conditions for the cells.

Like other chambers used for growing cells, incubator shakers need to be kept clean, with many offering high-temperature decontamination, this allows the user to decontaminate the inside chamber, eliminating the possibility of cross-contamination. Other features such as seamless interior chambers provides an internal surface that eliminates a potential source of contamination and makes the chamber exceptionally easy to clean.

In fact, it pays to look for a wide range of features when shopping for a temperature-controlled shaker, and some seem more obvious than others. For example, most users would look for easy decontamination, but what about options that save money? For example, sealed inner glass door for viewing the cultures without compromising the sample and environmental integrity while reducing costly CO2 consumption. So sometimes you can gain convenience and save money where you might not expect it.

Finding your features

When you go shopping for an incubator shaker, it's worth putting together a checklist of what you need. For one thing, how much room do you have? The answer to that question might determine whether you need a shaker that sits on a benchtop or one that sits on the floor. Even various versions of benchtop and floor models offer a size range. Still, there's much more to consider. How much do you want to shake? You should have an upper weight in mind. Also, keep in mind that all shakers have weight limits for maximum performance.

What you want to shake things in—the containers that you'll use—should also be part of the purchasing decision. Most manufacturers offer dedicated platforms that are designed to shake only a single vessel size, such as a flask, these platforms provide maximum capacity and come with clamps installed versus universal platforms that provide maximum flexibility for using a mix of different-sized labware on a single platform. If you don't plan to shake things too vigorously, say less than 250 revolutions per minute (rpm), adhesive mats and tapes might be enough to keep your containers in place. Whatever you have in mind, think about writing down a list of all the possible containers and shaking speeds you'll use to focus your search.

On top of those specifications, don't forget the more obvious ones, like the temperature range. In general, refrigerated incubator shakers can take cells down to about 4 degrees Celsius, and high-temperature ones can go up to 80 degrees Celsius, which can be used to grow thermophiles. Even if you just need incubated temperature ranges today, in the future you may want to perform protein studies where refrigerated temperatures of 16 degrees Celsius are required. Many users opt for an incubated/ refrigerated shaker to grow with their needs, with these versatile units you can grow bacteria and yeast at 37 degrees Celsius or hold temperatures at 4 degrees Celsius, which makes cells ideal for protein expression studies, plasmid purification, and insect cell culture.

Also, try to figure out how big a shaking range you need. Some models will shake as slow as 15 rpm for slowspeed staining applications and go as high as 1,200 rpm.

When it comes to temperature and shaking speed, think also about how accurately you need to adjust those parameters. Where more accuracy is needed, go for a digital shaker, which displays the settings on an LED screen as opposed to analog controls. The digital version also benefits anyone who needs to repeat procedures accurately.

Product Spotlight

Heidolph offers a wide range of lab shakers, from platform shakers overhead mixers, orbital shakers, vortex mixers, vibration shakers, incubator shakers up to different lab shakers which are available in different motions.

Choose your lab shaker from six specific motions, from one to three-dimensional movements – many models offer options of different orbits and angles to provide increased mixing in the motion range.

Learn More

Insights on Lab Shakers for...

by Mike May, PhD and Angelo DePalma, PhD

Separation

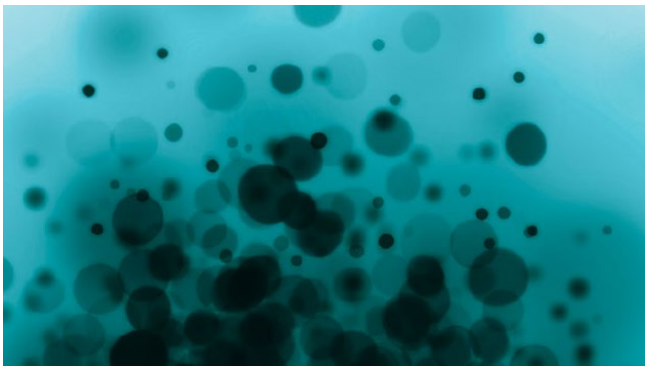
Sieve shakers can separate particles of a wide variety of sizes. These shakers get used in many applications, including work with anything from coffee and construction materials to sand and soils.

In this shaker market, customers seek different requirements. There has been more demand for calibrated sieve shakers and installation qualification/ operational qualification documentation for these sieve shakers." Consequently, some vendors are developing sieve shakers that provide this documentation.

Customers with multiple facilities in different countries are often concerned about reproducibility of the sieve analysis when compared across facilities. To deal with that issue, some shakers have a sieve acceleration mode that allows the sieve shaker to operate independently of the main's frequency—50Hz versus 60Hz—in various countries, which influences the sieving operation.

Beyond being able to move a device around the world, users want simplicity in the day-to-day use of a sieve shaker. This often affects which clamping system is combined with the unit to allow the customer to easily install and remove the sieve stack and sample.

At the very beginning of shopping for a sieve shaker, though, keep in mind the fundamentals. Some customers just want a very basic sieving operation, while others need a high level of calibration and accuracy. Some customers make ordering mistakes by just purchasing a basic sieve shaker, only realizing later that they would benefit from additional features or settings.



Biological Samples

"Shaken, not stirred" was James Bond's preferred mixing method for martinis. Similarly, biological shakers aerate and mix cells with their media by the action of a moving platform. Shaking is often preferred with cell cultures because overhead or magnetic stirrers can induce shear damage in cells and are impractical with multiple culture vessels.

Shakers may be deployed inside or outside incubators, depending on the requirements of the specific cell or organism. They are common equipment in pharmaceutical, biotechnology, and vaccine development, as well as in biological safety and environmental labs.

Shakers lend their name to another category of cell culture product, the shaker flask, a cell culture vessel specially designed for use with shakers. Until the advent of large-scale cell culture, many vaccine manufacturing processes occurred in shaker flasks.

Customization may occur when working with unusually shaped vessels or specialized cell cultures. Small orbital shakers can be integrated with carbon dioxide incubators, for example. This setup is suitable for biological samples that thrive in anaerobic environments and require temperature control as well.

Microtiter plates require some special care when subjected to automated shaking. Users require a system with a good hold-down mechanism. Some systems use clamps or spring-loading to keep plates from slipping on the platform. The other consideration is a means of sealing plates without encouraging condensation or leaching of foreign materials into the wells.

LINDA Says...

Purchasers should consider not just price alone, but also value and reliability. Shakers do not typically to break down. Many vendors do not even offer routine maintenance services. But in labs in which the devices operate 24/7, there is a higher risk of failure. If your shaker breaks down, there goes your experiment—so a high-quality shaker is an important investment.

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