

Temperature control instrument

Incubator: is a laboratory device used to grow and maintain mammalian cell cultures, microbes, or plant cells by controlling environmental conditions (temperature, humidity and carbon dioxide (CO₂) at optimal levels.

Changes in the atmospheric CO₂ can alter the pH of the culture media. A controlled atmosphere is achieved by using a CO₂-monitoring device, which draws air from the incubator into a sample chamber, determines the concentration of CO₂, and injects pure CO₂ into the incubator to make up any deficiency.

Air is circulated around the incubator by using a fan to keep both the CO₂ level and the temperature uniform.

Incubators According To Design:

Cell incubators usually come in one of three types of designs:

1. **Air draft incubators:** circulate air throughout the interior of the incubator to maintain constant temperatures. This style of incubator is the most commonly used and is used for growing large amounts of cells.

These incubators are designed to respond quickly to environmental needs of the cells. However, these incubators lose the temperature very quickly and must consistently adjust the air to control the temperature.

2. **Dry wall:** Pass air within the walls of the incubator. These walls then radiate the temperature to the growing chamber. For this reason these incubators are sometimes called radiant incubators. They are better

at **maintaining** a constant temperature because the jacket does not let heat escape through the walls of the incubator.

These incubators respond slowly to temperature adjustments compared to Air draft incubators

3. Water jacket.

Water-jacket incubators are surrounded by water within the walls of the three sides, the top, and the bottom.

Advantages include stable temperature and increased security in the event of power failure (due to water's natural insulation abilities).

These are usually smaller incubators and work by the same principles as dry wall incubators. These incubators also respond **more slowly** to temperature changes.

Water bath

The water bath, like incubator, is an apparatus for controlled temperature incubation of **cultures, liquids** and many other laboratory tests. The temperature of water bath is adjusted by a thermostat that can be set at any desired temperature ranging from 20-100 c. the water baths are available at various types and capacities. The heating coil may be of immersion type, or enclosed in a case. Some models have propellers that help to circulate the water so that identical temperature is maintained throughout the water bath.

Types of water bath

1. Circulating Water Baths

Circulating the water baths (also called stirrers) are ideal for applications when temperature uniformity and consistency are critical, such as enzymatic and serologic experiments. Water is thoroughly circulated throughout the bath resulting in a more uniform temperature.

2. Non-Circulating Water Bath

This type of water bath relies primarily on convection instead of water being uniformly heated. Therefore, it is less accurate in terms of temperature control. In addition, there are add-ons that provide stirring to non-circulating water baths to create more uniform heat transfer. Constant temperature water baths generally contain an immersed electrical heating arrangement with a thermostat for its control. Also in use are the simple type constant temperature baths heated by an electrical lamp or heating coil, which can be slid into and out of a metal pocket inside the water bath submerged at its bottom.

3. Shaking Water Bath

Shaking water bath used to keeps the samples in motion while they are heated.. In microbiological practices, constant shaking allows liquid-grown cell cultures grown to constantly mix with the air. Shaking water baths provide additional controls that allow users to control the speed and frequency of the movements, and oxygen with the culture.





Applications of Water Baths

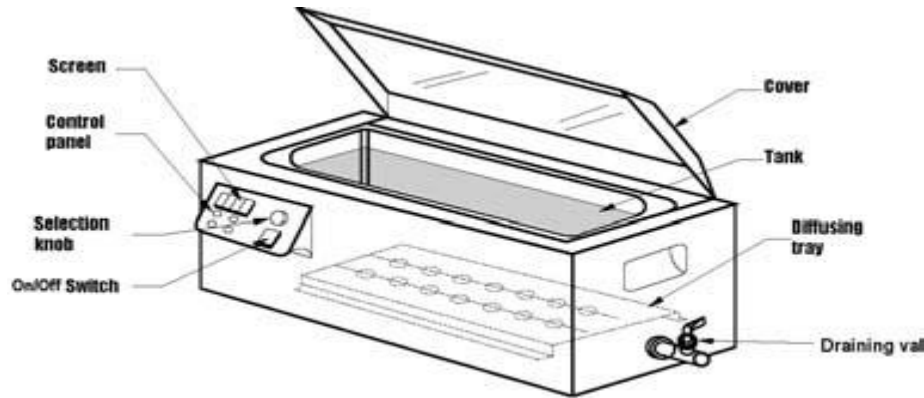
Some of their applications include:

- Coliform Determinations
- Sample Thawing
- Bacteriological Examinations
- Material / corrosion tests
- Educational / Government Laboratories
- Clinical Laboratories
- Research Laboratories – Chemistry, Biology, Microbiological Assays / Cell cultivation, Biochemistry, etc.
- Food & Cosmetic Technology Laboratories

Use and care of water bath

1. Maintain the minimum level of water bath with chemically pure water. Avoid using **tap water** as salts from tap water may get deposited on the coil and affect its function.
2. Always use a **thermometer to check that temperature** is stable at the desired level.
3. Be sure that the substance being incubated is below the surface of the water in the bath.

4. It is advisable to cover the flasks, plates and tubes during incubation to avoid contamination and dilution as a result of condensing water from the lid of water bath.
5. Clean the water bath regularly.



Autoclaves and hot air ovens

Autoclave: is one of laboratory devices used for **sterilization and decontamination** of different materials by subjecting high temperature and high pressure for full destruction of microorganisms.

Theory and principal

1. An autoclave operates by using **steam under pressure** for sterilizing agents. The principle is that water boils when its vapor pressure is equal to the pressure of the surrounding atmosphere. If the pressure is **raised inside** a closed vessel the temperature at which water boils **will rise above 100**°C. At 15 **psi** Pressured water boils at **120** °C and therefore high pressures enable steam to reach higher temperatures, thus increasing its killing power.
2. Steam is able to penetrate objects with cooler temperatures and once the steam contacts a cooler surface, it immediately condenses to water. **This creates negative pressure** at the point of condensation and draws

more steam to the area. Condensation continues as long as the temperature of the condensing surface is less than that of steam; once temperatures equilibrate, a saturated steam environment is formed.

3. Achieving high moisture content in the environment is important for effective autoclaving. **Since the ability of air to carry heat is directly**

related to the amount of moisture present in the air, the more moisture present, the more heat can be carried. Steam therefore results

in the efficient killing of cells, and the coagulation of proteins.

4. During the sterilization process the autoclave chamber should be completely saturated by steam, since any air pocket may adversely affect the sterilization and results in areas of insufficient sterilization.

What is the standard temperature and pressure of an autoclave?

Processes conducted at high temperatures for short time periods are better than over lower temperatures for longer times. Some standard temperatures/pressures employed are 115 C/10 p.s.i., 121 C/ 15 p.s.i., and 132 C/27 p.s.i. (psi=pounds per square inch).



Sterilization by using autoclave depends on:

1. Time: it is important to choose the sufficient time for autoclave cycle as prolonged time can cause damage to the material being autoclaved, example, nutrient materials in bacterial growth media, break down in the presence of heat for prolonged time. Time usually ranges from 15min. to 20 min. depending on the material being autoclaved.

2. Volume: never fill the container with material to be autoclaved more than 80% of total container volume. Otherwise, over filling may result in explosions.

3. Microbial contamination: Contaminated items take longer to sterilize than disinfected items. Consequently, water sterilized faster than yeast-extract containing media (which contains lots of microbes). Also, some types of microbes are more resistant to autoclaving than others.

4. Containers: steel containers are commonly used to contain material during autoclaving. The use of a plastic container increases the time needed for autoclaving, **since plastic is a good insulator**. On the other hand, stainless steel containers are not only durable; they are a -better conductor of heat so the run time will be a little faster.

Hot air ovens: are electrical devices used in sterilization by **circulating a dry hot** air and thus killing microorganism by protein denaturation.

They were originally developed by Pasteur. The oven uses dry_heat (temperature 160 c for 2 hours) to sterilize articles.

Hot air oven consists of:

Thermostat: controlling the temperature.

Double walls: to insulate and keep the heat in and conserves energy.

Air filled space: in between to aid insulation.

Air circulating fan: helps in uniform distribution of the heat.

Advantages of hot air oven

- Used for sterilizing items such as glass wares, metal instruments, powders, waxes, and impermeable oils.
- They do not require water and there is not much pressure build up within the oven, unlike an autoclave, making them safer to work with and also makes them more suitable to be used in a laboratory environment.

Disadvantages of hot air oven

- Autoclave is more rapid than ovens.
- As they use dry_heat instead of moist_heat, some organisms like prions, may not be killed by ovens.

Hotplate Magnetic Stirrer

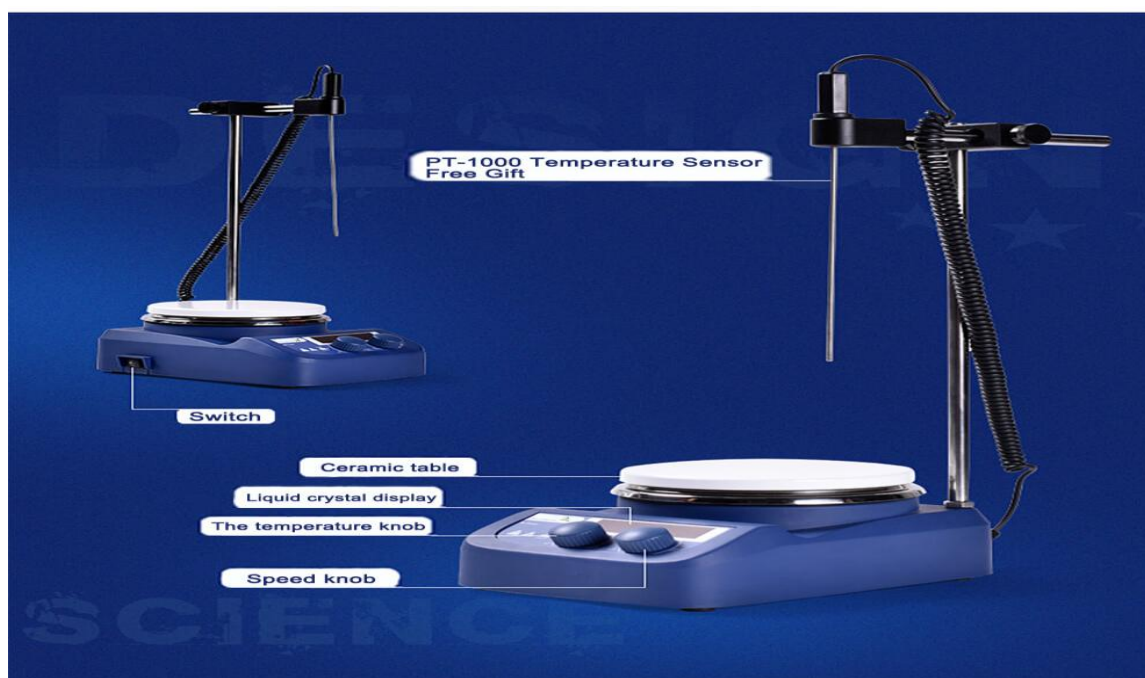
What is Hotplate Magnetic Stirrer?

- [Hotplate Magnetic Stirrer](#) is laboratory devices that uses to stir or mixing the solution by **create rotating magnetic field**. It is possible to use either liquids or solids samples to obtain a homogeneous liquid mixture.

- Laboratory magnetic stirrer hotplate is often used in chemistry and biology, for examples preparation of bacterial growth as well as buffer solutions. Respectively. And other application

-**The main function** of a stirrer is to agitate the liquid for speeding up the reactions or improving mixtures.

- **The way the Magnetic Stirrer works** that an **external magnetic field** is applied to the magnetic stirrer mix solution. This happens when the **magnetic bar** immersed in within the liquid causing the stirring action. The magnetic stirrer is a fairly small device and hence it is very easy to use in a laboratory. The hot plate reaches a temperature of over 250°C (480°F) with an output of 180 watts. The magnetic stirrer is adjustable from 0 to up to about 1400 rpm



- Who to use the magnetic bar

- In general the bar magnet is coated with plastic and plate contains rotating magnet. It is possible to **create a rotating magnetic field with the help of a rotating magnet.**

- as the **Magnetic stirrer bars** often is **small size**, **it's more easily cleaned & sterilized.**

- As the **magnetic stirrer bar limited size**, magnetic stirrer with heating is often **used in relatively small experiments, such as 4 liters or less stirring capacity.**

- Magnetic stir bars also have **difficulty in dealing with viscous liquids or thick suspensions.** So if you want to do larger capacity or more viscous liquids stirring experiment, some sort of mechanical stirring is typically needed.



Type of hotplates:

Generally there are two common types of hotplates:

1) **Electric Hotplate:** uses Aluminium/ceramic/Enamel/iron surface or coils which gets heated when electricity flows. There are pros and cons attached to all types of surfaces. These hotplates are although cheap in cost but risky and surface remains hot for quite a long time.

2) **Induction Hotplate:** This uses the magnetic induction heating technique by creating a magnetic field to heat the vessel. They are costly but quite safe and time taken to cool down the surface is also quite less.

Procedure

1. Prepare 50 ml of mackonky agar in 250 ml conical flask,
2. Homogenate the media by using magnetic hot plate at 70 C°. With Stirring it.
3. Finally the media will be homogenate, produced cleared and collared solution, and notice the distinction between two cases
4. Switch off the devices.

