

## Autoclave

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### Abstract:-

Autoclave is an instrument which is used for sterilization purposes. It works on the principles of steam under pressure. Autoclave is an example of moist heat sterilization. It works at 121°C, for 15 min. at 15 lb pressure depending on the load. The steam kills all the bacterial spores in addition to fungi, bacteria and viruses but it has no effect on prions. Prions exhibit resistance to moist heat sterilization. It is widely used for sterilizing media, glassware, pipettes, cultures and many others. One and only application is sterilization with respect to biology and biotechnology.

### Introduction:-

An autoclave is a pressure chamber designed for industrial processes that need pressure and an elevated temperature dissimilar to ambient air pressure. Autoclaves are useful in the chemical industry to vulcanize rubber and cure coating and in the medical application for sterilization and for hydrothermal synthesis. Charles Chamberland invented autoclaves in 1879. At that time, scholars started understanding the necessity of sterile surgery and medical practitioners needed a reliable sterilization method than that provided by open flaming. The autoclaves' benefits were soon apparent and eventually, it became an invaluable part of every hospital and private clinic.

Microbiology, agriculture, veterinary medicine, body piercing, dentistry, funeral homes and mycology are some of the fields where sterilization autoclaves are largely used. They differ in function and size depending on the media that needs to be sterilized. Autoclaves are built to operate at high temperature. This characteristic enables steam to infiltrate material within the autoclave and effectively decontaminate it. The microorganism can be removed by way of the high temperature features of the autoclave. Autoclaves provide a number of display features that indicate whether the device is effective. These displays work in tandem with one another to specify how temperature change based on treatment times. The

autoclaves market has been witnessing strong growth over the years as it requires low capital investment for installation and is more reliable than other sterilising equipment. Rising demand for healthcare services and the aging population will fortify the demand for autoclave in the coming years.

#### **Autoclave work :-**

The autoclave is used for sterilization of experimental materials and instruments which are needed in sterile conditions. The sterilization is done based on moist heat killing. Moist heat has high penetration power and can penetrate the bacterial cell and denature the proteins. The denaturation of essential enzymes and protein would eventually kill the bacteria. Apart from proteins, nucleic acids and cell membranes are also disrupted. Moist heat sterilization is carried out at a temperature more than 100°C. At 100°C, water boils and the steam is produced. The steam is concentrated in the chamber of the autoclave. The temperature of the autoclave is 121°C and pressure is 15 psi. The reason why we consider this temperature and pressure as ideal is that at this condition most of the bacteria and its spores are killed. The most resistant bacteria such as *Bacillus stearothermophilus* and *Clostridium PA3679* are killed at this temperature.

#### **Construction:-**

The autoclave consists of a chamber made up of gun metal, pressure valve, pressure meter, safety lock, and other essential parts. There are two major types of autoclaves, vertical and horizontal autoclaves. Vertical autoclave is most commonly used in the laboratory. The horizontal autoclaves are used in industries as well as laboratories. The horizontal autoclaves can be used to sterilize a large volume of samples.

#### **Material can be sterilized:-**

Different types of material can be sterilized using an autoclave. Material such as Lab coat, Nutrient media, non-corrosive reagent can be sterilized. However, materials such as oil, wax, flammable liquids such as alcohol, cannot be sterilized by autoclave. The steam cannot penetrate through oil and wax. Thus, for such material hot air sterilization is preferred. For petroleum products, membrane filtration process is carried out.

Nutrient media containing a high amount of sugar cannot be sterilized as autoclaving sugar leads to the formation of caramel.

#### **Uses:-**

It is a steam sterilization chamber, so it is used for sterilization. Typically, the types of things sterilized in autoclaves are lab equipment/supply reusable medical goods and general lab biohazard.

**There are three primary types:-**

- Gravity
- Prevacuum
- Steam Flush pressure Pulse (SFPP)

Gravity is the oldest type, using steam pressure and gravity to remove ambient air from the system.

Prevacuum is the most common large capacity type used in hospitals, through most new hospitals size autoclaves also have gravity and Pulse cycle for those instruments that demand them.

**Operational steps of an autoclave:-**

- Unlock the outer chamber by rotating the lock mechanism.
- Add a sufficient level of water for steam generation in the water storage tank.
- Make sure that the chamber is clean.
- Place the items to be sterilized in the inner chamber.
- Close the lid and turn the power on.
- Monitor change in temperature and pressure till desired levels have been achieved.
- Release steam/pressure if necessary
- Turn off power once the process is complete and release the steam/pressure using the release valve.
- Carefully remove the sterilized product

**Now we have discussed about different parts of an autoclave are following:-**

An autoclave is not a simple machine, It is a result of sincere efforts and hard work. There are more than 100 little and main components which are used in an autoclave. In this part, I am showing the main parts of an autoclave for smooth operation and knowledge.

- **Test Chamber:-** The test chamber shown here is an triple walled test chamber. These are ideal for dry sterilization of surgical equipment and can generate a pressure of up to 20 PSI.

- **Multi Port valve:-** This is used to transfer of steam from the jacket to test chamber. With multi port valve, the user can easily select the quantity and pressure of steam to be transferred to the jacket. whether it has to be slow, quick. All options are available.
- **Safety Valve:-** Used to release pressure in case the pressure generated is more than what was needed.
- **Vacuum Breaker:-** To ensure no vacuum is created.
- **Compound Gauge for chamber:-** Shows values in kg/cm<sup>2</sup>
- **Pressure Gauge for the jacket:-** Shows values in kg/cm<sup>2</sup>
- **Pressure lock:-** For locking and securing the sterilization chamber.
- **Phase indicator:-** shows how many phases of electric current are available.
- **Load:-** Confirms that the steam pressure is built.
- **Digital Temperature Indicator:-** shows the current temperature as well as the option to change the temperature setting.
- **water Level:-** The storage tank shows the water level inside the unit.

**Now we have discussed about autoclave used while preparation of the media to grows microbes :**

When you prepare media, the environment in which you do so is not sterile, so the media is not sterile. If that is the case, unwanted bacteria will grow in the media. By autoclaving, all bacteria is killed so anything that grows is the bacteria you intend on growing. Autoclaving also helps homogenize the media (due to the high temperature) since solubility in water increases at a higher temperature.