MEDICAL INSTRUMENTATION
SECOND YEAR
2021-2022
LECTURE NO.(6 PART B)
AUTOCLAVE

DR. SAIF AL-SABTI

Procedure for running an autoclave

In general, an autoclave is run at a temperature of 121°C for at least 30 minutes by using saturated steam under at least 15 psi of pressure. The following are the steps to be followed while running an autoclave:

- Before beginning to use the autoclave, it should be checked for any items left from the previous cycle.
- A sufficient amount of water is then put inside the chamber.
- The materials to be sterilized are placed inside the chamber.
- The lid is then closed, and the screws are tightened to ensure an airtight condition, and the electric heater is switched on.
- The safety valves are adjusted to maintain the required pressure in the chamber.
- Once the water inside the chamber boils, the air-water mixture is allowed to escape through the discharge tube to let all the air inside to be displaced. The complete displacement can be ensured once the water bubbles cease to come out from the pipe.

The drainage pipe is then closed, and the steam inside is allowed to reach the desired levels (15 lbs in most cases).

- Once the pressure is reached, the whistle blows to remove excess pressure from the chamber.
- After the whistle, the autoclave is run for a holding period, which is 15 minutes in most cases.
- The electric heater is switched off, and the autoclave is allowed to cool until the pressure gauge indicates the pressure inside has lowered down to that of the atmospheric pressure.
- The discharge pipe is then opened to allow the entry of air from the outside into the autoclave.
- Finally, the lid is opened, and the sterilized materials are taken out of the chamber.

4. Types of Autoclave

There are different types of autoclaves present in the market, some of which are:

- Pressure cooker type/ Laboratory bench autoclaves (N-type): These, as domestic pressure cookers, are still in use in many parts of the world. more modern type has a metal chamber with a secure metal lid that can be fastened and sealed with a rubber gasket It has an air and steam discharge tap, pressure gauge, and safety valve. There is an electric immersion heat at the bottom of the chamber.
- Gravity displacement type autoclave: This is the common type of autoclave used in laboratories. In this type of autoclave, the steam is created inside the chamber via the heating unit, which then moves around the chamber for sterilization. This type of autoclave is comparatively cheaper than other types.
- Positive pressure displacement type (B-type): In this type of autoclave, the steam is generated in a separate steam generator which is then passed into the autoclave. This autoclave is faster as the steam can be generated within seconds. This type of autoclave is an improvement over the gravity displacement type.
- Negative pressure displacement type (S-type): This is another type of autoclave that contains both the steam generator as well as a vacuum generator. Here, the vacuum generator pulls out all the air from inside the autoclave while the steam generator creates steam. The steam is then passed into the autoclave. This is the most recommended type of autoclave as it is very accurate and achieves a high sterility assurance level. This is also the most expensive type of autoclave.

Pressure Cooker Type

Common Laboratory Autoclave

Vertical Autoclave

Horizontal Autoclave

Large Automatic Hospital Autoclave

Figure 4: Types of Autoclaves

5. Construction/Parts of Autoclaves

The autoclave is made of following components/parts:

- Vessel/pressure chamber: The vessel is made from stainless steel. The inner chamber is protected by outer jacket. The inner chamber is the place where we keep the autoclavable material for sterilization. The size of the chamber varies and selected based on the motive of use.
- Heater: The electric heater is placed beneath the chamber. The electric heater working principle is similar to geezer. The electric heater start heating it causes boiling of water. The user need to maintained the water level as per the marking. Less water may cause burning and more water may lead to enter water in the experimental material. .
- Lid/Door: The Vessel mouth is covered by lid or door. It is also made from stainless steel. The lid allows trapping and retaining the heat and pressure inside the chamber and producing favorable environment for sterilization. The lid is tightly closed with the help of airtight screw.
- Pressure gauge: It is present on the upper surface of lid. Its function is to indicate the level of pressure that is produced during autoclaving. It is vital part because it allows us to visually see the rise of pressure and alert for any forthcoming mishap hence it ensures the safety. والتنبيه الى اي حادث موسف وشيك
- Pressure releasing unit/whistle: The whistle is placed on top of the surface of the lid, just like pressure cooker. The whistle allows us to release the pressure whenever required.
- Safety Valve: It is present on the surface of the lid. Their function is to avoid catastrophic accident especially when pressure inside the chamber is uncontrollable.

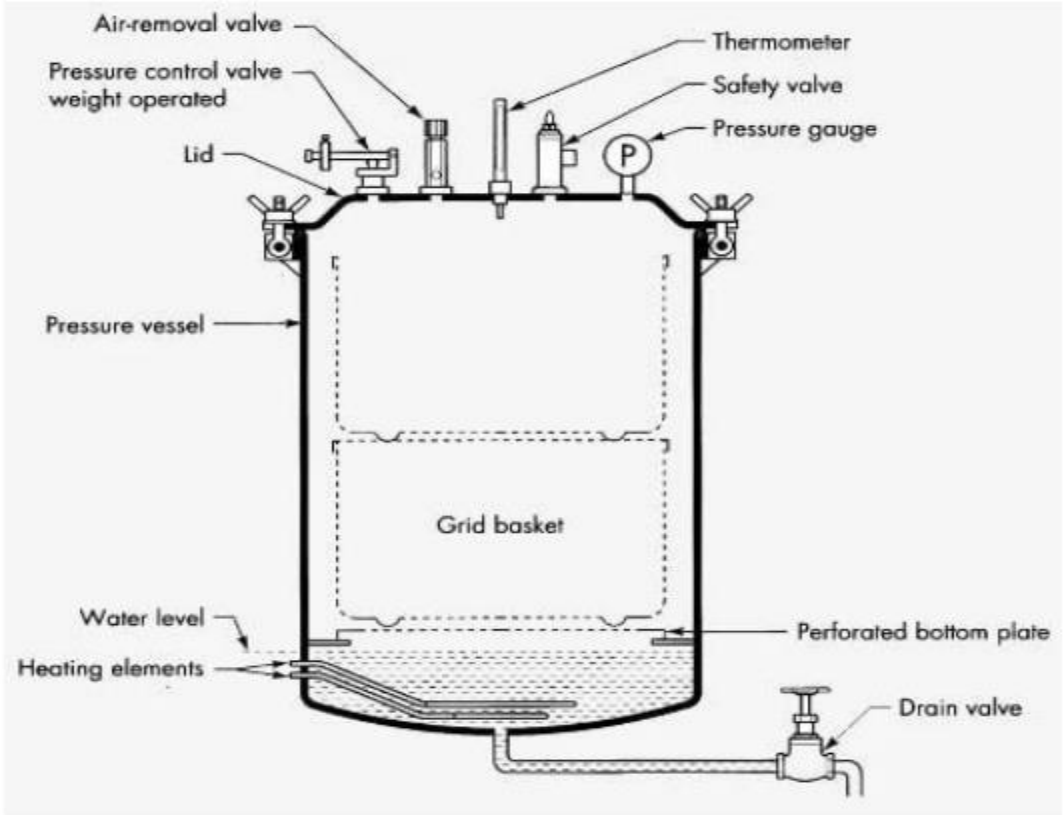

Figure 5: Construction/Parts of Autoclaves

6. Materials Are and Aren't Autoclavable

An autoclave is an effective way to sterilize equipment, tools, and certain chemicals. However, not all materials can be autoclaved. Therefore, before autoclaving, ensure the material or items can withstand high temperatures and pressure.

- Autoclavable materials:

- Glass: Only autoclave pyrex or pyrex type glass materials. Therefore, before purchasing, ask the vendor about the glass material.
- Metals: Most metals available in labs can withstand an autoclave environment.
- Polypropylene-made items: It's an autoclavable inexpensive resin used to make different bags, trays, and pans.
- Plastic items: Not all plastics are autoclave safe. Other than products made from polypropylene (PP) and polypropylene copolymer (PPCO), items made from fluoropolymers, such as Teflon PFA, FEP, or ETFE, can be autoclaved
- Autoclave polycarbonate items with caution. Do not expose them to steam additives and alkaline detergents. Also, they can only withstand 30-50 autoclaving cycles. However, you should note that sterilizing these materials reduces their mechanical strength.
- Media solutions, paper and latex gloves placed in biohazardous autoclave waste bags, surgical tools, contaminated solid items, water, hospital linens, and animal food and bedding are autoclavable.

- Non-autoclavable materials:

- Do not autoclave the plastic materials made from HDPE, LDPE, PET, and PETG resins. They can melt and damage your autoclave – instead, sterilize these materials with gas (ethylene oxide formaldehyde).

-Paper is a combustible substance, so it should not be directly autoclaved. It might catch fire.

-Do not sterilize water-proof or water-resistant materials like powders and oil with an autoclave.
- Never autoclave materials that are flammable, toxic, and corrosive (such as phenol, ether, trichloroacetic acid, and chloroform).
- Do not sterilize household bleach or chlorine-based (or chlorine-containing) products, radioactive materials, acids, low-density (LDPE) and high-density polyethylene (HDPE), materials contaminated with chemotherapeutic agents, or paraffin-embedded tissue using the autoclave.

7. Industrial Autoclaves VS. Medical Autoclaves

Autoclaves may be used in a variety of industrial and medical applications. Industrial autoclaves are used in manufacturing environments to process parts and materials using heated steam and pressure: for example, in the manufacturing of pressure treated woods and specialized rubbers used in the tires of your car. Autoclaves are also used in the scientific research and pharmaceutical industries – beyond sterilizing equipment used in laboratory research most autoclaves come equipped with a liquid cycle to sterilize liquids used in aboratory environments. Medical steam sterilizers are used in healthcare environments for the sterilization of heat and moisture-stable items such as surgical instruments, implanted medical devices and surgical drapes and linens. The cycles used in medical steam sterilizers are developed and validated according to recognized industry standards. In the United States, steam sterilizers used in healthcare must be cleared for use by the Food and Drug Administration for the sterilizer manufacturer's stated intended use.