TOPIC 6. STERILIZATION AND PASTEURIZATION EQUIPMENT

PLAN:

1. Sterilization process.
2. Vertical autoclave AB-2.
3. Rotary sterilizer.
4. OXS-1 "Xunister" sterilizer.

GLOSSARY (ГЛОССАРИЙ)

Uzbek	Russian	English	Content
Sterilizatsiya	Стерилизация	Sterilization	A thermal, chemical, or physical technological process aimed at destroying all microorganisms in a product or equipment, including vegetative cells and spores.
Pasterizatsiyalash	Пастеризация	Pasteurization	The process of reducing the number of pathogenic and vegetative microorganisms by heating food products at a specific temperature and for a specified period of time.
Sterilizator	Стерилизатор	Sterilizer	A special technological device designed for the sterilization of products or technological containers.
Avtoklav	Автоклав	Autoclave	A hermetic apparatus that allows for the sterilization of materials and products using high-pressure saturated steam.
Bosim	Давление	Pressure	The physical quantity of vapor or gas acting on the internal surface of the apparatus in autoclaves and other airtight devices.

Sterilization process

The sterilization process is carried out periodically and continuously in devices used for transportation above atmospheric pressure and at atmospheric pressure. Products in glass containers are sterilized in water. Tin containers can be sterilized with steam and water. During the sterilization process, the pressure inside the containers increases, resulting in the deformation of tin cans and the opening of glass lids. To prevent this, an excess pressure is created in the autoclave using water or compressed air.

The process of steam sterilization of tin containers is carried out as follows. The containers are loaded into the autoclave and sealed. Open the valve on the autoclave cover and let the steam flow for 10 minutes to release the air. Then the tap is closed and steam is pumped into the autoclave to create the required temperature. The temperature must not change during sterilization. To protect the jars from deformation, they are introduced into the autoclave gradually.

When the temperature inside the device equals the sterilization temperature, the steam intake slows down, and the condensate valve is opened slightly. Once the sterilization process is complete, the steam valve is closed. The air exhaust valve is opened, and the temperature and pressure are gradually reduced. It is impossible to drastically reduce the pressure in the autoclave.

When the pressure is equal to atmospheric pressure, the lid is opened and the jars are cooled to 40^0C with cold water. To prevent the jars from crumbling, compressed air is pumped into the autoclave, followed by cold water under pressure. Under the influence of water, the vapor condenses rapidly and the pressure drops sharply. Compressed air compensates for the pressure in the jars.

Glass containers are sterilized as follows. The autoclave is filled with water and heated. When the temperature is 10–200°C above the product temperature, the sterilized product is placed in the internal cauldron. The autoclave lid is closed, and the water temperature is gradually raised (3-40°C/min). At the same time, excess pressure is created using water or compressed air.

Upon completion of sterilization, the cooling process is initiated, and the steam intake is stopped. Hot water is discharged from the bottom through a tap, and cold water is discharged from the top through a barbotrier. (Cold water must not touch the jars.) The product is cooled slowly at a rate of 2–30 °C/min. The water temperature is 30-35°C.

Vertical autoclave AB-2

Vertical autoclaves have 2 and 4 meshes. They differ from each other only in size. The vertical autoclave AB-2 consists of a housing-3, a cover-1, a balance beam-8, and a clamping device-2.

In the lower part of the housing, there are supports for installing meshes, and a lower barbotrier is located. Steam enters the barbotrier through pipe 5. The water in the autoclave is pumped out through another pipe. The drainage opening is closed with a metal mesh (to capture glass fragments).

A pressure gauge box is attached to the side wall of the autoclave from the outside. A thermometer and a contact manometer are installed inside it. In addition, there is a safety valve on the side wall and a water gauge tube. If the pressure in the autoclave exceeds the specified limit, the safety valve will open automatically.

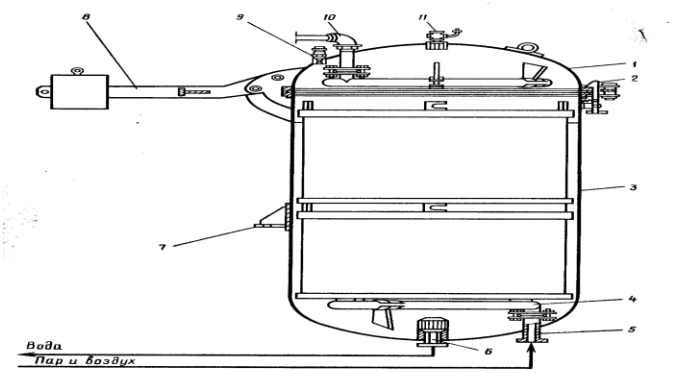


Figure 6.1. Vertical autoclave

Metal meshes are loaded into the autoclave using an electrotelfer. Pressure is created inside the apparatus to prevent the lids of glass jars from opening and to prevent the deformation of tin containers.

Rotary sterilizers

In rotary sterilizers, the product is sterilized at a temperature of 1000°C after being packaged in metal containers of the same size. The sterilizer consists of a stationary horizontal cylinder. A ribbed drum rotates inside it. Jars are placed between the edges. When the drum rotates, the jars rotate together with their axis and drum and move toward the end of the drum using a spiral guide.

Rotary sterilizers are two-body: sterilizer, refrigerator, three-body: heater, sterilizer, and refrigerator, and four-body. The four-chamber unit consists of a heater, a sterilizer, and two refrigerators.

Devices can operate at atmospheric pressure or above. The jars are loaded into the heater using a chain elevator. If the pressure is higher than atmospheric, the jars are loaded through airtight valves (t-95-980C). From the heater, the jars pass through the valve into the sterilizer and are sterilized with steam. From the sterilizer, the jars are transferred to the refrigerator and cooled with cold water to 30–400°C. To prevent the jars from being crushed, excess pressure is created in the heater and cooler using compressed air.

Disadvantage of the device: only tin cans of the same size can be sterilized in the sterilizer.

OXS-1 "Xunister" VNR Sterilizer

The OXS-1 "Xunister" VNR sterilizer is used for the sterilization and pasteurization of all canned goods. The device housing consists of three separate sections: heating, sterilization, and cooling. The heating and cooling sections consist of 6 chambers. Each chamber is divided into two by vertical barriers.

A sterilizer has a belt conveyor, a device for moving jars from a vertical position to a horizontal one, and chain conveyors for loading and moving jars. The jars enter the heating zone and pass through 6 chambers in a row.

Key phrases.. *sterilization, autoclave, barbotyor, nozzle, deformation, safety valve.*

CONTROL QUESTIONS

1. What is the purpose of performing sterilization?
2. Sterilization equipment?
3. What is the operating principle of autoclaves?
4. Continuous sterilizers?
5. For what purpose are safety valves installed?
6. How many parts does the "Xunister" sterilizer consist of?
7. How does the product move in a sterilizer?

MAIN CONCLUSIONS:

1. During the sterilization process, high temperature and pressure are utilized to achieve the maximum destruction of microorganisms, including their spores, within the product.

2. The pasteurization process serves to reduce the amount of pathogens and other harmful microorganisms by heating the product at relatively low temperatures for a short or specified period.

3. In the sterilization process, autoclaves, sterilizers, and other heat-treating devices are widely used, while in pasteurization, pasteurizers with plates, tubes, and tubes are used.

4. When selecting equipment, it is necessary to consider indicators such as product type, physicochemical properties, temperature, pressure, processing duration, and production productivity.

5. The use of modern sterilization and pasteurization equipment allows for a reduction in energy and raw material consumption, preserves product quality, and increases production efficiency.

Independent work topics

1. Main indicators of automation efficiency and their calculation.
2. Techniques and technologies for drying products using various methods.
3. Mastering the principle of operation and the automatic program control system.

Information and methodological support:

1. Buriev Kh. Ch., Umidov Sh. E., Merganov A. T."Technology for the storage and processing of agricultural products." Textbook. Tashkent: Muhr Press, 2022.

2. Food Processing Technology.Fellows, P. J. Food Processing Technology: Principles and Practice. 6th Edition. Woodhead Publishing (Elsevier), 2022.

3. Food Plant Engineering Systems.James R. Couper, Richard K. Sinnott va boshqalar. Food Plant Engineering Systems. 2nd Edition. Elsevier, 2023.

4. Engineering Principles of Unit Operations in Food Processing.Singh, R. P., Heldman, D. R. Engineering Principles of Unit Operations in Food Processing. CRC Press, 2024.

SELF-CONTROL TESTS:

Test samples

1. What is the primary purpose of sterilization?

A. Destruction of microorganisms and their spores

V. Change the color of the product

B. Increase product mass

G. Crushing the product

2. What is the primary purpose of the pasteurization process?

A. To reduce harmful microorganisms in the product

V. Freezing of products

B. Drying the product

D) Crushing the product

3. Which equipment is most commonly used in the sterilization process?

A. Autoclave

V. Grinder

B. Sieve

G.Conveyor

4. What is most often used as a heat source in pasteurizers?

A. Steam or hot water

V. Sand

B. Cold weather

G.Ice

5. Under what conditions is autoclave sterilization performed?

A. Using high-pressure steam

V. Only with cold air

B. Using sunlight.

G. Through mechanical pressure.