NEWSTER® - Sterilizer for health care risk waste

System Overview

NEWSTER® sterilization system is a highly automated system, specifically designed to fit small to medium-sized healthcare facilities, allowing potentially infectious medical waste to be finely ground and sterilized, turning them into urban solid waste (CER 200301) or refuse-derived fuel (CER 191210).

NEWSTER® waste sterilizer turns the medical waste into homogeneous dehydrated granules, reducing initial volume by 75 % approximatively and its weight by 25 to 40 % depending on humidity in the waste to treat.

The unit is compact for easy transport and can be installed even in a small-size room as long as it is equipped with aeration system and adequate power supply.

NEWSTER® is the result of an advanced research project which has developed every technical detail of the system in order to guarantee ideal ergonomic conditions resulting in lower purchase price and running costs than any other existing systems. Final disposal of sterilized waste is also much safer and easier as the granules resulting from treatment can be sent directly to incinerators, waste-to-fuel conversion plants or authorized dumpsites.

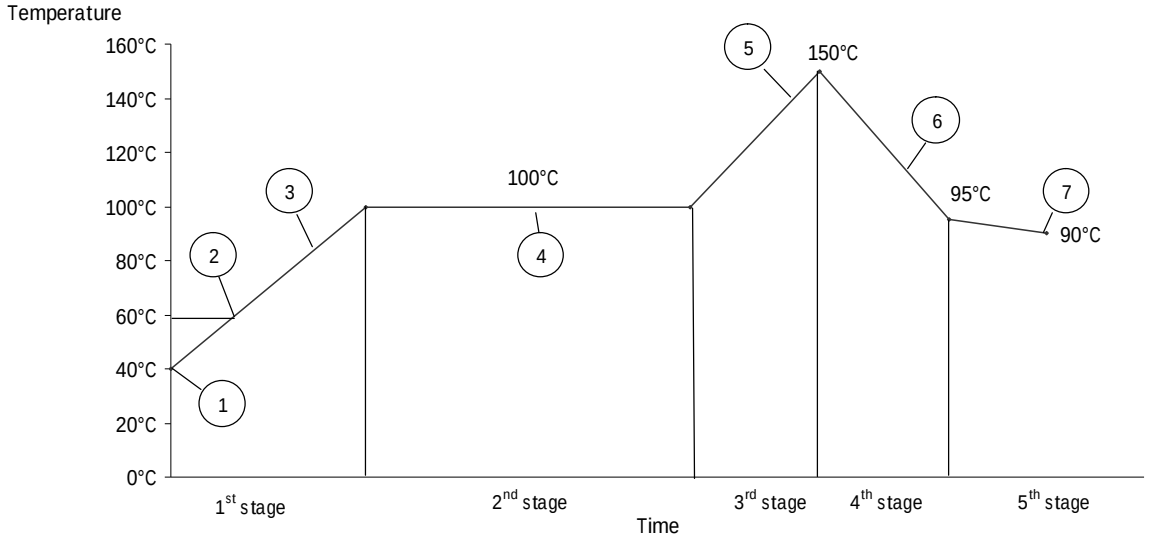
NEWSTER® automatically and continuously records all stages of the sterilization cycle and allows Medical Directors to act in full compliance with the existing laws.

Treatment Cycle

The NEWSTER® sterilizer is designed to treat Healthcare Risk Waste (HCRW) at atmospheric pressure and high temperature in a wet environment, as illustrated in the following diagram:

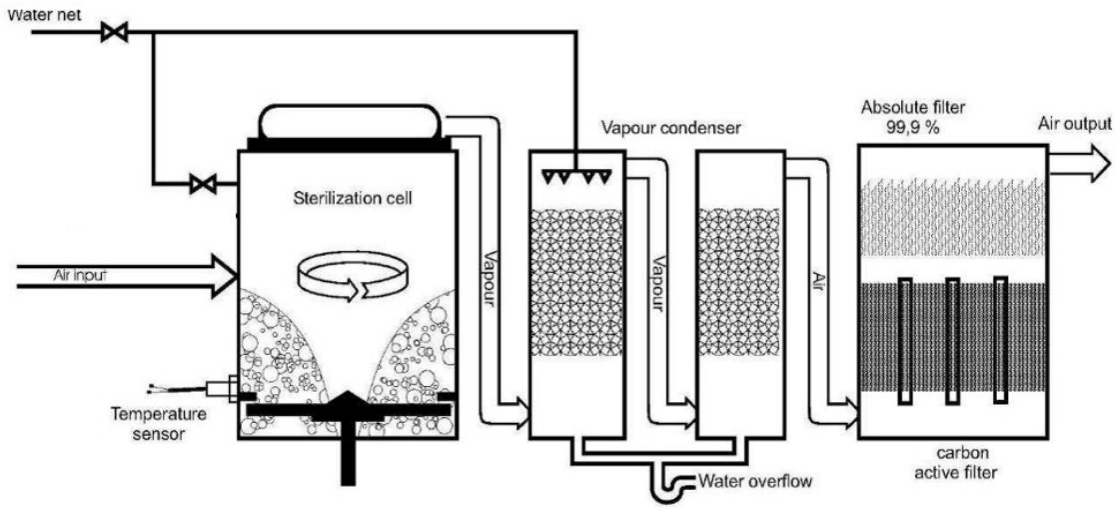
- First stage : loading and start of heating phase
- Second stage : evaporation of liquids
- Third stage : superheating and sterilization
- Fourth stage : cooling
- Fifth stage : unloading

Sterilization cycle



In a closed sterilization vessel a powerful rotor fitted with blades disintegrates, agitates and heats the wastes by impact, friction and resistances.
The temperature of the mass of wastes is measured in real time and with great accuracy by special sensors, while they are being constantly and vigorously agitated.
When the temperature reaches the predetermined level of 150°C, the mass of wastes is automatically sprayed with water so that the temperature decreases.
The treated wastes are cooled down to 95°C. At this point the cycle has been completed, and the product, by now sterile, is automatically unloaded.
To disperse the heat produced by the system, part of the water is continuously replaced by fresh water from the mains supply. Excess water and incondensable gases are discharged into the sewers, with values within legally established limits.
The process lasts for around 25 minutes, depending on the rate of organic matter in the waste, and work as shown in the diagram:

1. Wastes are loaded into the sterilization vessel, the lid is closed and the treatment process is started by pressing a button. The engine starts in the first speed, filters start and resistances are turned on.
2. At 60°C the general water electrical valve opens and water starts to flow in the cooling columns. The rotor turns slowly at first, starting to pulverize the materials, and at the same time the temperature starts to rise.
3. The rotor turns faster (change from the first speed to the second), the temperature starts to rise rapidly and the materials are finely pulverized.
4. When 96–100°C are reached, temperature remains stable until the water present in the wastes has completely evaporated.
5. After the water has evaporated the temperature starts to rise rapidly again, reaching 150°C. After the peak the rotor turns slowly (first speed) and resistances turn off.
6. The mass of wastes is sufficiently moistened by a water spray to cool down to 95°C.
7. The sterilization cycle has now been completed. The vessel is opened, and the product is extracted and collected in the stainless integrated waste collector.



The vapors released during liquid evaporation are treated by a filter block consisting of absolute filter and charcoal filters. Water and condensable gases are discharged in the sewer system as they fully comply with the limit values set by the current legislation.
During the cycle, plastic and waste are turned by the high temperature into small size grey-brown granules.

During the cycle three processes take place simultaneously to guarantee effective sterilization, namely
• Thermal decomposition of proteins by reaction with water
• Break-up of cell membranes
• Chemical modification of cell components

WATER - PROTEIN REACTION
NEWSTER® sterilizers high-speed rotor heats waste thanks to a high-speed rotor which generates shocks and friction, while also disintegrates and stirs the material inside the vessel. In order to reach the sterilization temperature faster and homogeneously in the cell, some thermal resistances are installed around the cell. They turn on when the cycle start and turn off when a certain temperature is reached and they help the heating process in being faster.
The shocks and friction produce diffused heat and according to the rules of physics induce compressive deformation affecting the vibrational movement of molecules and, therefore, their temperature.
The parts affected by deformation receive the kynetic energy lost by the element which generated the shock.
As the material is reduced to particles by the rotor, the deformation induced by shocks affects the entire mass of each particle. Therefore, particles are heated to their core unlike in autoclaves where only the outer surface is heated.
Once the sterilization temperature is reached, the material is cooled down by automatic water sprinklers controlled by a temperature sensor.
The water spayed into the vessel is first absorbed by the material which becomes wet and then immediately evaporates subtracting energy. This wetting/evaporation action is repeated at regular

intervals every few seconds throughout the cooling step. Therefore, reagent "water" is present here in two physical states, i.e. liquid water and steam.

RUPTURE OF CELL MEMBRANES

In autoclaves steam does not exert mechanical action on microorganisms because their inner pressure is almost the same as the steam pressure. Instead, the Newster® system produces mechanical action leading to membrane rupture and, therefore, death of microorganisms. The sterilizer performs a cooling phase at high temperature inside the vessel by means of water, which is absorbed by the dehydrated material. The high temperature inside the vessel turns liquid water into steam, which increases the inner pressure within the cells. The increase in pressure produces steam inside the cells which literally explode. This mechanical action causes microorganisms to die simultaneously and regardless of their number.

List of potentially infectious healthcare waste processed by NEWSTER® sterilizer

MATERIAL THAT CAN BE TREATED

- Sanitary towels, diapers and children diapers
- Materials and cotton cellulose, cotton
- Tubing, catheters and drainage systems, infusion kit
- Catheters (bladder, venous, arterial drainage, etc..)
- Connections to sensors, circuits for extracorporeal circulation and dialysis filters
- Cuvette and disposable syringes and multi-purpose
- Disposable gloves and reusable
- Plastic disposable gender
- Textile disposable gender
- Infusion, infusion
- Residues surgical
- Residues meals not primarily liquid (broth)
- Material for dressings and bandages
- Plastic Film
- Bags for transfusions, urine, ostomy care, nutrition
- Plastic or glass vials
- Boxes, cardboard or plastic
- Speculum and brushes
- Disposable staplers
- Plasters and bandages
- Teeth and small body parts unrecognizable
- Organic farming, laboratory samples
- Plates and culture media
- Guinea pigs and small rodents
- Glass containers and drugs
- Paper and similar materials

MATERIAL THAT CANNOT BE TREATED

- Organic waste and inorganic liquids (broth, oil, sewage, washing etc.).
- Organic residues with water content above 30%
- Radioactive materials, isotopes
- Compact metal masses heavier than 100 gr.
- Gas containers and tanks
- Chemicals
- Flammable materials
- Explosive materials
- Stones
- Timber
- Carcasses of large animals
- Sheets, blankets, pillowcases and so on