Autoclave operation through Disinfection of Biomedical Waste

In previous months article we have seen the details of operation for Biomedical Waste incineration. In this issue we will discuss about the autoclave operation for disinfection of biomedical waste. As per Biomedical waste rules 2016, only red category waste can be disinfected by the autoclave and they have clearly given the operation parameters and associated infrastructure required is provided in the rules and guidelines.

Autoclaves are closed chambers that apply both heat and pressure, and sometimes steam, over a period of time to sterilize medical equipment. Autoclaves have been used for a century to sterilize medical instruments for re-use. Surgical knives and clamps, for instance, are put in autoclaves for sterilization. Similarly Autoclave is used to disinfect the biomedical waste. This waste is further shredded in the shredding machine (To avoid the reuse) and can be sold to the authorised recycler.

In the autoclave operation as per capacity of the autoclave waste is kept inside the chamber and boiler (generally mini boiler) is started to produce heat. Waste is kept for specific time as per selected cycle and Temp and pressure is monitored throughout the cycle. Strip test (Tape Test) is carried out and record is maintained for the same.

Autoclave Operation Parameters:

When operating a gravity flow autoclave, medical waste shall undergo any of the following three cycles.

(i) A temperature of not less than 121° C and pressure of 15 pounds per square inch (psi) for an autoclave residence time of not less than 60 minutes; or

(ii) A temperature of not less than 135° C and a pressure of 31 psi for an autoclave residence time of not less than 45 minutes; or

(iii) A temperature of not less than 149° C and a pressure of 52 psi for an autoclave residence time of not less than 30 minutes.

For Vacuum Autoclaves:

When operating a vacuum autoclave, medical waste shall be subjected to a minimum of three pre-vacuum pulses to purge the autoclave of all air. The air removed during the pre-vacuum, cycle should be decontaminated by means of HEPA and activated carbon filtration, steam

treatment, or any other method to prevent release of pathogen. The waste shall be subjected to the following:

(i) A temperature of not less than 121°C and pressure of 15 psi per an autoclave residence time of not less than 45 minutes.

(ii) A temperature of not less than 135°C and a pressure of 31 psi for an autoclave residence time of not less than 30 minutes.

Recording of operational parameters:

Each autoclave shall have graphic or computer recording devices which will automatically and continuously monitor and record dates, time of day, load identification number and operating parameters throughout the entire length of the autoclave cycle.

Fig: Showing Feeding of Waste in the Autoclave Chamber

Following Tests are carried out at prescribed frequency

1. **Routine Test:** A chemical indicator strip or tape that changes colour when a certain temperature is reached can be used to verify that a specific temperature has been achieved. It may be necessary to use more than one strip over the waste package at different locations to ensure that the inner content of the package has been adequately autoclaved. The occupier or operator of a common bio medical waste treatment facility shall conduct this test during autoclaving of each batch and records in this regard shall be maintained.

2. **Spore Testing:** The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit. Biological indicator for autoclave shall be Geobacillusstearothermophilus spores using vials or spore Strips; with at least 1X106 spores. Under no circumstances will an autoclave have minimum operating parameters less than a residence time of 30 minutes, a temperature less than 121o C or a pressure less than 15 psi. The occupier or operator of a common bio medical waste treatment and disposal facility shall conduct this test at least once in every week and records in this regard shall be maintained.

3. **Validation test for autoclave:**

   The validation test shall use four biological indicator strips, one shall be used as a control and left at room temperature, and three shall be placed in the approximate centre of three containers with the waste. Personal protective equipment (gloves, face mask and coveralls) shall be used when opening containers for the purpose of placing the biological indicators. At least one of the containers with a biological indicator should be placed in the most difficult location for steam to penetrate, generally the bottom centre of the waste pile. The occupier or operator shall conduct this test three consecutive times to define the minimum operating conditions. The temperature, pressure and residence time at which all biological indicator vials or strips for three consecutive tests show complete inactivation of the spores shall define the minimum operating conditions for the autoclave. After determining the minimum temperature, pressure and residence time, the occupier or operator of a common biomedical waste treatment facility shall conduct this test once in three months and records in this regard shall be maintained.

Sources:

1. http://mpcb.gov.in/biomedical/pdf/BMW_Rules_2016.pdf
2. http://smslucknowbmw.co.in/process/