Microwave Sterilization

Microwave Sterilization Definition:

Microwave sterilization definition Microwaves are electromagnetic waves with frequencies from 300MHz to 300GHz. The microwave thermal effect is the direct interaction between microwaves and materials, converting ultra-high frequency electromagnetic waves into heat energy. Microwave sterilization is the result of the combined effect of microwave thermal effect and biological effect. Microwave potential distribution on the bacterial membrane section affects the concentration of electrons and ions around the cell membrane, thus changing the permeability of the cell membrane, bacteria are therefore malnourished, can not be normal metabolism, growth and development is hindered by death. From a biochemical point of view, the normal growth and reproduction of bacteria nucleic acid (RNA) and deoxyribonucleic acid (DNA) is made up of a number of hydrogen bonds tightly connected to the curly macromolecules, microwaves lead to hydrogen bond relaxation, breakage and reorganization, thus inducing genetic genes or chromosomal aberrations, or even breakage. Microwave sterilization is the use of electromagnetic field effect and biological effect to play a role in the killing of microorganisms. Practice has shown that the use of microwave devices in sterilization temperature, sterilization time, product quality maintenance, product shelf life and energy saving have obvious advantages.

Microwave Sterilization Principle:

1. The thermal effect of microwave energy: under the action of a certain intensity of microwave field, food insects and bacteria will be due to the phenomenon of molecular polarization, absorption of microwave energy to warm up,

so that its protein denaturation, loss of biological activity. The thermal effect of microwaves is mainly a rapid warming and sterilisation effect;

2. The non-thermal effect of microwave energy: the high frequency electric field also causes the membrane potential and polar molecular structure to change, so that the proteins and physiologically active substances in the microorganism mutate, and lose their vitality or die. In the sterilization played a special role in the conventional physical sterilization is not, but also caused one of the causes of bacterial death.
3. microwave sterilization, preservation is the result of the combined effect of microwave thermal and non-thermal effects. Therefore, microwave sterilization temperature is lower than conventional methods, in general, the conventional method sterilization temperature to 120 □ -130 □, time about 1 hour, while the microwave sterilization temperature of only 70 □ -105 □, time about 90-180 seconds.

Microwave Sterilization Advantages:

1.Short Time, Fast

Conventional thermal sterilisation is carried out by heat conduction, convection or radiation to transfer heat from the food surface to the interior. It often takes a long time to reach the sterilization temperature. Microwave sterilization is a direct interaction between microwave energy and food and its bacteria and other microorganisms, thermal and non-thermal effects work together to achieve rapid temperature sterilization effect, processing time is greatly reduced, the sterilization of various materials in general 3-5 minutes.

2.Low-Temperature Sterilization To Maintain Nutrients And Traditional Flavor

Microwave sterilization is through the special thermal and

non-thermal effect of sterilization, compared with conventional thermal sterilization, can be at a relatively low temperature and a shorter period of time to obtain the required sterilization effect. Practice shows that the general sterilization temperature at 75-80 □ can achieve the effect, in addition, microwave treatment of food can retain more nutrients and colour, fragrance, taste, shape and other flavours, and puffing effect. Such as conventional heat treatment of vegetables to retain the vitamin C is 46-50%, while microwave treatment is 60-90%, conventional heating of pig liver vitamin A to maintain 58%, while microwave heating for 84%.

3.Save Energy

Conventional heat sterilization often in the environment and equipment heat loss, while the microwave is a direct role in the treatment of food, and therefore no additional heat loss. In addition, its electrical energy to microwave energy conversion efficiency in 70-80%, compared to the general can save 30-50% of electricity.

4.Surface And Internal Are Carried Out At The Same Time

Conventional thermal sterilisation starts at the surface of the material and then passes through heat conduction to the interior, where there is a temperature difference between inside and outside. In order to maintain the flavour of the food and shorten the processing time, often the internal temperature of the food does not reach enough to affect the sterilisation effect. Due to the penetrating effect of microwaves, when the food is treated as a whole, the surface and the interior are subjected to simultaneous action, so the sterilisation is uniform and thorough.

5.Easy To Control

Microwave food sterilization treatment, equipment can be used immediately, no conventional thermal sterilization of thermal

inertia, flexible and convenient operation, microwave power can be continuously adjustable from zero to rated power, transmission speed from zero to start continuous adjustment, easy to control.

6.Simple Equipment, Advanced Technology

Compared with conventional sterilization, microwave sterilization equipment, no boilers, complex piping systems, coal yards and transport vehicles, etc., as long as the basic conditions of water and electricity can be.

7.Improve Labour Conditions, Save Floor Space

The working environment of the equipment is low temperature and low noise, which greatly improves the labour conditions. The whole set of microwave equipment requires only 2-3 operators. Widely used for the warming, drying and sterilisation of beef jerky, dried pork, fish slices, fontina meat, duck meat, chicken and other products. After microwave sterilization of meat products, its freshness, tenderness, flavor are maintained as is, health indicators can be lower than the national food hygiene standards, shelf storage time up to 1-2 months, microwave sterilization of meat products, the successful application of preservation technology, from the original freshness period of 3 days, extended to 1-2 months, has raised the technical achievements to a new stage.

Microwave Sterilization Applications:

Microwave sterilization is a process that uses microwave energy to kill bacteria, viruses and other microorganisms in food, medical equipment and other products. The following are some of the applications of microwave sterilization.

1. Food Sterilization. Microwave sterilisation can be used to sterilise food products such as meat, fish and

vegetables. This process is faster and more effective than traditional methods, such as boiling, steaming or canning.

2. Medical Equipment Disinfection. Microwave sterilisation can be used to disinfect medical equipment such as surgical instruments, gowns and masks. This method is faster and more effective than traditional disinfection methods such as autoclaving.
3. Water Treatment.Microwave sterilisation can be used to treat water, killing bacteria and other microorganisms that may be present. This method is faster and more effective than traditional water treatment methods (e.g. chlorination).
4. Packaging Sterilisation. Microwave sterilisation can be used to sterilise packaging materials, such as bottles, jars and pouches. This process is faster and more effective than traditional disinfection methods such as chemical treatment or irradiation.
5. Pharmaceutical Disinfection. Microwave disinfection can be used to sterilise pharmaceutical products such as medicines, syringes and medical implants. This method is faster and more effective than traditional disinfection methods such as autoclaving or ethylene oxide treatment.

Significance Of Microwave Sterilisation:

Microwave sterilisation offers a fast and effective method to sterilise a wide range of products, making it a valuable technology for industries such as food, healthcare and pharmaceuticals. The significance of microwave sterilisation is that it can provide a safe, efficient and environmentally friendly method of sterilising food and other materials, helping to protect public health and reduce the environmental impact of the sterilisation process.