

White paper: Comparison of ozone and ultraviolet

Ozone is a strong oxidant, and the sterilization process is a biochemical oxidation reaction. The principle of ozone sterilization has the following 3 forms:

1. Ozone can oxidize and decompose the enzymes required for the degradation of glucose inside bacteria, so that the TCA cycle cannot be carried out, which causes the required ATP for cell life activities to be unable to supply, causing the bacteria inactivate and die;
2. Directly interact with bacteria and viruses, destroy their organelles, DNA and RNA, destroy the metabolism of bacteria and cause the death of microbes.
3. Through the cell membrane tissue, invade into the cell, and act on the lipoprotein of the outer membrane and the lipopolysaccharide inside, causing the microbe to undergo permeability distortion, dissolve and die.

UV characteristics:

Ultraviolet bactericidal is the most killing and destroying the molecular structure of DNA (deoxyribonucleic acid) or internal RNA (ribonucleic acid) in bacteria and viruses in the ultraviolet wavelength range of 240~280nm, causing growth cell death and (or) regenerative cell death , to achieve the effect of sterilization. Especially when the wavelength is 253.7, the bactericidal effect of ultraviolet rays is the strongest.

Ultraviolet rays have a strong bactericidal effect, but their ability to penetrate objects is weak. It is suitable for space disinfection in operating rooms, burn wards, infectious wards and sterile rooms, as well as disinfection of heat-labile objects and table surfaces.

The short comings of traditional sterilization methods and the characteristics of ozone sterilization:

There are mainly three traditional sterilization methods: one is ultraviolet sterilization, the other is reagent sterilization, and the third is heat sterilization. These methods have been used by people, their safety and reliability have been confirmed by long-term practice, and people are assured of them. But everything is divided into two, and they also have their own flaws.

Ultraviolet rays are sterilized by light wave radiation, the light wave travels in a straight line, and its irradiation intensity is inversely proportional to the square of the distance. Only when the irradiated position meets the irradiation standard can there be a sterilization effect. And the bactericidal ability of all UV lamps decreases with the increase of the time of use. The main problems of ultraviolet sterilization are: its penetrating ability is small, and the sterilization effect is not good in places where ultraviolet rays are not irradiated, its sterilization ability decreases with the increase of use time, and the lamp life is short and the replacement is too frequent, high operating costs

The chemical reagents are sterilized, the medicine smells great, and cannot be discharged naturally. The air conditioner needs to replace the fresh air for a long time, thus increasing the energy consumption. At the same time, there is also the problem of secondary pollution. The remaining medicine is directly discharged into the atmosphere, causing pollution to the surrounding environment. Formaldehyde fumigation is trouble, long fumigation time, secondary pollutants, have certain hazards to the human body. It takes 8 hours to do a fumigation, the residue adheres to the clean walls and the surface of the equipment and needs to be wiped. Within a few days after disinfection, the number of suspended particles will increase. Moreover, the air duct is required to be stainless steel, which also increases the one-time investment cost. Heat sterilization includes dry heat and moist heat. Its disadvantages are high temperature and high energy consumption. Some items such as raw materials, instruments and meters, and plastic products are not suitable for heating.

The disadvantages of the above three sterilization methods are objectively present, but people have to use them until there is no better alternative.

Ozone sterilization has many unique advantages:

1. High efficiency

Ozone disinfection and sterilization use air as coal, without any other auxiliary materials and additives. The body has good inclusiveness, complete sterilization, and has a strong function of removing mildew, fishy and odors.

2. High cleanliness

The rapid decomposition of ozone into oxygen is the unique advantage of ozone as a disinfectant. Ozone is produced by the use of oxygen in the air. During the disinfection process, the excess oxygen is combined into oxygen molecules after 30 minutes. There is no residue, which solves the problem of secondary pollution caused by disinfectant disinfection methods and no need clean again after disinfection.

3. Convenience

Ozone sterilizers are generally installed in clean rooms or air purification systems or sterilization rooms (such as ozone sterilizers, transfer windows, etc). According to the sterilization concentration and time verified by debugging, set the time-based opening and running time of the sterilizer, which is easy to operate and use.

4. Economy

Compared with the use and operation of ozone disinfection and sterilization in many pharmaceutical industries, medical and health institutions, the ozone disinfection method has great economic and social benefits compared with other methods. In today's rapid industrial development, environmental issues are particularly important, but ozone disinfection avoids secondary pollution caused by other disinfection methods.

Attachment: In China country's GMP verification, there is a comprehensive introduction to ozone:

"Scientific research shows that ozone has a strong bactericidal effect."

"The disinfection principle of ozone (O₃) is: the molecular structure of ozone is unstable under normal temperature and pressure, and it will quickly decompose into oxygen (O₂) and a single oxygen atom (O), the latter has strong activity and is effective against microbes. Extremely strong oxidation, ozone oxidation decomposes the enzymes necessary for the oxidation of glucose inside the microbe, thereby destroying its cell membrane and killing it. The excessive oxygen atoms will recombine themselves into ordinary oxygen atoms (O₂), and there is no poison residues, so called non-pollution disinfectants.

Not only have Ozone a strong ability to kill various bacteria (including hepatitis virus, Escherichia coli, Pseudomonas aeruginosa and other bacteria, viruses and microbes), but also very effective in killing mycin. "

In addition, it is included in the "Disinfection Technical Specifications" issued by the Ministry of Health of China at 1991. Seeking ozone's bactericidal effect, the scope of use and the method of use have clear regulations. Among them, the bactericidal effect of ozone was clearly affirmed: "4.12.2 bactericidal effect: Ozone is a broad-spectrum bactericide, which can kill bacteria and spores, viruses, fungi, etc., and can destroy botulinum toxin.

When used in water, Ozone has a higher sterilization speed than chlorine."

The above are all laws and regulations of China, which fully explain the principle and characteristics of ozone sterilization. It is the basis for pharmaceutical factories to choose ozone sterilization process, and it is also a strong driving force for ozone generator manufacturing factories to manufacture ozone generators.