

Application of Microwave Sterilization in Processing of Meat Products

Microwave sterilization is a sterilization method that is very adaptable. It can be used in a variety of food systems such as powdered materials, paste materials, liquid materials and solid materials. This is not possible with many other sterilization methods. Sterilization is a very important operation in the processing of meat products. Microwave sterilization can be applied to various food processing such as meat products, which can shorten the sterilization time, facilitate the continuous production, and has less equipment and easy operation. It is a sterilization process worthy of vigorous development. However, there are relatively few studies on the mechanism of microwave sterilization. Some studies believe that there is no non-thermal effect in microwave sterilization. In fact, the non-thermal effect is still very important in the microwave sterilization process, just because the research system and the object are different. No non-thermal effects of microwaves were observed during these studies, but the non-thermal effects of microwave sterilization could not be denied. In the future, research in this area should be strengthened to lay a solid foundation for the promotion and application of this technology. Compared with traditional high-temperature sterilization, microwave sterilization has the advantages of high speed and good nutrition for maintaining food. However, if the operation method is improper, sometimes the microwave sterilization effect is not as good as high temperature sterilization, but from the long-term In practice, the effect of microwave sterilization is still very good, so it should continue to strengthen the laboratory research and industrialization process of microwave sterilization process.

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4. 1 Research status of foreign countries For the research of microwave sterilization technology, microwave technology is applied in actual production, and fresh milk, beer, biscuits, bread, ground beef, etc. are taken as research objects to discuss the sterilization effect and mechanism of microwave; microwave process parameters are carried out. For a more specific discussion, Shandong Leader Machinery will store 180% of boxed fish and meat products in a microwave oven at 72-75 °C. The product can be stored in a refrigerator at 0 to 4 °C.

The optimization of process parameters has become a hot topic in research.

Shandong Leader Machinery treats 150, 600g and 1,500g beef pieces separately with 713W and 356W microwaves. As a result, it was found that the sterilizing effect was the same as long as the microwave dose (power × treatment time/weight) was the same regardless of the microwave power and the amount of treatment. The microwave dose correlates well with the bactericidal effect and temperature, which means that microbial power, processing time and temperature can be used to predict microbial growth.

Shandong Leader Machinery inoculated the spores of *Bacillus cereus* and *Clostridium perfringens* in unknown concentrations into the minced meat samples and treated them in a microwave oven. The results showed that the number of spores of *Bacillus cereus* decreased with the increase of microwave treatment time. However, it was not completely killed, and the number of spores of *Clostridium perfringens* showed a decrease first and then increased with the increase of microwave treatment time. Nagy et al. [16] found that the combined application of gamma rays and microwaves can prolong the shelf life of beef products and have a low impact on the flavor of meat products. Im-Sun Woo et al. [17] used microwave treatment of *Escherichia coli* and *Bacillus subtilis*, and found that as cells release DNA and protein during

warming, the number of viable cells decreases with the release of DNA and protein, but the density of cells does not change significantly. .

Shandong Leader Machinery used a microwave oven to sterilize beef samples inoculated with *E. coli* O157:H7 and determined bacterial survival rates at different sterilization times and bactericidal strengths. The results showed that at 30, 60, 90, and 120 s of microwave intensity at 70%, 80%, 90%, and 100%, the effect of microwave on bacteria was obvious (p Shandong Leader Machinery [Microwave Sterilization Technology](#) was applied late in China's food industry. Domestic scientists and technicians began research on the theory and practice of microwave sterilization technology in the food industry from the 1970s, due to various reasons such as equipment and technology. Its application has been relatively small. In recent years, with the improvement of domestic microwave equipment production technology, the application research of microwave sterilization in food processing is increasing. Jin Shengyu et al [25] used microwave sterilization and heat sterilization to study the microbial sterilization of fish balls. The results showed that: microwave 850W, lasting 130s or heating in 98°C water bath for 60min, killing *E. coli* The efficiency of the bacteria is 100%.

The final temperature of microwave sterilization is a key factor affecting the sterilization effect of microwave.

When the microwave heating time is less than 30s, that is, when the temperature is lower than 40 °C, the killing effect on spoilage bacteria is not obvious; when the microwave heating temperature reaches 60 °C or above, most of the spoilage bacteria can be killed. After microwave sterilization at a frequency of 2 450MHz and a power of 750W, the product can kill most of the main spoilage bacteria in the beef sauce within 60s, greatly reducing the initial number of bacteria in the product, and has no adverse effect on the sensory quality of the product. The shelf life of the sauce beef. Li Guifen et al [27] optimized the microwave sterilization process parameters of the fish segment. The optimal parameters were microwave power 750W, sterilization time 80s, and the total bacterial count of the product after sterilization was 8cfu/g. The normal temperature control test after sterilization showed that the sensory quality of the control group began to change badly on the third day, and it was no longer edible on the fifth day, but the microwave treatment group began to show slight changes on the 13th day. The microwave-treated group was placed at room temperature for 15 days, and the T-VBN (volatile nitrogen) value was only 152 mg/kg, while the control group had exceeded 200 mg/kg on the fifth day.

Shandong Leader Machinery studied the microwave sterilization process of halogenated pig liver. After measuring the heat absorption rate of the liver of the brine, and carrying out the storage period test, the liver of the brine pig was microwave-sterilized and placed at room temperature 22 to 26 ° C, 1 After the month, its microbiological indicators still did not exceed the hygiene standards of retail halogenated pig liver. Kong Shujing et al. [29] used microwave sterilization, high temperature sterilization and boiling water sterilization to treat soft canned beef, and compared the bactericidal effects in sensory, physical and chemical, microbial and food properties. The test results show that microwave sterilization is superior to the other two sterilization methods. The application effect of microwave sterilization on beef jerky was studied. The orthogonal factors were tested on the main factors affecting the sterilization effect of beef jerky, namely the anode current of the microwave processor, the chain speed of the conveyor and the thickness of the beef jerky. The main factors affect the substantial cause of the bactericidal effect. The results show that for 2 kinds of products The optimum process parameters for the sterilization of dried beef jerky are: anode current 0.

2A and 0.4A, conveyor chain speed 1 100r/d and 1 100r/d, beef dry thickness 20mm and 20mm. Under this treatment condition, the total number of bacteria in the sample was reduced by 37.15%. Fu Yongcai et al. [31] studied the effects of microwave sterilization, room temperature sterilization and high temperature sterilization on the storage performance of braised pigeons. The results showed that the sensory quality of microwave sterilization products was significantly better than the other two sterilizations. The way the product is obtained. The heating process and power of 0.65 kW × 4, temperature 85 ° C, time 2 min were determined. The temperature protection process of 65kW × 1, temperature 85 ~ 90 °C, intermittent treatment for 6min is the best sterilization condition, and the product shelf life is more than 6 months.

Taking mutton ham as an example, the preservation effect of microwave heating sterilization was studied. The results showed that: microwave 120s had the best effect, and the shelf life of mutton ham was refrigerated for three months, and the total number of bacteria in the third month was 3.89cfu/g, pH value 5.71, sensory score 9.0. In the experiment of studying the effects of different sterilization methods on the quality of salted chicken wings, it was found that the microwave sterilization effect was significantly better than the low temperature long-term sterilization, the damage to meat quality was small, the sterilization time was short, and the microbial growth was slow during storage. The period is longer.

[Microwave sterilization](#) in the experiment not only preserved the sensory properties such as color, aroma, taste and shape of the trotters, but also improved the preservation performance of the trotters, so that the shelf life was more than 3 months. Qi Hanming and Jiang Yufei [35, 36] found that the total number of bacteria in white-cut chicken decreased with the extension of microwave time, and the total number of bacteria in white-cut chicken was still relatively high. The chicken legs have reached 43 000 cfu/g, which exceeds the national standard for the total number of bacteria in meat products (30 000 cfu/g), while the total number of bacteria in microwave sterilization at 7, 8 and 9 minutes is very small, and it still meets the national standard after 60 days of storage; The best microwave treatment process is: white cut chicken weight 800 ± 20g, microwave frequency 2 450MHz, microwave power 670W, microwave time 7min (one at a time). Yan Hanming et al [37] found that the whole chicken weight 0.8 ± 0.1kg, microwave frequency 2 450MHz, power 670W, time 10min microwave sterilization process can keep chicken soft canned food better sensory quality, and save at 6 °C for 6 months.