

Food safety: Microwave Sterilization Machines can kill COVID-19 viruses

Food safety is essential for maintaining our health and preventing the spread of diseases. To do so, countries have implemented strict regulations and developed advanced sterilization machinery to ensure manufactured food products are safe to eat. Most processed foods today go through certain sterilization processes. There are various different methods of food sterilization. Microwave sterilization processing is one of them. This type of food sterilization can inactivate harmful pathogens such as SARS-CoV-2 while offering the advantage of quicker and more uniform heating that can preserve the quality of food products.

What is microwave sterilization and how does it work?

Microwave sterilization is a thermal process that delivers energy to packaged food under controlled pressure and temperature to kill off potentially harmful bacteria and viruses. This is achieved by transmitting radio-frequency waves in an alternating electrical field to water molecules in food products. This causes an increase of intermolecular friction among water molecules, causing them to vibrate rapidly, producing enough heat to sterilize food.

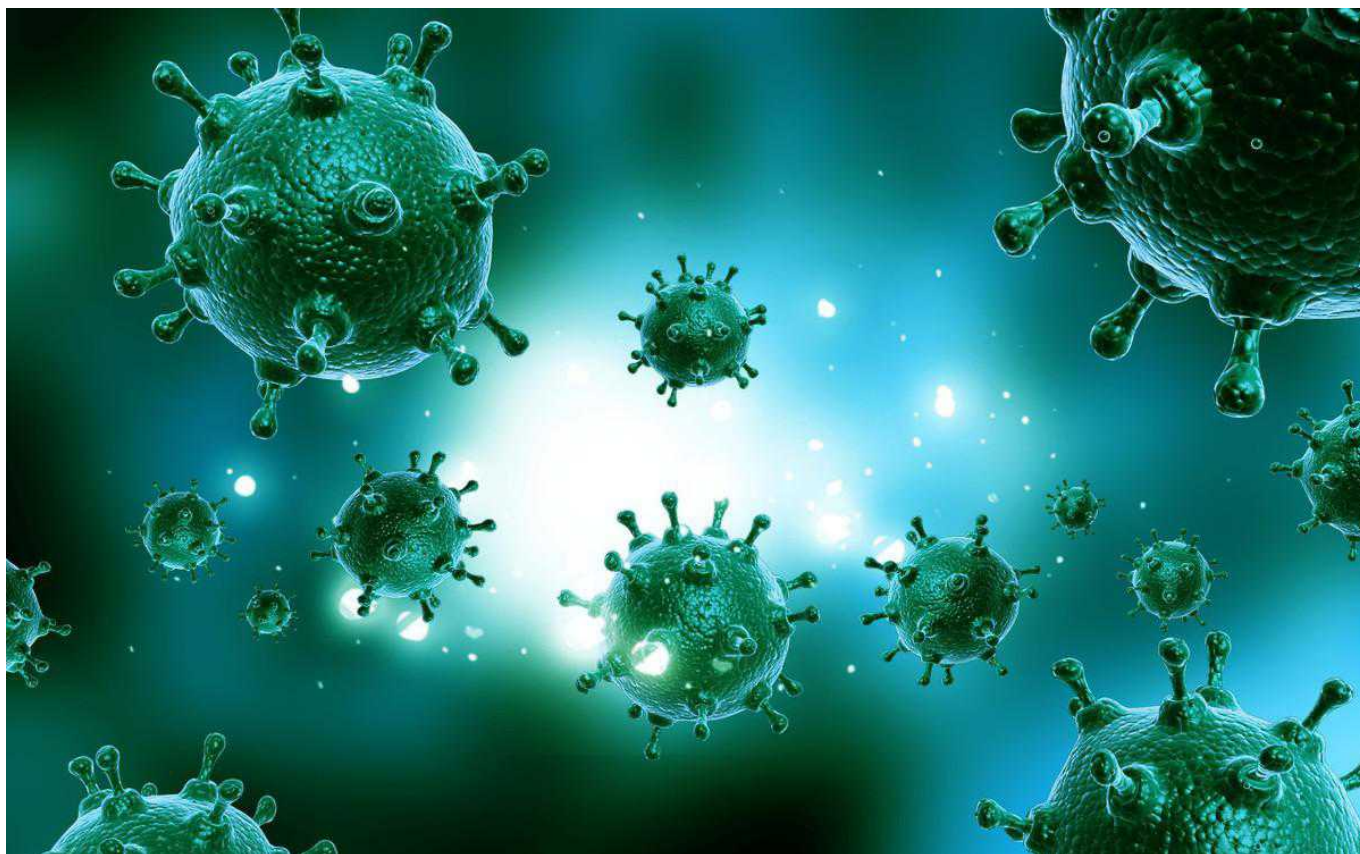
What are the advantages of microwave sterilization?

When compared to traditional heating methods of sterilization, microwave sterilization can preserve colour, texture, and other features of food products. This is because prolonged exposure to high heat, although able to eliminate pathogens, negatively affects food quality. As a result, these food products often lose nutritional value and palatability, making them unattractive towards consumers. Since microwaves directly

produce heat within the food, thermal processing time can be greatly reduced while still meeting microbial safety requirements. The radio-frequency waves generated by microwaves are also able to uniformly heat up food products, ensuring complete and thorough sterilization.

Microwave sterilization machines have their unique advantages. Microwaves are very versatile; they can heat solid, semi-solid and meal combination food products. It is also possible to instantaneously turn on or shut down industrial microwave machines. There is no thermal inertia. This allows for more precise control and increased workplace safety. Microwave sterilization occurs after post-packaging, which reduces unintentional food spoilage or wastage during the process. When considering cost, microwave sterilization technology is economical for manufacturers too. As mentioned previously, the thermal sterilization process is often shorter than traditional heating methods and because heat is generated from within, there is much less heat loss overall. This translates into a 30% to 50% reduction in electricity cost compared to conventional heating sterilization methods. The sterilization equipment itself requires only 2 to 3 workers to operate and produces minimal noise and pollution. There are no radiation hazards or toxic gas by-products.

Another important perspective to consider is the possibility of innovative food products. Certain types of food are severely damaged under high heat and cannot enter the market due to limitations in conventional heat sterilization processes. With microwave processing, food companies can develop new food products without worrying about compromising taste and nutrition value during sterilization. Current processed food products can also be improved by employing microwave sterilization over traditional methods.



Microwave sterilization processing and COVID-19

Food safety is of particular concern during the COVID-19 pandemic. The current state of knowledge on temperatures and the coronavirus by CDC states that “Generally coronaviruses survive for shorter periods at higher temperatures and higher humidity than in cooler or dryer environments. However, we don't have direct data for this virus, nor do we have direct data for a temperature-based cut-off for inactivation at this point”. However, there is some literature on the requirements to inactivate the SARS-CoV-2 virus. Based on the results of 5 studies by Abraham J. in the review article *Using heat to kill SARS-CoV-2*, temperatures above 65 °C are sufficient to cause near complete inactivation of the virus with an exposure duration of more than 3 minutes.

It should be noted that there are some limitations to the current data. First of all, there are different sensitivities for different strains of the SARS-CoV-2 virus. Secondly, the media can affect virus survival. Higher protein content makes

the virus more resistant to heating. Given these limiting factors and considering the potential disease consequences following COVID-19, it is reasonable to increase the temperature recommendations by about 10 °C.

Overall, the review article by Abraham J. takes on a conservative approach by recommending heating virus-containing objects for 3 minutes above 75 °C, 5 minutes above 65 °C and 20 minutes above 60 °C. This is consistent with WHO guidelines and information for killing other pathogens.

It may be difficult to determine how capable microwaves are at killing SARS-CoV-2 viruses because it is impossible to directly measure the heating temperature inside food products. That being said, it is possible to make predictions based on how fast microwaves heat up a cup of water. A home-type microwave operates at about 1.2kw and requires about 65 seconds to heat up 225 grams of water from 15°C to 100°C. Therefore, based on the data above, heating the water for about 4 minutes will inactivate SARS-CoV-2. This is consistent with information from CDC, which states that home-type microwaves can completely inactivate bacterial cultures, mycobacteria, and viruses within 60 seconds to 5 minutes. It also states that these home-type microwaves may not have even distribution of radio-frequency waves, leaving some areas of food only partially disinfected.

Unlike home-style microwaves, industrial microwaves operate at higher standards. They run at wattages anywhere from 12kw to 30kw and distribute radio-frequency waves more uniformly. Compared to home-style microwaves, they can heat up food products much more quickly and reliably. Sterilizing food products with industrial microwaves for 3 minutes will almost certainly inactivate SARS-CoV-2 viruses.

As important as food sterilization is, the SARS-CoV-2 virus generally spreads from person-to-person via respiratory droplets. It is still possible to catch COVID-19 not from food

products but from eating a meal with others or from hand-to-mouth contact. Therefore, it is extremely important to always practice handwashing with soap and water 20 seconds before eating or preparing food. Other general food safety practices include keeping raw meat separate from other foods, refrigerating perishable foods and cooking meat to right temperatures.

In conclusion, [microwave sterilization machines](#) are effective in sterilizing food products with reduced thermal processing times and more uniform heating. They can preserve food quality and are more economical than conventional heat sterilization equipment. Based on current data, heating objects at least 3 minutes at temperatures above 75 °C inactivates SARS-CoV-2 viruses. Given the output of industrial microwaves, microwave sterilization is effective at killing the virus. However, it is always important to practice good hand hygiene to limit the spread of COVID-19.