Virus inactivation for SARS-CoV-2

Using the Heratherm Advanced Protocol Security Microbiological Incubator

Introduction

In early 2020, the World Health Organization (WHO) identified SARS-CoV-2 as a new infectious disease. The novel coronavirus quickly spread around the world and was declared a global health crisis. Known to trigger a respiratory infection targeting the sinuses, nose, throat, trachea, and lungs, SARS-CoV-2 is easily transmitted from person to person with varied sources of transmission.

The need for testing

As a result of coronavirus infections, the establishment of safe laboratory methods for handling SARS-CoV-2 samples has become increasingly important. This is multiplied twofold considering the high volume of cases that are processed every day, increasing the overall associated risk. Protecting the health and safety of laboratory professionals remains a critical component of securing a safe workplace and ensuring peace of mind.

Two approaches are used to determine SARS-CoV-2 infection—antigen and polymerase chain reaction (PCR) testing. PCR testing involves a crucial step of virus inactivation to protect laboratory professionals from infection and to enable safe handling of samples prior to RNA analysis. Several methods are available for inactivation of SARS-CoV-2, including heat, chemicals, and ultraviolet (UV) light [1].

Heat inactivation technology

Applying heat to SARS-CoV-2 samples is a reliable method known to help prevent the spread of infection. It is recommended that samples be heated between 56°C and 65°C for at least 30 minutes to deactivate the virus. More recent studies indicate that the recommended temperature is about 65°C (or even higher in some cases) [2].

If done correctly, heat inactivation neutralizes the virus while maintaining the quantity of detectable RNA needed to provide a diagnosis. However, if done incorrectly,

overheating may remove too much RNA, while underheating may put laboratory professionals at risk. Therefore, maintaining precise temperature control, without temperature overshoot or undershoot, is vital for any heat inactivation program. Laboratory ovens and microbiological incubators are controlled-temperature technologies typically found in testing laboratories. Here we examine how each performs for the purpose of SARS-CoV-2 virus inactivation.

Lab ovens provide high temperature ranges (between 50°C and 330°C). They are commonly used for baking, curing, annealing, drying, and sterilization. In a medical setting, lab ovens can also be used for virus inactivation. Due to powerful heating elements and internal fans, lab ovens provide the advantage of quickly heating to their set temperature. Ramp-up time to 65°C can take between 10 and 15 minutes [2]. However, lab ovens have the potential to provide minor fluctuations between set temperatures (typically between 1°C and 2°C).

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Microbiological incubators offer a controlled, contaminant-free environment by regulating temperature. They provide moderate temperature ranges (between 27°C and 105°C) and can be used for virus inactivation. A clear strength for microbiological incubators is their temperature accuracy. Once ramped to the set temperature, microbiological incubators provide very little room for temperature drift (usually just a tenth of 1°C). Due to different heating elements, ramp-up time to 65°C can take longer when compared to lab ovens—between 25 and 35 minutes [4].

Both technologies have clear advantages and disadvantages. However, microbiological incubators more precisely fulfill the requirements for SARS-CoV-2 inactivation due to their ability to heat samples to precise temperatures with superior uniformity and stability. Therefore, microbiological incubators provide a more reliable environment for inactivation. While laboratory ovens provide faster ramp-up times, they can overshoot set temperatures and maintain a slightly less uniform and stable environment throughout the chamber.

Testing considerations

When using a microbiological incubator for SARS-CoV-2 inactivation, the first step towards establishing a robust workflow is to ensure the chamber is heated. This provides temperature control. Firmly secure all access port openings to retain internal chamber heat. Proceed with loading samples evenly to allow air circulation for optimal temperature uniformity and stability.

During the inactivation process, keep the incubator door closed. A door open for more than a few minutes permits enough heat escape that the incubator must be fully reheated to reach the set temperature. For peak efficiency, samples should be prepared for quick loading and unloading to ensure that set temperatures are maintained without the need to reheat. To maintain aseptic handling of samples, incorporate periodic chamber cleanings to provide a safe workspace for laboratory personnel.

Heratherm Advanced Protocol Security Microbiological Incubator

The Thermo Scientific™ Heratherm™ Advanced Protocol Security Microbiological Incubator can be used to apply heat to coronavirus samples to deactivate the virus. Powered by mechanical convection, the Heratherm Microbiological Incubator provides superior temperature uniformity and stability. Complete with audible alarms to alert of internal temperature deviations, and an open-door warning system, users can rely on the intelligent design of the Heratherm Incubator to achieve temperature consistency.

Equipped with a secure, lockable door, the Heratherm Advanced Protocol Security Microbiological Incubator restricts access from unauthorized personnel—a key feature when guarding against hazardous samples. Once heat inactivation is complete, a push-button decontamination cycle set to 140°C effortlessly cleanses the chamber. Available in a range of capacities (60 L, 100 L, 180 L, 400 L, and 750 L), the Heratherm microbiological incubator provides flexible configurations for workflows of every scale and size.

References

1. Patterson EI, Prince T, Anderson ER et al. (2020) Methods of inactivation of SARS-CoV-2 for downstream biological assays. *J Infect Dis.* doi:10.1093/infdis/jiaa507
2. Pastorino B, Touret F, Gilles M et al. (2020) Heat inactivation of different types of SARS-CoV-2 samples: What protocols for biosafety, molecular detection and serological diagnostics? *Viruses* 12(7):735. doi: 10.3390/v12070735
3. Based on the Heratherm Advanced Protocol Security Ovens, model no. OMH60, OMH100 and OMH180 with chamber volumes of 62 L, 97 L, and 170 L.
4. Based on the Heratherm Advanced Protocol Security Microbiological Incubator, model no. IMH60, IMH100, IMH180 with chamber volumes of 66 L, 104 L, and 178 L.

Find out more at **thermofisher.com/incubators**

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