What to consider when choosing a CO_2 incubator

Faz Ahmed, Technical Sales Representative, Haier Biomedical

Incubators play a crucial role in creating optimal conditions for cell and tissue growth, by regulating parameters such as temperature, humidity and gas concentrations. Achieving the ideal conditions for any given application relies on selection of a suitable incubator model for the organism of interest, coupled with appropriate maintenance of the equipment. This article discusses the key factors to consider when purchasing an incubator, and highlights best practices to ensure optimal instrument performance and successful cell culture outcomes.

Carbon dioxide (CO_2) incubators are designed to maintain a controlled environment for cell cultures and other biological experiments. This is crucial for the growth and proliferation of cells ***in vitro***, mimicking the ***in vivo*** physiological environment to promote essential processes, such as cell division and cellular development. Any CO_2 incubator should be able to regulate the temperature, humidity and concentration of CO_2 within the growth chamber, but their ability to keep these parameters within the proper limits will vary considerably depending on the device's hardware design and control paradigm.

Choosing the right model

There are many CO_2 incubators on the market, which vary widely in terms of their accuracy and control. It is essential to consider the intended application when choosing a new system, as this will help to determine what is most suitable for your laboratory and workflow. Once you have a clear understanding of your process needs, you should consider the following factors:

Temperature and humidity ranges

Standard CO_2 incubators offer temperatures of between 5 to 50 °C and humidity control within 80 % to 95 %. However, high-end or specialised models may provide even wider ranges of these parameters to accommodate specific experimental requirements.

Gas partial pressures

Some CO_2 incubators can also regulate the oxygen (O_2) concentration, allowing the user to set any desired value within the range of 1 % to 21 %.

Sensing and control

Keeping all parameters within the narrow windows appropriate for cell growth requires accurate and reliable monitoring, as well as precise control. High-quality incubators can provide temperature control down to 0.1 °C.

Recovery times

The temperature and CO_2 level recovery time after a door has been opened for 30 seconds should be taken into account, as it can differ from 4 to 15 minutes depending on the model.

Process security/data logging

In some cases, it is possible to log the temperature 24/7, with data being automatically saved to a file that can then be easily transferred to a USB.

Sterilisation and cleaning

Sterilisation methods and temperature can vary significantly, and common ways to sterilise an incubator include UV, moist heat at temperatures above 90 °C and dry heat at 150-180 °C.

Ease of use

Some incubators have user manuals that can be accessed on the instrument's touch screen, making it easier for new operators to get the most out of the instrument.

Best practices

Choosing the correct CO_2 incubator for your workflow is only the first step to ensuring reliable and reproducible cell culture growth. There are also a number of best practices that should be followed to keep the system in optimal condition:

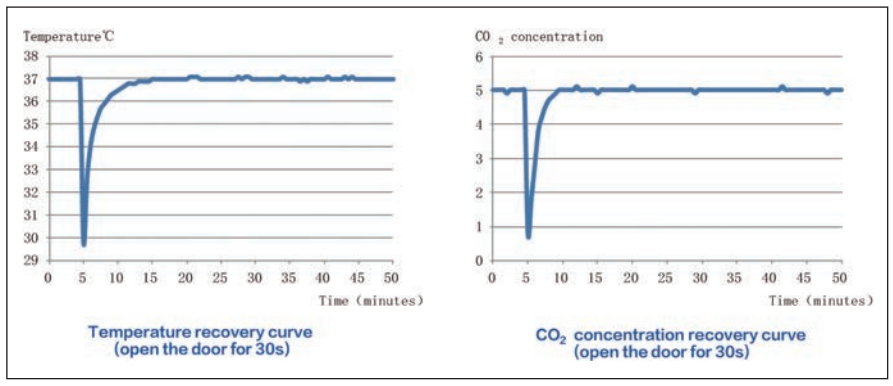

Figure 1: Temperature and CO_2 level recovery times in a top-tier incubator after the door has been opened for 30 seconds.

Placement

The CO_2 incubator should be positioned away from doors, windows and other draughty areas, including those with frequent foot traffic, to help minimise temperature fluctuations and maintain stable conditions. Although the incubator should be housed in a room with a well-regulated air conditioning system – to ensure a stable ambient temperature – it must be placed away from wall or ceiling vents, as the enhanced airflow could not only affect the temperature and gas partial pressures within the measurement chamber, but also force contaminants inside the incubator. Incubators should not be placed close to laminar flow hoods, fume hoods or microbiological safety cabinets for similar reasons.

Cleaning

Regular, systematic cleaning of the incubator - as well as the biohazard cabinet and laboratory that it is housed in - is essential to help avoid cross-contamination and maintain the integrity of the cell or tissue cultures. This should be done using a mild, non-toxic and non-oxidising disinfectant suitable for CO_2 incubators. Water in the pan used for humidity control must also be replaced on a regular basis to avoid microbial growth. Most CO_2 incubators require that the water used for this purpose is sterile and distilled, helping to ensure appropriate humidity levels while avoiding contamination. If experiments are carried out in an ISO-5 clean room, the particulate count has to be kept within strict limits, imposing more stringent requirements on the cleaning procedures and air conditioning. It is also necessary to autoclave everything that is placed inside the incubator for some clinical applications.

Calibration and servicing

Temperature, humidity and CO_2 sensors must be calibrated regularly to ensure accurate and consistent readings. Implementing a servicing schedule to inspect and, if necessary, replace components – such as filters, gaskets and heating elements – is also recommended. Having an independent temperature monitoring system can provide an extra layer of security for the storage of precious samples, and may be a requirement for conforming to certain ISO standards.

Summary

A CO_2 incubator is an essential piece of equipment for many labs and, with various types on the market, it is crucial to select the optimal model for your application. Seeking guidance from companies specialising in incubator manufacturing can be invaluable in the decision-making process, as they can provide expert advice tailored to your specific needs and requirements, ensuring the selection of a suitable and efficient model. They should also be able to offer ongoing support and advice on maintaining the instrument, helping to ensure that cells or tissues can grow in optimal conditions.