

Cell culture

Q
A**Question: How should I clean, disinfect, and maintain the 100% pure copper inner chamber in my CO₂ incubator?****Answer:**

Thermo Scientific™ CO₂ incubators featuring a 100% pure copper chamber provide continuous and reliable protection for valuable cultures, as they have since 1976. Research demonstrates that nothing matches the efficiency of this pure element¹. No special handling is required for copper, and maintenance is minimal. It is not necessary to use a chemical disinfectant, due to copper's inherent properties. We recommend using only mild soap and water for cleaning the copper, followed by 70% ethanol to remove any remaining residues. These recommendations should be strictly followed, to retain the copper's integrity and natural properties.

A CO₂ incubator with a 100% copper chamber should be maintained and cleaned following the manufacturer recommended procedures, to retain its integrity and natural properties. It is entirely natural and normal for the copper surface inside the incubator to change after a certain amount of time. You will see it transition from the gleaming, uniform orange-red color (Figure 1) to a mix of black, green and/or blue colors (Figure 2). This is a natural oxidation process, inherent to the copper surface and a normal part of the development of a visible patina or tarnish of the pure elemental copper². The presence of water normally

speeds up the process, and this is why oxidation occurs fastest on the areas which are in contact with water. As copper ages, the surface oxidation that creates the patina makes the copper stronger and more effective^{3,4}. The surface will feel smoother, and the tarnishing effect also results in an increased amount of cupric ions to accelerate the natural properties that help protect cultured cells. This process should not cause any concerns, as copper ions do not become airborne and are not analogous to corrosion. Rather, the oxidation layer adheres strongly to the copper surface creating no threat to precious cells incubated in culture vessels.

Thermo Scientific CO₂ incubators undergo our "end of line" testing procedure. This includes complete operation of the high temperature decontamination or sterilization cycle. The heat from the cycle will initiate the oxidation process and accelerate the development of the patina. This is normal behavior, inherent to natural copper, and a reflection of the testing that we perform on every unit that we produce.

The copper can be affected by materials that come into contact with its surface. In this respect, any dirt or spills should be cleaned immediately to ensure the copper can keep working its best. Any chemicals or salts other than those naturally in air or



Figure 1. Thermo Scientific™ Heracell™ VIOS™ CO₂ incubator with 100% copper interior, before use

water that contact the copper surface may produce a precipitate. The composition of these copper compounds is dependent on the procedures used in the incubator and on the type of water or disinfecting agents used.



Figure 2. Appearance of a pure copper incubator after several years of activity.

What should I consider when cleaning and maintaining my 100% copper CO₂ incubator?

Importance of correct disinfectant

Across the world, there are many disinfectant options available, but not all are safe for your cells or for incubator components. Because of copper's inherent efficacy it is not necessary to use chemical disinfectants, but only mild soapy water followed by 70% alcohol. We must stress that you should never use bleach-containing cleaners. Chlorine bleach and its derivatives with oxidizing activity will corrode and damage the copper.

Importance of correct water

To provide the proper humidity required by your cultured cells, we recommend only sterile distilled water with a pH of 7-9 and a conductivity of 1-20 microSiemens/cm.⁵ A water with low conductivity value, like DI (de-ionized) or ultra-pure Type 1 water, is poor in ions and therefore very aggressive. These water types would damage the pure copper incubator interior surfaces as the deionized water actively pulls ions from the pure copper, glass door, and other incubator components. In addition, do not use water disinfectant additives because they often contain very high concentrations of chemicals and should not be used in the CO₂ incubator water.

Procedure for cleaning the incubator with 100% copper chamber

Carefully following these simple steps will keep your incubator clean and help keep your cells growing well. You should not need to use a disinfectant or attempt to remove the tarnish with abrasive cleaning cloths. Please note that the cleaning procedure for a 100% copper chamber is much simpler in comparison to a stainless steel chamber. Due to the natural properties of copper the frequency of cleaning can also be reduced.

1. Move all the cultures to a different incubator. Then, turn off the incubator, including turning off the gas supply.
2. Remove all the shelves, the shelf supports, and any brackets or air ducts. Empty the water reservoir and wipe it dry with a clean, lint-free cloth.
3. Clean all the internal surfaces, ducts, shelves, shelf supports, inner door, fan and door gaskets with mild soapy water and non-abrasive cloth. A mild dish detergent works well for this.
4. Rinse these surfaces and parts using distilled water and lint-free wipe them dry again using a clean, lint free cloth.
5. Wipe the interior surfaces and parts with 70% alcohol.

6. Turn the incubator heat back on and allow the incubator to dry completely.
7. If desired, you may initiate the automated decontamination/sterilization cycle now. After the cycle is complete, fill the water reservoir with sterile distilled water, and turn on the gas supply.
8. Remember to clean the incubator exterior to eliminate dirt and microorganisms that could find their way inside.

That's it, you're done! When the incubator has reached the set conditions, return your cells inside.

Summary

A CO₂ incubator with 100% copper chamber is easy to clean and maintain due to copper's natural properties, with no need for additional disinfectant cleaning agents or water additives.

References

1. Grass G, Rensing C, Solioz M. Metallic copper as an antimicrobial surface. *Appl Environ Microbiol* 77(5) 2011.
2. Hilden J, Laitinen T, Maekelae K, Saario T, Bojinov M. Surface films and corrosion of copper. Swedish Nuclear Poer Inspectorate (SKI), SKI Project Number 97153, 1999.
3. Michels HT, Wilks SA, Noyce JD, Keevil CW. Copper alloys for human infectious disease control, Materials Science and Teaching Conference, 2005.
4. EPA registers copper-containing alloy products. U.S. Environmental Protection Agency. [Online] 2008. https://www3.epa.gov/pesticides/chem_search/ppls/082012-00005-20080229.pdf.
5. Thermo Scientific Smart Note: How can using the wrong type of water to provide in-chamber humidity cause corrosion in my CO₂ incubator? Thermo Fisher Scientific SNCO2WATER 0714.

Find out more at thermofisher.com/co2

thermo scientific