PREVENTING CONTAMINATION IN CELL CULTURES WITH 100% COPPER CHAMBER CO_2 INCUBATOR

Abstract

Cell culture is one of the vital procedures in a life sciences laboratory. A major concern in this field is the existence of contaminants. Many sources of contamination could be eradicated through right implementation of standards in laboratory practices and usage of proper and certified equipment. Copper surfaces exhibit a mechanism called contact killing. The antimicrobial effect of copper has long been recognized and continuously being studied as a mechanism to reduce contamination. Copper, Cu(II), induces an inhibition of growth in bacteria and has toxic effect on most microorganisms, which are common contaminants in the laboratory. Effects may involve substitution of essential ions and blocking of functional groups of proteins, inactivation of enzymes, production of hydroperoxide free radicals by membrane bound copper, and alterations of membrane integrity[1]. Esco CelCulture® CO_2 Incubator with 100% Copper Chamber guarantees maximal protection to cell cultures.

Introduction

CO_2 incubators are widely used in scientific research to grow and maintain cell cultures. Typical fields of application include tissue engineering, in vitro fertilization, neuroscience, cancer research and other mammalian cell research. Esco CelCulture® CO_2 incubators provide all-rounded sample protection with complete contamination control methods, precise parameter controls and intuitive software interface.

To maintain pure cultures efficiently, copper has been recently studied due to its self-sanitizing and antimicrobial properties. Dating back to early human civilizations, the use of copper in medical field was to sterilize chest wounds and drinking water. It was later on discovered to have a promising contribution to laboratory, pharmaceutical and clinical setting. Researchers discovered that copper metal have antimicrobial properties to aid in prevention and elimination of common biological contaminants in cell cultures like bacteria, viruses, and fungi. It has been registered at the U.S. Environmental Protection Agency as the first solid antimicrobial material[2].

Copper as an antimicrobial surface

Studies suggest that copper could be used as an alternate to stainless steel as interior chamber material in laboratory equipment, e.g. CO_2 incubators. Stainless steel is commonly used as exterior and interior metal component in the laboratory due to its resistance in corrosions and neat appearance. However, this metal has no immanent antimicrobial property. Copper has been found to be toxic to bacteria via oligodynamic effect or the biocidal effect of metals. Bacteria are expeditiously killed on copper surfaces and studies said that the copper ions are released from the surface plays a major role in the killing process.

1 (Faundez et. al., 2004)
2 (Grass et. al., 2011)

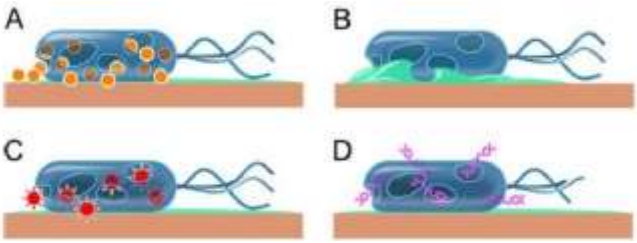

Figure 1. Illustration of suggested events in contact killing by Copper. (A) Copper dissolves from the copper surface and causes cell damage. (B) The cell membrane ruptures due to copper and other stress phenomena, leading to loss of membrane potential and cytoplasmic content. (C) Copper ions induce the generation of reactive oxygen species, which cause further cell damage. (D) Genomic and plasmid DNA becomes degraded[2].

Copper metal exhibits contact killing on microorganisms like bacteria and fungi. Experiments suggest that contact killing proceeds by a mechanism whereby the cell membrane/ envelope is damaged which makes the cells susceptible to further damage by copper ions[3]. As seen in Figure 1, the cell membrane is ruptured, followed by copper influx into the cells, impeding cell respiration and metabolism, resulting to oxidative damage, cell death and DNA degradation[2,4]. Thus, cells will not have sufficient time to reproduce.

In addition, dry solid copper demonstrated antimicrobial efficacy against a range of significant microorganisms, including Staphylococcus aureus[5], meticillin-resistant Staphylococcus aureus[6], Enterobacter aerogenes, Pseudomonas aeruginosa, Listeria monocytogenes, Klebsiella pneumonia, Salmonella enterica and Campylobacter jejuni[1,4]. It was also reported that several other fungi, specifically Fusarium culmorum, Fusarium oxysporum, and Fusarium solani, Penicillium chrysogenum and Candida albicans showed a total die off on copper after 24 hours[4]. These microorganisms pose public health problems if not handled properly and if it contaminates the cell cultures in a laboratory. All cell cultures, inoculated or not to a specimen, is considered hazardous, especially in healthcare.

The prevention and elimination of such contaminants in cell cultures can be achieved with the right choice of equipment in the laboratory, emphasizing on CO_2 incubators. Esco CelCulture® CO_2 incubator with 100% copper chamber could guarantee zero contamination. Esco's vision is to provide enabling technologies for scientific discoveries to make human lives healthier and safer. With this equipment, contamination in precious cell cultures could be eliminated, thus, bringing reliable and accurate results in research experiments.

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2 (Grass et. al., 2011)
3 (Mathews et. al., 2013)
4 (Michels et. al., 2015)
5 (Airey & Verran, 2007)
6 (Noyce et. al., 2006)

Figure 2. Esco CelCulture® CO_2 Incubator with 100% Copper Chamber

Conclusion

In attempt to curtail biological contaminations in the laboratory and nosocomial infections, Esco offers a CO_2 incubator that will give optimum protection to samples and cell cultures. Equipped with 100% copper chamber as its interior material, the antimicrobial effect of copper will ensure the contamination-free environment for cell cultures stored and incubated in a CO_2 incubator. Through laboratory tests, copper was found to kill a broad range of bacteria, fungi, and viruses.

References

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