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Full Length Research Paper

In a Microbiological Laboratory, Contamination

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In the biological laboratory, contamination is a well-known issue with grave repercussions. Physical, chemical, and biological are its three primary categories. Bacteria, molds, yeasts, viruses, mycoplasma, and cross-contamination by different cell lines are the most frequent biological contaminants that are encountered. An overview of the main important sources and available controls for pollutants is given in this article. The primary cause of contamination is the unintentional or intentional introduction of pollutants into the intended system from the start of laboratory activity until its conclusion. Obtaining pure and viable cells from reliable gene banks, occasionally assessing the culture's properties, employing antibiotics on a regular basis, and adopting good aseptic technique are just a few of the many tactics that must be used every day to tackle the difficulty. This research generally proposed that visual evaluation of the culture within a few days of infection could minimize or eliminate the frequency and severity of contamination.

Key words: Contamination, Source, Control, and Effect

INTRODUCTION

The unwanted introduction of contaminants, such as chemicals, microorganisms, or physical materials, into or onto a beginning or intermediate cell culture while it is being sampled, held, processed, stored, transferred, packaged, or transported is known as contamination. Any component of the culture system that is undesired due to the potential negative effects on the system or its utilization is referred to as a cell culture contaminant. The most frequent issue that arises in many microbiological laboratories is undoubtedly cell culture contamination, which can occasionally have quite detrimental effects. Overall, preventable procedural errors and misguided approaches are the main causes of contamination. Microbes are present in many various locations, including within a laboratory, and are freely dispersed throughout the environment. One of the largest global challenges facing researchers who work with microbial cultures is microbial contamination. It might lose strains that are beneficial in the lab. False-positive cultures are microbiological laboratory findings that resulted from both common and uncommon contamination. In a microbiological lab, improper management leads to high concentrations of microbial contaminants. It is a worldwide health hazard that makes it challenging to obtain reliable research results. It harms the caliber of our job and is introduced into our culture either manually or methodically. It has been reported in a lot of articles lately, and earlier reports support the difficulty. Ultimately, to minimize them, first implement acceptable laboratory practices, then adhere to the relevant guidelines [2, 6, 7, and 12].

Although contaminants are getting a lot of attention, little is known about their causes and mechanisms. The study's main methodology is based on a long-term visual investigation experience in the work environment (laboratory) and an observational cohort study. The current study's goal was to pinpoint the main causes of bacterial contamination in the lab before providing answers on how cross-contamination occurs. In order to minimize false positive culture reports, prevent microbial, physical, or chemical cross-contamination, and optimize the actual results from the microbiological laboratory through practical methods, this study aims to outline suitable and essential solutions.

2. TYPES OF CELL-CULTURE CONTAMINATION

2.1. Physical Contaminants

Materials regarded as natural or man-made components that function as pollutants are known as physical contaminants. The term "unwanted foreign bodies" also refers to items like glass shards, metal, stone, plastics, extraneous vegetative matter, hair, fibers, pipettes, storage equipment, instruments, aluminum foil or paper residues, and incubator dust particles left behind by detergents or disinfectants.

2.2. Chemical Contamination

Any non-living material that has an unfavorable impact on the culture system is referred to as chemical contamination. It is pointless because cell cultivation always results in cell death. It might even cause poisoning. The primary constituents are contaminants present in water, serum, media, metal ions, endotoxins, free radicals, detergents, and residues of pesticides or germicides. Furthermore, gases employed in carbon dioxide incubators include extraneous impurities.

2.3. Biological Contamination

Living and classified into several divisions, including bacteria, molds, yeasts, viruses, algae, protozoa, and invertebrates, biological pollutants are made easier by cross-contamination by other cell lines. Microbial contamination can spread both biologically (direct or indirect contact on hands) and physically (sharing media and reagents, using unplugged pipettes, handling and using non-sterile reagents improperly, spilling accidentally, or making abnormal contact with an inanimate object). Biological contamination can affect any kind of microbiological laboratory. Therefore, it is easy for the airborne microbes to infiltrate, spread, and outgrow the desired cells in culture. This is because there is a high microbial load and appropriate cultural procedures are not being observed: [12].

4. EFFECTS OF CONTAMINANTS ON CELL/MICROBIAL CULTURE AND OTHERS

- Competing for nutrients and they are hinders for cell growth and proliferation
- Expositing cells to unwanted primary and secondary metabolites utilization and production respectively.
- Altering levels of protein, RNA, or DNA synthesis in terms of quantity and quality
- Changing gene expression, cell signaling, morphology and physiology
- Damaging membranes and organelles at the high level
- Causing mutations and chromosomal changes
- Destroying the natural microbial community structure and function
- Devastating the growth and characteristics of the cultures. It has adverse effects on inhibition of cell metabolism
- Damaging of valuable products and boring to get pure and viable culture.
- Contributing several risks /outbreaks of laboratory - acquired infections for technicians, researchers, healthcare workers and patients. Immune deficiency individuals are sensitive to severe human disease. The persistent pathogens the mode of transmission is huge in number
- Influencing on signal transduction
- Serving as public health concern it becomes available for a biological weapons.
- Causing severe economic challenges registered
- Losing the quality of research outcome and inaccurate or erroneous experimental results recorded
- Losing time, money (for cells, culture vessels, media, and sera), and effort (spent developing cultures and setting up experiments) already happen
- Frustrating feelings become occurred and Personal embarrassment also.

In summary, these three recommended practices help to provide a safe laboratory environment while preserving the accuracy and integrity of cell cultures. Use a suitable lab design first. Second, follow the right culturing techniques. Thirdly, follow the right cleaning techniques. It is the best assurance that it will be completed successfully.

5. THE FUTURE DIRECTION OF CONTAMINATES

To find an abnormally high number of false-positive cultures and a method to deeply analyze the potential causes, laboratories need to conduct an investigation review procedure. It must, at the very least, be carried out within a monthly or yearly follow-up period. Interpreting odd results that arise from cross-contamination and self-contamination requires constant communication between researchers, laboratory staff, and clinicians. Three activities will receive careful support in the future. That is: (I). Identity of the taxa through various well accepted scientific methods like metabolic and genetic fingerprinting. Sources of potential hazards based on the isolation and identification of indicator microorganisms, (II). Development of methods for the treatment of microbiological hazards.

When investigating contaminants for the first time. Future results like the manufacture of antibiotics, their medical utility, biotechnological research, and antibacterial activity for drug resistance and susceptibility tests will be encouraging. In the future, it will be crucial to produce comprehensive scientific information through ongoing study, including surveying the community, functional, and structural

patterns of microbial diversity. More thorough research will be conducted in the field to disregard the debilitating and frustrating notion: To achieve something different and obtain an acceptable, viable, pure culture. The positive aspects will outweigh the negative ones.

6. CONCLUSION

In general, the current investigation found that the environment and laboratory equipment serve as possible sources of contamination with large concentrations. Several approaches must be used to fix the issue. These days, the most acceptable and economical course of action is to develop, implement, and periodically revalidate procedures. Control points must be established for everyone. A proper and meticulous management approach that takes into account all important factors at every stage, from sample collection to processing, can greatly reduce the load of contamination. Finally, it was determined that pollutants can disrupt the regular organization or operation of central cell dogma and result in loss of research work. This research addresses the immediate and long-term effects of pollutants in the microbiological laboratory in support of this evidence. In conclusion, by implementing excellent laboratory practices, contamination can be completely eradicated and even managed to lessen the severity of its effects and the frequency of its occurrence.

RECOMMENDATION

To preserve the purity of culture, physical, chemical, and microbiological assemblages should always be the subject of seasonal surveys and ongoing surveillance. The possibility of cross-contamination should be eliminated by practical follow-up control measures.

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