LIGHTHOUSE
WORLDWIDE SOLUTIONS

OVERVIEW OF COMPOUNDING OF ASEPTIC PRODUCTS AND MONITORING FOR VIABLE AND NON-VIABLE PARTICLE CONTAMINATION.

Lighthouse Worldwide Solutions

Overview

Sterile pharmaceutical products are widely used in healthcare systems for the treatment and prevention of various diseases. These products are manufactured under strict regulations to ensure the safety and efficacy of the final product. One of the critical aspects of sterile pharmaceutical manufacturing is the compounding process. Compounding refers to the process of combining different ingredients to create a pharmaceutical product tailored to the needs of an individual patient. In this article, we will discuss the compounding of sterile pharmaceutical products, including its importance, challenges, regulations, and references.

Importance of Compounding of Sterile Pharmaceutical Products:

Compounding of sterile pharmaceutical products is essential because not all patients can be treated with commercially available drugs. Some patients may require specific formulations, dosages, or administration routes that are not available in the market. Compounding allows pharmacists to tailor pharmaceutical products to meet the individual needs of each patient. This individualized approach is particularly important for patients with unique medical conditions or allergies that require customized formulations. Additionally, compounding is crucial in cases where commercially available drugs are not effective or have adverse effects on patients.

Challenges in Compounding of Sterile Pharmaceutical Products:

Compounding of sterile pharmaceutical products presents several challenges that require strict adherence to regulations and guidelines to ensure product quality and patient safety. One of the main challenges in compounding is maintaining sterility throughout the process. Any contamination of the product during the compounding process can compromise its quality and safety, leading to serious health consequences for the patient. Another challenge is ensuring that the final product meets the appropriate quality standards, including identity, purity, and potency. In addition, pharmacists must have the appropriate training and equipment to perform compounding procedures safely and effectively.

Compounding of aseptic products refers to the process of preparing sterile products in a controlled environment to minimize the risk of microbial contamination. This process involves several steps, including cleaning and disinfecting the compounding area, wearing sterile clothing, and using aseptic techniques to handle sterile ingredients. One of the critical aspects of compounding aseptic products is monitoring for viable and non-viable particle contamination to ensure product quality and patient safety. In this article, we will provide a comprehensive overview of compounding aseptic products and how to monitor for viable and non-viable particle contamination.

Compounding of Aseptic Products:

The compounding of aseptic products requires a controlled environment to minimize the risk of microbial contamination. The compounding area should be designed to maintain a positive pressure, ensuring that air flows from the cleanest area to the least clean area. The area should also be equipped with HEPA (High-Efficiency Particulate Air) filters to remove airborne particles, and surfaces should be cleaned and disinfected regularly. Laminar Airflow or Biological Safety Cabinets are mainly used in Compounding Facilities.

Compounding aseptic products involves several steps, including the preparation of sterile ingredients, the use of aseptic techniques to transfer ingredients into sterile containers, and the filling and packaging of the final product. The use of aseptic techniques involves the use of sterile equipment, including syringes, needles, and vials, and the use of sterile clothing, including gowns, gloves, and masks. The compounding process should be monitored for particle contamination to ensure product quality and patient safety.

Example of a Compounding Technician using a Biological Safety Cabinet to compound aseptic products.

There are three main types of compounding activities:

1. **Non-Sterile Compounding: Non-sterile compounding involves the preparation of medications that do not require a sterile environment, such as creams, ointments, and oral medications. These preparations are typically made using commercially available ingredients and do not require a clean room or special equipment.**
2. **Sterile Compounding: Sterile compounding involves the preparation of medications that require a sterile environment to prevent contamination, such as intravenous (IV) medications, eye drops, and inhalation solutions. These preparations are typically made using aseptic techniques in a clean room or sterile hood.**
3. **Hazardous Drug Compounding: Hazardous drug compounding involves the preparation of medications that are considered hazardous, such as chemotherapy drugs and other medications that can be harmful to healthcare workers if proper precautions are not taken. These preparations require specialized equipment and procedures to minimize the risk of exposure.**

It is important to note that each type of compounding activity requires specific training, equipment, and facilities to ensure patient safety and minimize the risk of contamination or harm. Healthcare professionals who engage in compounding activities should be appropriately trained and follow established guidelines and procedures to ensure that medications are prepared safely and effectively.

Example Sterile Compounding: Compounding Technician using a filter membrane manifold system inside a Biological Safety Cabinet to filter sterile liquid formulations for injections.

Monitoring for Viable Particle Contamination:

Viable particle contamination refers to the presence of live microorganisms, including bacteria, yeast, and mold, in the compounding area or the final product. Monitoring for viable particle contamination involves the use of environmental monitoring and sterility testing.

Environmental monitoring involves the collection of air, surface, and personnel samples to assess the level of microbial contamination in the compounding area. Air samples are collected using an air sampler that draws a known volume of air through a filter, which is then incubated to detect microbial growth. Surface samples are collected by swabbing surfaces in the compounding area and incubating the swabs to detect microbial growth. Personnel samples are collected by swabbing the gloves and gowns worn by personnel in the compounding area.

Sterility testing involves the incubation of the final product to detect microbial growth. Sterility testing is typically performed on a sample of the final product using an appropriate culture medium and incubation conditions. The absence of microbial growth indicates that the product is sterile and free of viable particle contamination.

Compounding Technician setting up a portable Air Sampler to take samples prior to compounding activities inside a Biological Safety Cabinet (BSC).

Monitoring for Non-Viable Particle Contamination:

Non-viable particle contamination refers to the presence of inert particles, including dust, fibers, and other foreign materials, in the compounding area or the final product. Monitoring for non-viable particle contamination involves the use of particle counters and visual inspection.

Particle counters are used to measure the level of particle contamination in the air and on surfaces in the compounding area. The particle counter measures the number and size of particles in the air or on surfaces and generates a report that can be used to assess the level of particle contamination.

Compounding aseptic products requires a controlled environment and the use of aseptic techniques to minimize the risk of microbial contamination. Monitoring for viable and non-viable particle contamination is essential to ensure product quality and patient safety. Environmental monitoring, sterility testing, particle counting, and visual inspection are critical tools used to monitor for particle contamination in the compounding area and the final product.

Compounding Technician setting up a Portable Particle Counter to monitor the compounding environment during compounding activities.

Regulations for Compounding of Sterile Pharmaceutical Products:

The compounding of sterile pharmaceutical products is subject to various regulations and guidelines, including federal, state, and local regulations. The main regulatory body that oversees the compounding of sterile pharmaceutical products in the United States is the U.S. Food and Drug Administration (FDA).

The FDA's regulations for compounding of sterile pharmaceutical products are outlined in the Current Good Manufacturing Practice (CGMP) guidelines for Outsourcing Facilities. The CGMP guidelines provide a framework for the manufacturing, processing, packing, and holding of sterile drugs. These guidelines include requirements for the facility, equipment, personnel, process controls, and quality assurance.

In addition to the FDA regulations, the United States Pharmacopeia (USP) has developed standards for sterile compounding that provide guidance for the compounding of sterile pharmaceutical products. The USP General Chapter <797> provides guidelines for the compounding of sterile preparations, including facility design, environmental monitoring, personnel training, and quality control. The USP General Chapter <797> also outlines the requirements for sterile compounding of hazardous drugs, which require additional precautions to ensure safety.

These guidelines outline the procedures and requirements for preparing, storing, and dispensing sterile medications, with the goal of ensuring patient safety and reducing the risk of contamination or infection.

Chapter <797> applies to all healthcare settings, including hospitals, clinics, pharmacies, and other facilities that prepare sterile medications. It covers a wide range of topics, including facility design and maintenance, personnel training and competency, environmental monitoring, and quality assurance.

The guidelines are regularly updated to reflect new scientific and technological advances, as well as changes in the regulatory environment. Compliance with USP <797> is mandatory for facilities that prepare sterile medications, and failure to comply can result in penalties or fines.

References:

1. Current Good Manufacturing Practice (CGMP) guidelines for Outsourcing Facilities. (2018). U.S. Food and Drug Administration. https://www.fda.gov/media/89976/download
2. USP General Chapter <797>. (2019). United States Pharmacopeia. https://www.usp.org/compounding/general-chapter-797
3. Azimi, S., Jafari, S. M., & Abdollahi, M. (2020). Sterile pharmaceutical products: Challenges and solutions. Journal of controlled release: official journal of the Controlled Release Society, 327, 849-862.
4. DeSimone, E. M., & Sagel, P. A. (2019). Sterile compounding of hazardous drugs: Meeting USP chapter <797> requirements. American journal of health-system pharmacy: AJHP: official journal of the American Society of Health-System Pharmacists, 76(19), 148