Sterile Compounding

A Guide for Community Pharmacists

by David Malian, R.Ph., B.Sc.Phm.

After reading this article you will:

- **understand the principles of sterile compounding**
- **understand the requirements for sterile compounding**
- **understand the principles of operation of a laminar air flow hood**

Introduction

Health care is increasingly moving into the home setting, creating new challenges for pharmacists. Pharmacists may be asked to fill prescriptions for intravenous solutions, and prepare such products as ophthalmic and bladder preparations which require sterile compounding.

Pharmacists are health practitioners educated and skilled in the science of compounding medications. Furthermore, pharmacists can compound sterile products if they have the skills and facilities necessary to ensure that certain products are prepared in a non-contaminated environment, free of particulate matter.

Sterile compounding practices vary between community pharmacies, indicating that there are no clear guidelines for pharmacists to follow. Studies also show a wide variance between hospitals in their sterile compounding practices.[1] The improper compounding of sterile products can lead to serious consequences for patients in community and hospital settings.

Pharmacists have a responsibility to provide sterile compounding services to their patients in a manner consistent with expected standards of practice, which are being developed by provincial regulatory bodies to ensure patient safety. Pharmacists should be cognizant of the importance of technique, staff education, appropriate facilities (including a laminar air flow hood), and proper monitoring to maintain the safety of products for patient care.

Background

The compounding of sterile products falls under Section C.01.065 of the federal *Food and Drug Regulations*.[2] Although this section applies to commercial manufacturers of sterile products only, the Health Protection Branch does expect appropriate procedures regarding technique, facilities, and equipment for sterile compounding to be followed by hospital and community pharmacists.[1] Health and Welfare Canada's *Intravenous Therapy Guidelines* (revised 1991) appears to be the most comprehensive and accepted guidelines available for community pharmacists. The Canadian Society of Hospital Pharmacists (CSHP) *Guidelines for Preparation of Sterile Products in Pharmacies* (August 1993) also is a useful tool in the establishment of sterile compounding facilities and procedures.

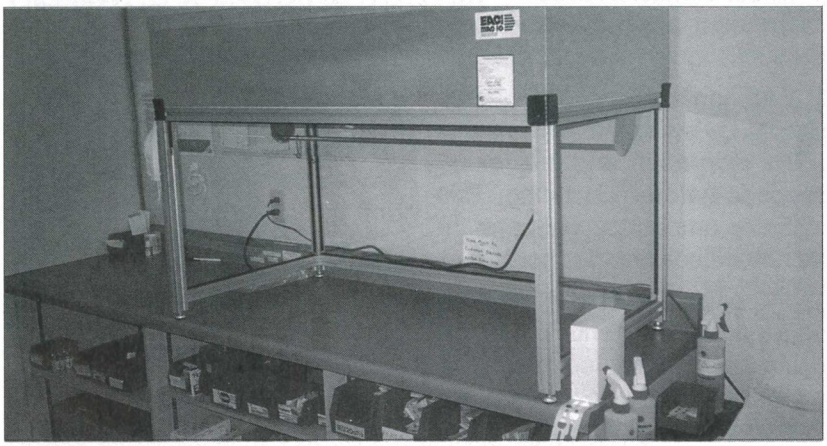
Aseptic Preparation Area

A sterile compounding service in a community pharmacy can be established and operated within a reasonably small area if it is well planned and organized. The aseptic preparation area may be a separate room, or located in a low or controlled traffic area with limited access. Ideally, the area should be adjacent to the dispensary, clean and free from excess clutter and debris. The CSHP's standards for an aseptic preparation area should be followed.

A laminar air flow hood is essential for the preparation of sterile products and should be located in the aseptic preparation area. Storage shelves, refrigerators, sinks, etc., should be located in a separate adjacent area to help reduce possible contamination. Inventory in the aseptic area should be kept at minimal levels and no exterior packaging of pharmaceuticals should be present. Materials such as needles, syringes and alcohol swabs can be kept in the preparation area but only at minimal levels. Activities such as gowning/gloving (if needed), handwashing and disinfecting should be done in a separate support area with clear, posted guidelines and procedures.

Laminar Air Flow Hood

All sterile compounding in a community pharmacy should be performed in a laminar air flow hood.[2,3] These hoods are designed to reduce the risk of airborne contamination during the preparation of sterile products.



Laminar Air Flow Hood

Laminar air flow hoods have two basic functions:

1) To filter bacteria and exogenous materials from the air.

2) To maintain constant air flow out of the hood to prevent contaminated room air from entering the hood.

The hood functions as a high efficiency dual filtering system. Air is taken into the unit and passes through a prefilter, removing gross contaminants such as dust or lint. The prefilter is very similar to those found in household furnaces. It is easily removed and can be cleaned by washing or vacuuming the particles. It should be checked periodically and replaced if needed.

After passing through the prefilter, air is channelled through the high efficiency particulate air (HEPA) filter to remove fine bacterial contaminants. This filter is built into the hood and is responsible for the sterile environment in the hood. The HEPA filter is not easily removed and generally requires outside maintenance for cleaning.[4]

Air flow velocity determines the filtering capacity of the hood. If air flow is reduced, the filter is presumed to be clogged with contaminants and must be cleaned.

Levels of air flow velocity are predetermined and exist for different types of hoods[4] (see Table 1).

There are two types of laminar air flow hoods available for compounding non-toxic sterile products:

1) **Horizontal Air Flow**. The air flow is directed forward. Work is performed in the hood and the product is protected, however the operator is not protected from particles or fumes originating from the ampoules or vials.

2) Vertical Air Flow. The air flow is directed downward and away from the operator providing a safer working environment. This is the preferred hood for community pharmacies.

When working under a laminar air flow hood, these guidelines should be followed to ensure proper use:[5,6]

1) Ideally, the hood should be operating continually, 24 hours a day. Since this is not feasible in a community setting, the hood should be turned on at least 30 minutes prior to use.

2) The working countertop and sides should be cleaned with a suitable disinfectant (eg., Savlodil) prior to and after each use.

3) Any bottles, vials or containers should be wiped down with alcohol or disinfectant before being brought into the hood to prevent possible contamination.

4) Objects placed in the hood should be suitably spaced to provide good air flow with minimal obstruction.

Table 1 - Basic Environmental Standards for the Manufacturing of Sterile Products

Grade	U.S. Fed. Std. 209D	Air Changes Per Hour	Max. Permitted No. of Particles per m^3 Equal 70 or above		Max. Permitted No. of Viable Microorganisms per m^3
A laminar air flow work station	100	flow of 0.3 m/s (vertical) or 0.45 m/s (horizontal)	0.5 um 3500	5 um 0	less than 1
B	100	5 - 20	3500	0	5
C	10,000	5 - 20	350,000	2000	100
D	100,000	5 - 20	3,500,000	20,000	500

Table adapted from *Guidelines for Preparation of Sterile Products in Pharmacies,* The Canadian Society of Hospital Pharmacists, Aug 1993.

Work should always be at least 15 cm into the hood.

5) The HEPA filter should be checked, cleaned and recertified once a year.

6) It is suggested that anyone working under a hood be gowned, gloved and masked. A lab coat should be worn to protect the operator from spills and, if hair is long, a suitable cap should be worn.

Aseptic Technique

Aseptic technique is defined as procedures that will minimize the chance of contamination with micro-organisms. Contaminants may be brought into the aseptic area by equipment, supplies, or people, so it is important to control these factors during preparation. A number of simple guidelines should be followed:

1) Anyone using the laminar air flow hood should wash their hands with a suitable antimicrobial at the beginning of their work and when re-entering the aseptic preparation area.[2,3,5,6]

2) Appropriate dress (ie. gown, gloves or mask if needed) suitable for sterile preparation should be worn.

3) Activities unrelated to product preparation should be kept to a minimum.

4) Eating or drinking, or the storage of food, drinks or personal items should not be allowed in the aseptic area.

5) Only one person should be working in the hood at any given time.

6) All items that will be used during preparation should be checked for defects and expiry dates prior to use.

7) All non-sterile item surfaces should be disinfected with an appropriate disinfectant prior to being placed into the hood. This includes scissors, clamps, pumps, etc.

8) All items necessary for the preparation should be placed into the hood prior to commencing the procedure.

9) Direct contact between a sterile product and any non-sterile product should be avoided.

10) All non-sterile surface areas should be swabbed with alcohol (70% isopropyl) and left for 30 seconds before puncturing. This includes ampoules, vials and intravenous solution portholes.

11) Ampoules and vials should be opened and contents aspirated using appropriate techniques to avoid particulate contamination. This may require the use of filters for glass containers/ampoules.

12) Reconstituted powders should be mixed carefully according to manufacturer's recommendations to ensure complete dissolution of the drug.

13) Needle entry into vials with rubber stoppers should be done at a 45 degree angle to minimize rubber core particulates.

14) All finished products should be carefully inspected after preparation for visible precipitation. This should be done outside the laminar air flow hood.

15) Each prepared sterile product should be assigned an expiry date based upon available data. If none is available, a short period should be applied (e.g., 24 hours) based upon manufacturer's recommendations, pharmaceutical texts, professional literature, or in-house stability/sterility studies.

If aseptic technique is not followed, the final product may in fact be contaminated. It is important that proper technique be utilized to ensure the integrity of the product.

Conclusion

The guidelines for sterile compounding may be adapted in individual pharmacies. Sterile compounding should not be attempted if products cannot be compounded properly, and it should be clear that not all pharmacies may be equipped to fill a prescription for a sterile product. Pharmacists must review their resources to determine if sterile compounding is a service they wish to offer. Provided that proper technique is used, policies and procedures followed, and facilities designed correctly, sterile compounding can be done with minimal risk of contamination in the community pharmacy, furthering the pharmacist's ability to meet the specific needs of certain patients.

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Mr. Malian is a Staff Pharmacist at Big V Pharmacies in Windsor, Ontario, and Councillor of District 11 for the Ontario Pharmacists' Association.

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