Everyday Compounding

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Everything that we cover in the Pharmacy Technician Program is about the science of pharmacy. There is one topic, however, that is more about the art of pharmacy: compounding. Compounding is preparing a medication from scratch using bulk chemicals. Here, the science is just as important as in any other area of pharmacy, because the product still has to function in the patient's body as expected. When you compound a product, it also has to be pharmaceutically elegant. That means it not only needs to work, it needs to look good doing it. A patient isn't going to want to use a cream that is gritty, or has clumps in it. They are going to be skeptical of a capsule that is half empty, or a liquid medication that tastes or smells bad.

It takes a lot of time and practice to effectively make compounds that are pharmaceutically elegant. We will have some practice doing that this term when we meet for a live lab session, but don't expect to become an expert after a two hour lab. As with the sterile compounding lab we did in Pharmacy Technician I, the techniques and manipulations that are learned in compounding do not come naturally to most people, so it does take patience and practice. For now, it is more important that you understand the background on compounding. This essential aspect of pharmacy is still practiced today in both hospital and retail pharmacies, so don't be surprised if you are asked to compound something in your workplace.

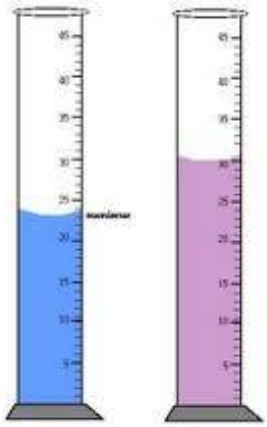
Compounding can be broken down into two major categories: non-sterile and sterile. Both non-sterile and sterile compounding were covered in Pharmacy Technician I. The intent of this lecture is to focus on the non-sterile compounds that you are most likely to prepare in a typical pharmacy. The primary forms of non-sterile compounds that are seen in a non-specialized pharmacy are oral suspensions and topical creams and ointments.

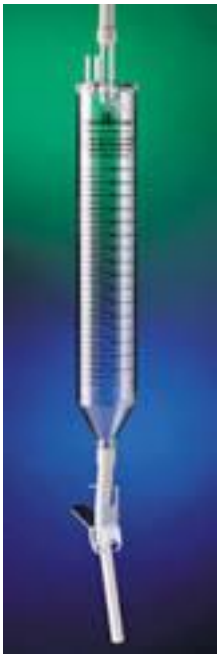
Usually, a suspension is ordered when the patient is unable to, or has difficulty with, swallowing capsules or tablets. This can be in pediatric patients, but it can also be in elderly patients, or those that have throat or esophageal cancers. Oral suspensions are usually intended to have a systemic effect, meaning they work throughout the patient's body. There are some, such as viscous lidocaine, that are intended to primarily work locally, numbing the mouth and throat in cases of painful lesions, seen with cancer treatments and certain infections.

By far, the most common compounding seen in a retail pharmacy is the reconstitution of dry powder anti-infectives. There are many medications that, if they are prepared in a liquid form, do not remain stable for very long. That means that if the manufacturer were to prepare them as liquids, they would probably expire before the patient could actually use them. The solution to this is suspensions! There are several antibiotics that come as oral suspensions for pediatric patients. Here, the dry powder is prepared in a bottle that is intended to be a unit-of-use, or one full course of therapy. The manufacturer will denote on the product packaging how much distilled water needs to be added to the bottle to reach a pre-determined concentration. Typically, this concentration will give the usual dose for a pediatric

patient per teaspoonful. Examples of this are Amoxicillin, which comes in strengths of 250mg/5ml or 400mg/5ml, or Fluconazole, which comes in a concentration of 40mg/5ml.

The volume of water to be added to the bottle can be measured either with a graduated cylinder, or with a reconstitube.





graduated cylinders **reconstitube**

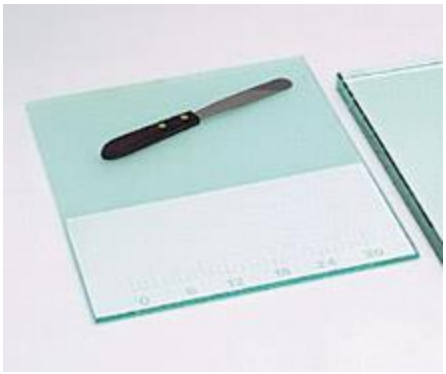
If you are using a graduate, you need to be sure to measure the volume at eye-level. Water, when added to a graduated cylinder, due to surface tension and hydrostatic pressure, will either be attracted to the surface of the cylinder, or it will be repelled by it. Consequently, the water will either rise up along the edges of the cylinder, or it will bulge in the middle. Either instance will create what is called a meniscus, when the water forms a broad u- or n-shaped curve along its surface. When you measure liquids in graduates, you want to measure at the center of the meniscus, just as shown in the graduate with the blue liquid.

A reconstitube is a very common piece of equipment in pharmacies, and is similar to a graduate, but it eliminates the need for such careful measuring. The tubing at the top of the reconstitube is attached to a jug of distilled water. There is a clamp on the tubing, both above and below the tube. If you open the top clamp, water will run from the jug into the tube, which is marked with the same measurements as a graduated cylinder. Once the correct volume has been added to the tube, closing the top clamp will stop any further water from running into the tube. Then, open the bottom clamp and the water will pour out into the bottle to be reconstituted.

When reconstituting dry powder suspensions, you must always tap the bottle first to loosen the powder. Once the correct volume of distilled water has been measured, add half of the volume, shake the bottle

vigorously to wet all of the powder, and then add the remaining measured water. Shake the bottle for at least thirty seconds before dispensing it after reconstitution.

Ointments and creams can be used for both topical and systemic treatment. Topical ointments will only have a local effect, meaning they will only work on the skin and the tissues surrounding the site of application. An example of a local effect would be triamcinolone ointment. This product has many uses, including rashes due to allergic reactions, dermatitis, or poison ivy contact, to name a few. It affects primarily the surface of the skin, but can help with swelling of tissues below the skin as well. An example of an ointment with a systemic effect would be nitroglycerin ointment. This is applied to the skin, but is intended to be absorbed and have a systemic effect of controlling angina.



pill tile

ointment paper

Occasionally, pharmacy technicians may see prescriptions that require the combining of two or more ointments or creams into one product. To do this type of compounding, a large, clean, non-porous surface is needed. This can be accomplished using either a pill tile, which is a large slab of glass, or ointment paper, which is a sheet of waxed paper. When combining two or more ointments or creams, the individual ingredients are weighed out and placed on the compounding surface in separate piles, usually near the corners of the pill tile or ointment paper. Using a spatula, a small amount of each ointment is pulled toward the center and mixed thoroughly, which is called levigation. When levigating, you want to use the spatula much like if you were frosting a cake. Use the edge of the spatula blade and apply even pressure across the compounding surface. This will maximize the surface area in contact with the spatula and pill tile, ensuring complete mixing of the ingredients. Continue to pull small portions of the ingredients to the center and combine them with levigation until everything is included. This process of incorporating small portions is called geometric dilution.

A pharmacy technician may receive an order that requires a solid to be added to an ointment. That solid could be a tablet or capsule, or it might be a crystal or powder. When adding solids to ointments or creams, it is very important that the solid be crushed to a fine powder prior to levigating into the cream or ointment base. If the solid is not effectively crushed, it can lead to a compound that is gritty or lumpy in appearance. While that would not be pharmaceutically elegant, it could also be potentially dangerous for the patient.

Ineffectively-levigated compounds could be painful to apply when the patient tries to rub the particles into their skin. If the solids are not thoroughly crushed, they also will not be evenly distributed throughout the base. This would lead to areas in the compound where there is a higher concentration of drug than in the compound as a whole. This could cause adverse effects, including chemical sensitivities, irritation, and possibly local areas of drug overdose.

glass mortar and pestle

porcelain mortar and pestle

When crushing solids, a mortar and pestle should be used. Mortars and pestles come in either porcelain or glass. Both types appear to be quite smooth, but in fact they have many microscopic pores throughout their surfaces. These pores allow for maximum surface area, which increases the amount of contact between the mortar and the solid being crushed. This ensures that the chemical is pulverized, or triturated, to a very fine powder. Once the drug is triturated to a fine powder, it is incorporated into the ointment or cream base using geometric dilution on either a pill tile or ointment paper.

The examples of compounding we've covered can be performed in any pharmacy using the basic equipment that is legally required to be in-stock. Creating more complex dosage forms is typically performed at a specialty compounding pharmacy. In this unique pharmacy setting, dosage forms such as solutions or suspensions, capsules, gels, suppositories, lollipops, orally-disintegrating tablets, and even animal treats can be compounded. All of these require specialized equipment and extensive training to be prepared safely and consistently, so they are not typically undertaken at a standard pharmacy.

Be sure to look through the handouts that are included in this learning unit. They cover both sterile and non-sterile compounding, and will help you to gain a more comprehensive understanding of compounding.