LESSON ASSIGNMENT

LESSON 2

Introduction to Manufacturing, Quality Control, and Prepackaging.

LESSON ASSIGNMENT

Paragraphs 2-1 through 2-9.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

2-1. Given a group of definitions, select the definition of the term pharmaceutical (bulk) manufacturing.

2-2. Given a group of statements, select the most appropriate justification of pharmaceutical (bulk) manufacturing.

2-3. Given a group of possible uses, select the use of the Bulk Compounding Formula Record (Master Formula Card) as presented in Lesson 2.

2-4. Given a group of possible actions, select the action that must be performed to order controlled substances for manufacturing purposes using the DOD Prescription Form (DD 1289).

2-5. Given the type of product to be prepared and/or the use of a particular piece of manufacturing equipment and a list of names of pieces of manufacturing equipment, select the piece of equipment to be used to prepare the product and/or described.

2-6. Given a group of definitions, select the definition of quality control as presented in Lesson 2.

2-7. Given a group of tests, select the test used to perform quality control procedures.

2-8. Given a group of statements, select the definition of pharmaceutical prepackaging as presented in Lesson 2.
2-9. Given a group of statements, select the most appropriate justification of pharmaceutical prepackaging as presented in Lesson 2.

2-10. Given a list of labeling information, select the piece of essential information that should appear on labels for prepackaging dispensing units.

2-11. Given a list of labeling information, select the piece of essential information that should appear on labels for prepackaged drugs in nondispensing units.

**SUGGESTION**

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 2

INTRODUCTION TO MANUFACTURING, QUALITY CONTROL, AND PREPACKAGING

Section I. PHARMACEUTICAL MANUFACTURING

2-1. BACKGROUND INFORMATION

a. Definition. Pharmaceutical (bulk) manufacturing is the compounding of large quantities of a pharmaceutical product that is designed to be dispensed to more than one patient.

b. Justification. There are two primary justifications for pharmaceutical (bulk) manufacturing in the modern pharmacy.

(1) In some cases, a commercially available product can be manufactured in the pharmacy in order to save money. Obviously, all the costs (for example, ingredients, equipment, and manpower) must be considered when this justification is used.

(2) In other circumstances, a product is manufactured because an equivalent product is not commercially available. For example, if a dermatologist were to frequently prescribe a particular ointment that is not commercially available, it would be cost effective to manufacture this product rather than to compound each individual prescription for the ointment.

2-2. FORMS USED IN THE MANUFACTURING SECTION

As you might anticipate, there are no specific manufacturing forms that are used in all U.S. Army medical treatment facilities (MTFs). This subcourse will merely provide guidance on the types of information that should be contained on certain forms used within the manufacturing section. Again, it is important to realize that forms are tailored to meet the individual needs of a particular MTF. So, the forms you see in your MTF might contain more or less information than you see on the forms used to train students in the 91Q Pharmacy Specialist Course.

a. Bulk Compounding Formula Record (Master Formula Card). The Bulk Compounding Form (Master Formula Card) is the official recipe for a particular product compounded in the pharmacy. The Master Formula Card (see figure 2-1) contains specific information on the preparation, packaging, and labeling of a product. Observe that the Master Formula Card is designed to tell you everything you need to know about the preparation of a product.
**Figure 2-1. Bulk Compounding Formula Record (Master Formula Card).**

<table>
<thead>
<tr>
<th>Item</th>
<th>Ingredients</th>
<th>Manufacturer</th>
<th>Lot No.</th>
<th>EXP Date</th>
<th>Amount used</th>
<th>Weighed By</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Guaiifenesin</td>
<td></td>
<td>300 Gm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Simple Syrup, USP</td>
<td></td>
<td>9,600 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chloroform</td>
<td></td>
<td>45 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Menthol</td>
<td></td>
<td>1.5ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Wild Cherry Flavor</td>
<td></td>
<td>10.5ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Amaranth, 1% Solution</td>
<td></td>
<td>30 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ethyl Alcohol, USP</td>
<td></td>
<td>750 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Purified Water, qsad</td>
<td></td>
<td>15,000 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PROCEDURE:**

1. Dissolve the guaiifenesin in 2,000 ml of hot purified water while the water is still on the hot plate.

2. In a separate container, dissolve the chloroform, menthol, and wild cherry flavor in the ethyl alcohol.

3. Add and mix both solutions together in the Alsop Mixer/Filter Unit and agitate thoroughly. Then add the simple syrup.

4. Add the amaranth solution to the solution.

5. Add sufficient purified water to make the product measure 15,000 ml.

6. Filter the product using #51 filter pads.

7. Package and label the product.

**Theoretical Yield**

15,000 ml

**Actual Yield**

15,000 ml

**Reason for Loss**

---

**Packaging**

125-4 oz amber bottles

<table>
<thead>
<tr>
<th>Cost/Batch</th>
<th>Cost/Unit Container</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4 hours</td>
</tr>
</tbody>
</table>

**Compound By**

**Packaged By**

**Labeled By**

**Label Directions:**

ALAMO ARMY HOSPITAL
FT. DAVY CROCKETT, TEXAS 221-2351

GAUIFENESIN EXPECTORANT
Take 1 to 2 teaspoonsful every 3-4 hours for cough.

Control #: 503384

KEEP OUT OF REACH OF CHILDREN
FOR INSTRUCTIONAL USE ONLY

**QUALITY CONTROL PROCEDURES:**

a. Specific Gravity of final product is 1.044

b. pH of final product is 6.3

Approved for release by Quality Control

Signature: Date:
b. **Batch Sheet.** The Batch Sheet (see figure 2-2) is a work copy of the Bulk Compounding Formula Record (Master Formula Card). The Batch Sheet is to be used to record entries (that is, initials of the individual who weighed the ingredients) during the manufacturing process. Thus, the Batch Sheet provides a means to ensure the product is prepared according to the established standards.

![Batch Sheet](image)

**Figure 2-2. Batch Sheet.**
c. **Prescription Form (DD 1289).** Department of Defense (DD) Form 1289 (see figure 2-3) is the official prescription form used in the U.S. Army. In the manufacturing section, the DD Form 1289 is used to order controlled substances used to manufacture products. To order controlled substances for manufacturing purposes, the Rx must be lined out. The Rx is lined out because the prescription order is not intended for an individual patient. The DD Form 1289 is not signed by a physician in this particular case. Instead, the DD Form 1289 is prepared by manufacturing personnel, signed by a pharmacy officer, and carried to the controlled drug area where it is filled.

![DD Form 1289](image.png)

Figure 2-3. DD Form 1289 used to acquire controlled substance (ethyl alcohol) for manufacturing purposes.
2-3. EQUIPMENT USED IN THE MANUFACTURING SECTION

A manufacturing section usually contains certain types of equipment. There are numerous brands and variations of these items available. The specific pieces of equipment presented and discussed in this area of the subcourse are representative samples of what you could see in a pharmacy manufacturing area.

a. Alsop Mixer/Filter Tank. The Alsop mixer/filter tank (figure 2-4) is probably the most frequently used piece of manufacturing equipment. As the name implies, it is both a mixer tank and a filter tank. The mixer tank can be used to prepare a variety of pharmaceutical products (for example, solutions). The filter tank can be used to filter solutions.

![Alsop mixer/filter tank](image)

b. Eppenbach Colloid Mill. The Eppenbach colloid mill (figure 2-5) is used to reduce the particle size of ingredients and to make preparations such as suspensions, lotions, magmas, and emulsions. The colloid mill should never be operated without tap water flowing through the cooling hoses because the grinding knives could be damaged due to heat caused by friction.

c. Erweka Power Unit. The Erweka power unit (with sliding rheostat) (figure 2-6) is the driving force for three commonly used attachments.

(1) The three roller mill (ointment mill) (figure 2-7). The three-roller mill is used in the preparation of ointments, salves, pastes, and other similar products.

(2) The agitator (figure 2-8). The agitator consists of a stirring kettle and an agitating driving unit. It is used for stirring, agitating, and beating all kinds of liquids, emulsions, suspensions, and similar mixtures.
Figure 2-5. Eppenbach colloid mill.

Figure 2-6. Erweka power unit.
Figure 2-7. The three-roller mill (ointment mill).

Figure 2-8. The agitator.
(3) The kneader-mixer (figure 2-9). The kneader-mixer serves two functions. It is equipped with a stirrer for use with liquids to be mixed and a kneading wood roller attachment with which heavy viscosity materials can be kneaded. The unit is also supplied with a scraper that removes material from the kettle walls and returns it to the center of the container to ensure proper mixing. The stainless steel kettle rotates and the mixing attachments move along the inside of the kettle at the same time. A stirring beater attachment is used to intermix-lighter viscosity materials.

Figure 2-9. The kneader-mixer.

d. The Vacuum 3 SF (Suction Flask) Bottle Filler. The vacuum 3 SF (suction flask) bottle filler (figure 2-10) is used primarily for the repackaging of bulk liquid preparations into smaller, more suitably sized containers for individual patient use. Examples of products repackaged in this manner are milk of magnesia, mouthwash, kaolin with pectin, and cough syrup.
e. **The Sobar Labeling Machine.** The Sobar labeling machine (figure 2-11) is a printing press. This label printing machine has its own type which can be used to set any letter/number order required to print labels for a manufactured or a repackaged product. A sample label depicting how the product must be labeled will appear on the Master Formula Card for that product. This sample label is used as an example for the printing of the required number of labels.
Section II. QUALITY CONTROL

2-4. INTRODUCTION TO QUALITY CONTROL

Quality control is an important term in pharmacy. Patient lives, as well as the reputation of the pharmacy, depend upon quality control procedures. This section will focus on quality control procedures that can be used in the manufacturing section.

a. Definition. Quality control is a process which builds high quality into a product by ensuring the use of good raw materials and the adherence to a rigid set of good manufacturing practices during every step of the manufacturing process. Quality control begins with checking raw ingredients and continues by performing many checks throughout the production process. Quality control ensures that the correct number of labels are printed and used for each batch of a manufactured product. Quality control procedures are used to ensure that the manufactured product meets the standards that have been established for its use.

b. Quality Control Information. Each particular manufactured product has certain characteristics that can easily be determined. Originally, when the product was first formulated, these characteristics (for example, specific gravity, refractive index, and/or pH were determined and established on the Master Formula Card for that particular product (see figure 2-12). Always be familiar with this area of the Master Formula Card because it clearly describes the standards the product must meet before it can be dispensed to patients.

2-5. QUALITY CONTROL TESTS

The following quality control tests are used to evaluate manufactured products to ensure their quality and purity for patient use.

a. Visual Inspection. With visual inspection, the ingredients and the final products are carefully examined for purity and for appearance.

b. Specific Gravity. Specific gravity is defined as the weight (in grams) of a substance per unit volume (in milliliters). Each prepared product has a characteristic specific gravity. A device called a hydrometer tube is used to measure the specific gravity of a liquid preparation. If the specific gravity of a prepared product does not meet established standards for that product, the product must not be dispensed to patients.

c. Refractive Index. The refractive index is a measure of the degree of the bending of light, which passes through the substance. The refractive index of a substance is measured with a device called a refractometer. Again, each product has an established refractive index.
d. **pH.** The pH of a substance refers to its acidity or alkalinity. As with the other quality control measures, each particular product has its own characteristic pH. The pH of a product can be determined by using pH papers or pH meters.
Section III. PHARMACEUTICAL PREPACKAGING

2-6. INTRODUCTION TO PREPACKAGING

Many pharmacies operate a prepackaging section. This section will focus on the function of this important area.

a. **Definition.** Pharmaceutical prepackaging is defined as the repackaging of bulk supplied drugs into containers which contain quantities of the drug which are more suitable for individual patient use.

b. **Justification.** The following are two reasons of justification:

   1. **Cost.** Many preparations can be purchased in bulk quantities at fairly low prices. Then, the medication can be repackaged in smaller containers that contain enough of the medication for one patient. For example, during the “flu and cold” season, the demand for nasal decongestants increases tremendously. Physicians who prescribe this type of medication usually write for the same number of capsules to be dispensed. Further, physicians normally give the same dosage directions to each patient who is to receive that particular drug. Thus, money can be saved if the nasal decongestant is prepackaged and labeled.

   2. **Time.** Prepackaged drugs can be dispensed quickly and easily with the same professional checks as you would give any prescription. Thus, as in the last example dealing with the “flu and cold” season, time savings are quickly realized when hundreds of patients suddenly appear at the front window to obtain the same drug.

2-7. EQUIPMENT USED IN A PREPACKAGING SECTION

Many pharmacies use the Versacount prepackaging machine (see figure 2-13). This machine can be calibrated to place a specific number of capsules or tablets in a drug container.

2-8. LABELING REQUIREMENTS FOR PREPACKAGING DISPENSING UNITS

The pharmacy service in most hospitals is not in operation 24 hours a day. Thus, when situations arise (for example, in a clinic or in the emergency room) in which drugs must be dispensed when the pharmacy is closed, the medications must be dispensed and labeled as per Army Regulation (AR) 40-2. To prevent medication errors, properly labeled prepackaged medications are sent to various clinics or to the emergency room. This type of prepackaged medication is designed to be dispensed to the patient by authorized prescribers.
Figure 2-13. Versacount prepackaging machine.

a. Essential Labeling Information. All labels should have the essential information below.

(1) Name of patient (blank space is provided).
(2) Date medication is dispensed (blank space is provided).
(3) Directions to the patient (blank space is provided).
(4) Name of drug, its strength, and quantity dispensed.
(5) Lot number of the drug.
(6) Drug manufacturer.
(7) Expiration date of the drug.
(8) Prescriber’s name (blank space is provided).

NOTE: Although a blank space is provided for the prescriber’s name, this information is optional.

b. Sample Label Format. See figure 2-14 for a sample label format. In order to dispense this type of pre-pack, the information is filled in by the authorized prescriber and dispensed to the patient.
2-9. LABELING REQUIREMENTS FOR PREPACKAGED DRUGS IN NONDISPENSING UNITS

This type of prepackaging is used to stock the ward, clinic, or emergency room with authorized medication. This method is very advantageous because it helps these personnel to easily identify medications, assists in identifying expired medications, and facilitates the recall of drugs once they leave the pharmacy. Wards, clinics, and emergency rooms are authorized up to a 2-week stock level of medications from the pharmacy service. This method of repackaging breaks the bulk issue containers into more usable containers that can hold a 2-week supply of medication.

a. Essential Labeling Information. Make sure each label has the following information.

(1) Generic name of the medication, trade name of the medication in parentheses (if applicable), the strength of the medication, and the quantity of medication present in the container.

(2) Manufacturer of the medication.

(3) Lot number of the medication.

(4) Expiration date of the medication.

b. Sample Label Format. See figure 2-15 for a sample label format. To dispense this type of prepack, the label must be prepared and affixed to the container. It is important for you to understand that the container is not dispensed to patients.
Figure 2-15. Sample label format for prepackaged drugs in nondispensing units.

Continue with Exercises

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EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Select the most correct definition of the term bulk manufacturing.
   a. The preparation of a small amount of a pharmaceutical product designed to be dispensed to one patient.
   b. The preparation of large quantities of a pharmaceutical product designed to be dispensed to more than one patient.
   c. The preparation of large volumes of external pharmaceutical preparations designed to be dispensed to one patient.
   d. The preparation of small amounts of a pharmaceutical product designed to be dispensed to more than one patient.

2. From the group of justifications below, select the most appropriate justification for pharmaceutical (bulk) manufacturing in the modern pharmacy.
   a. The bulk manufacturing program insures that all people are kept working all the workday.
   b. The bulk-manufacturing program insures that products meet USP/NF standards.
   c. The bulk-manufacturing program insures that the required quality control steps have performed.
   d. The bulk-manufacturing program can help the pharmacy save money.
3. Select the action that must be performed to order controlled substances manufacturing purposes using DD Form 1289.
   a. The DD Form 1289 must be lined out.
   b. The Rx must be lined out.
   c. The specific gravity of the liquid substances must be written on the form.
   d. The patient information area must be lined out.

4. From the list of names of pieces of equipment, select the piece of equipment used to prepare products such as suspensions, lotions, magmas, and emulsions.
   a. The kneader-mixer.
   b. The Eppenbach colloid mill.
   c. The Erweka power unit/three roller mill.
   d. The kneader-mixer.

5. From the list of tests below, select the test used as a quality control measure.
   a. Specific gravity test.
   b. Kuder-Richardson Formula 21 test.
   c. Osmotic pressure test.
   d. Chemical precipitation test.

6. From the group of definitions below, select the most correct definition of the term pharmaceutical prepackaging:
   a. Repackaging drugs in unlabeled bottles for ease of storage.
   b. Repackaging drugs in flexible containers for safety purposes.
   c. Repackaging of tablets or capsules supplied in bulk-quantities for purposes of storage safety.
   d. Repackaging of bulk supplied drugs into containers that contain quantities of the drug that are more suitable for individual patient use.
7. From the list of justifications below, select the one that best justifies pharmaceutical prepackaging.
   
   a. Effective uses of personnel keeps people busy repackaging drugs.
   
   b. Time-prepackaged drugs can be dispensed professionally and quickly.
   
   c. Drug safety-drugs can be secured easier.
   
   d. Legal aspects-pharmacy personnel need not be concerned with laws and regulations when dispensing prepackaged drugs.

8. From the list of advantages below, select the advantage of proper labeling of prepackaged drugs in nondispensing units.
   
   a. It assists in identifying expired medications.
   
   b. It prevents loss of medications.
   
   c. It reduces the cost of medications.
   
   d. It insures the drug's-potency will be extended.

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 2

1. b (para 2-1a)
2. d (para 2-1b(1))
3. b (para 2-2c)
4. b (para 2-3b)
5. a (para 2-5b)
6. d (para 2-5a)
7. b (para 2-6b(2))
8. a (para 2-8)

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