

7

Dispensing techniques (compounding and good practice)

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After studying this chapter you will know about:

**Good dispensing practice to ensure quality
The working environment and procedures
Extemporaneous dispensing equipment and
its correct use, including:**

Balances
Liquid measuring
Mortar and pestle
Tared containers

Heat sources

Mixing and grinding

Identification and use of materials

Problem solving

Methods of counting tablets and capsules

Introduction

The previous chapter has dealt with the importance of 'quality' in all aspects of pharmacy. This chapter deals with some of the practical aspects of good pharmacy practice. It will concentrate on the small-scale manufacture of medicines from basic ingredients. This process is called compounding or extemporaneous dispensing. In addition, good practice which applies to all aspects of dispensing will be considered and current methods for counting solid dosage forms evaluated.

In modern practice, most medicines are manufactured under well-controlled conditions (see Ch. 15, which deals with the way in which they should be dispensed). Therefore, extemporaneous dispensing, which cannot be as well controlled, should only be used when such products are not available. The pharmacist has a responsibility to maintain equipment in working order, ensure that the formula is safe and appropriate and that all materials are sourced from recognized pharmaceutical manufacturers. There are also requirements concerning calculations, records and labelling.

These are all to be incorporated within Standard Operating Procedures (see Ch. 6).

It is important to remember in any dispensing process that the end product is going to be used or taken by a person or an animal who is ill. It is therefore important that the medicine is of the highest achievable quality. This, in turn, means that the highest standards must be applied during the preparation process. We expect quality assurance procedures to be important in the pharmaceutical manufacturing industry (see Ch. 6). The same careful attention to detail must be applied to small-scale production.

ORGANIZATION

The environment in which you work will have considerable influence on your efficiency and therefore it is important to develop a tidy and organized method of working. The pharmacist who works with a dispensing bench cluttered with several containers all containing different ingredients is more likely to select the incorrect one. Always return ingredients to their appropriate shelf when you have measured out the required quantity.

Cleanliness

The bench that you work at, the equipment and utensils you use and the container which is to hold the final product must all be thoroughly clean. Lack of cleanliness can cause contamination of the preparation with other ingredients. A spatula, which has been used to remove an ingredient from one container, will adulterate subsequent containers if not washed before being used again. Cleanliness will also minimize microbial contamination.

Appearance

A clean white overall should be worn. It should be kept buttoned up since open lab. coats are a potential hazard and

cannot prevent outdoor clothes becoming stained if any spillages occur. Hair should be tied back and any skin lesions covered with a dressing.

Documenting procedures and results

Keeping comprehensive records is an essential part of the dispensing process. Records must be kept for a minimum of 2 years (ideally 5 years) and include the formula, the ingredients and quantities used, their sources, batch numbers and expiry date. The record for a prescribed item should also include the patient and prescription details and date of dispensing. A record must be kept of the personnel involved, including the responsible pharmacist. It is best to develop a methodical approach. Being untidy or disorganized can lead to errors. In an attempt to produce neat and tidy lab. books many students do calculations and write details of ingredients on scraps of paper intending to copy the information into the lab. book at a later time. This practice should be discouraged. Information may get lost or mixed up and errors made when transferring details. Good habits learned as an undergraduate should be continued into professional practice.

EQUIPMENT

Not only is the selection of the correct equipment or 'tools' for the job essential, but the tools must also be used in the correct way.

Weighing

Balances

Three types of balance have traditionally been used in dispensing, Class A, Class B (the most commonly used, see Fig. 7.1) and Class C.

New legislation categorizes balances as Class I, Class II, Class III and Class IV. The Class II balance is its nearest equivalent to the Class B balance. All balances, including Class B balances, must be calibrated in metric units. All new balances must now be marked with both maximum and minimum weights that can be weighed. The weights previously allowable are shown in Table 7.1. The move is now to use electronic top-pan balances, where typically the smallest weighable quantity is 10–20 mg and a maximum capacity of about 300 g.

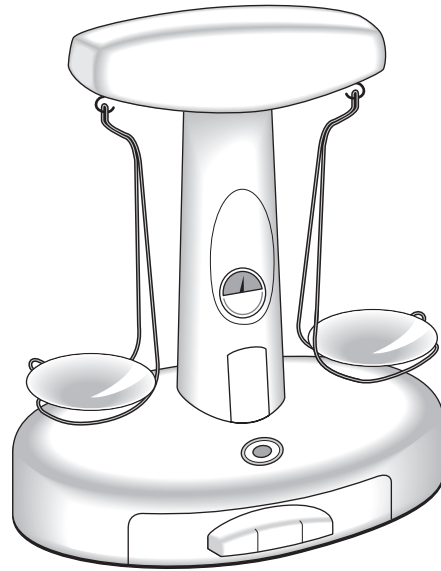


Fig. 7.1 Dispensing balance.

Rules for the use of a Class B dispensing balance:

- Ensure that the balance and pans are clean.
- Check that it is sited in a draught-free area and the pointer is swinging freely.
- Place a piece of paper under the right-hand pan to protect the balance from any spillages.
- Remove the appropriate weights from the drawer, using the tweezers provided, and place them on the left-hand pan. (Never handle weights, as this will affect their accuracy and risks contamination.)
- Immediately close the drawer after removal of the weights. If it is left open there is a possibility that ingredients to be weighed will fall into the drawer, contaminating the weights and affecting their accuracy.
- A solid material to be weighed should then be placed carefully onto the right-hand scale pan. Do not weigh ingredients onto a piece of paper as this introduces a

Table 7.1 Classes of balances with their weighing capabilities

Type	Minimum weight	Increment weight	Normal maximum
Class A	50 mg	1 mg	1 g
Class B	100 mg	10 mg	50 g
Class C	1 g	100 mg	2 kg

potential inaccuracy. The exception is when weighing greasy or semisolid material, e.g. white soft paraffin, when a counterbalanced piece of paper should be used.

- When the correct weight has been achieved the pan should be carefully removed from the balance and the material transferred to a suitable container.
- Errors in this transference stage may occur if care is not taken to ensure that all the weighed material has been removed from the scale pan. If the drug is to be dissolved or incorporated into a suspension it can be washed from the scale pan using some of the appropriate liquid vehicle.
- Do not become overzealous when removing material from a pan. Tapping the glass pan against the side of the container can cause it to become chipped. This will affect the accuracy of the balance and slivers of glass will not improve the health of the patient!
- The scale pan should then be washed and dried thoroughly, before any other substance is weighed. A second substance must never be weighed on the remains of the first.
- The weights should be returned to the drawer. Drawers are normally organized in four sections. The weights should be kept together with those of a similar size, e.g. a 10 mg weight should not be placed in the same section as a 10 g weight.

Use of top-pan balance:

- Ensure that the balance is level, in a draught-free environment and working properly.
- Place an appropriate container (such as a weighing boat) or piece of paper on the pan and use the auto-zero to cancel its weight.
- Add the material to be weighed until the correct weight is shown on the display.
- Carefully remove the weighed material as above.

In addition to using the balance correctly there are one or two other rules which should be observed, when weighing, to ensure good dispensing practice. These are:

- If using a solid material which requires to be size reduced (ground) or sieved, always ensure that this is carried out before weighing the required quantity. If a quantity of powder is weighed and then size reduced by grinding in a mortar or sieving, there is a strong possibility that some of the material will be lost in the process and the final preparation will not contain the correct proportions of ingredients. The best approach is to roughly weigh an excess quantity, grind or sieve it as required, then accurately weigh off the required quantity.

- As far as possible never split quantities and do two weighings, as this will increase the inaccuracies.
- If a quantity less than the legal minimum is needed, it is necessary to weigh the minimum weight allowable (or more) and make an excess of the product or prepare it by trituration (see Chs 8, 22 and 23).

Measuring liquids

Liquid measures

All measures for liquids must comply with current Weights and Measures Regulations and should be stamped accordingly. Traditionally, conical measures (Fig. 7.2) have been used in dispensing, although, if not used carefully, they can be less accurate than cylindrical measures.

Whichever type of measure is chosen always ensure that:

- The level of liquid is read to the bottom of the meniscus.
- The measure is vertical when reading the meniscus. If this is not done considerable errors in quantities can occur, especially with conical measures, where the error increases with height because of the slope of the sides.
- The measure is thoroughly drained. Even if the ingredient is only slightly viscous it is amazing how much can be left in the measure.

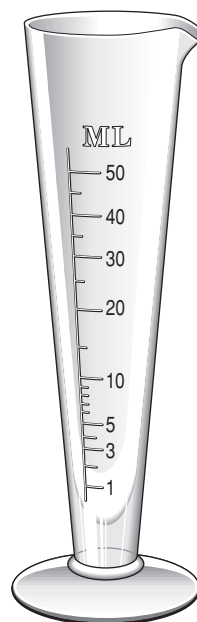


Fig. 7.2 Conical dispensing measure.

- As far as possible, never use more than one measure. Splitting the volume between two measures increases the potential for error.
- Always select the smallest measure which will hold the desired volume, because this gives the greatest accuracy.
- If the substance being measured is so viscous that it would be very difficult to drain the measure effectively, then the volume should be measured by difference. This is done by pouring an excess into the measure and then pouring off the liquid until only the excess volume remains (see Example 7.1).

EXAMPLE 7.1

25 mL of glycerol is required.

Because of the viscosity it is difficult to remove it completely from the measure.

It is therefore advisable to measure, say, 35 mL and pour off the 25 mL required, ensuring that 10 mL is left in the measure. Remember to allow sufficient time for the liquid to drain back down.

When measuring liquids it is important to observe two simple rules which ensure good dispensing practice.

- Always hold the liquid container with the label uppermost so that you pour away from the label. This ensures that any liquid which runs down the side of the bottle will not affect the label. There is nothing worse than bottles where the ingredient name has been obscured because large quantities of the liquid have been allowed to run down the side of the bottle. This is especially true for highly coloured substances (such as amaranth solution) or corrosive substances (like acids). Replace any damaged label immediately.
- If possible, when pouring liquids, hold the cap of the container in your hand, preferably between the fourth finger and the palm of your hand. It is possible you may be measuring more than one liquid and if caps are left lying on the dispensing bench it is easy to mix them up and place the wrong one back on the container.

Measuring small volumes

It is important to select the correct equipment when measuring. The minimum measurable volume for a 10 mL conical measure is 1 mL. Graduated pipettes can be used for volumes from 5 mL down to 0.1 mL. For volumes smaller

than this a trituration should be made. The viscosity of the substance being measured should also be considered.

Correct use of pipettes. Pipettes can be either the 'drainage' or 'blow-out' variety. A rubber bulb or teat should be used. Never use mouth suction.

- A bulb or teat should be placed over the mouth of the pipette, taking care not to push it down too far.
- The container of the substance to be measured should be ready on the bench.
- The top of the container should be removed and held in the hand, between the fourth finger and the palm of the hand.
- The pipette should be put into the container, taking care that only a short length of the pipette is immersed. If a quantity of liquid is allowed to collect on the outside of the pipette the accuracy of the measuring will be affected.
- The correct amount of liquid should then be drawn up the pipette. Take care at this stage as the liquid may shoot up the pipette into the bulb.
- If a pipette bulb is being used the appropriate valve is pressed to prevent the liquid running out of the pipette, the pipette is removed from the container and the liquid then released into the desired container.
- If using a simple teat this should now be flicked off with the thumb and a finger placed firmly over the top of the pipette, taking care not to allow any liquid to be lost. The pipette can then be withdrawn from the container and the liquid measured out by removing the finger from the top of the pipette.

Tared containers

Liquid preparations should as far as possible be made up to volume in a measure. There are, however, instances when accurate transfer of the preparation to the final container is difficult. With some suspensions it can be almost impossible to remove all the insoluble ingredients when pouring from one container to another. Emulsions and viscous preparations can also be difficult to transfer accurately. In these cases a tared container should be used.

To tare a bottle

A volume of water identical to the volume of the product being dispensed is accurately measured. This is then poured into the chosen medicine container and the meniscus marked with the upper edge of a small adhesive label, effectively making the bottle into a single-point measure. The

container is then emptied and allowed to drain thoroughly. The preparation is then poured into the container and made up to volume, using the tare mark as the guide.

This procedure should be used with discretion and only in situations when major inaccuracies would occur in the transfer of liquids. It should also only be used when water is present as one of the ingredients. Putting medicines into a wet bottle is generally considered bad practice.

MIXING AND GRINDING

Mortar and pestle

The mortar (bowl) and pestle (pounding device) are used to reduce the size of powders, mix powders, mix powders and liquids, and make emulsions. Two types, each available in a range of sizes, are used.

Glass mortar and pestle

These are generally small and therefore cannot be used for large quantities of material. The smooth surface of the glass reduces the friction which can be generated, so they are only suitable for size reduction of friable materials (such as crystals). They are useful for dissolving small quantities of ingredients, for mixing small quantities of fine powders and for the mixing of substances such as dyes which are absorbed by and stain composition or porcelain mortars.

Porcelain or composition mortars and pestles

These are normally larger than the glass variety and have a rougher surface. They are ideal for size reduction of solids and for mixing solids and liquids, as in the preparation of suspensions and emulsions.

Size reduction using a mortar and pestle

Selection of the correct type of mortar and pestle is vital for this operation. A flat-bottomed mortar and a pestle with a flat head should be chosen. A flat-headed pestle in a mortar with a round bottom, or vice versa, will mean a lot of wasted effort.

Using a mortar and pestle for mixing powders

Adequate mixing will only be achieved if there is sufficient space. Overfilling of the mortar should therefore be avoided. The pestle should be rotated in both right and left directions to ensure thorough mixing. Undue pressure should not be used, as this will cause impaction of the powder on the bottom of the mortar.

Filters

There are occasions when clarification of a liquid is required. Pouring the liquid through muslin can carry out coarse filtration, or 'straining'. Where a finer degree of filtration is required, filter paper or sintered glass filters should be used. Filter paper comes in different grades and selection of the correct grade is determined by the size of the particles to be removed. Details of grades of filter paper are found in Table 7.2. Filter paper has the disadvantages of introducing fibres into the filtrate and may also absorb significant amounts of active ingredient.

Sintered glass filters

These do not shed fibres, are easy to clean and can be used for substances which attack filter paper such as potassium permanganate and zinc chloride. A filter with a pore size 15–40 μm (grade 3) is suitable for most solutions. They will

Table 7.2 Filter paper characteristics

Number (Whatman series)	Filtration rate	Size of particle removed	Average pore size (mm)
54	1 (fast)	Coarse	3.4–5.0
1	4 (medium fast)	Medium	2.1–2.8
50	23 (slow)	Fine	0.4–1.1

pass through by gravity, although large volumes may be slow and need the assistance of a vacuum. A grade 4 filter (pore size 5–15 µm) requires a vacuum.

Heat sources

Bunsen burners

Bunsen burners should always be placed on a heat-resistant mat on the dispensing bench. When heating with a Bunsen burner, the flame control should be rotated to produce a blue flame. In most dispensing exercises only gentle heat is required, so only use a fierce blue flame if excessive heat is called for. When not in use the Bunsen burner should be turned to a yellow flame or turned off.

Water-baths

These are used when melting ointment bases or preparing suppositories. Normally the materials to be heated are placed in a porcelain evaporating basin and placed over the hot water in the water-bath. In most melting exercises the materials should be melted gently. There is no necessity to have the water boiling vigorously, this does not increase the heat, but does increase the risk of scalding.

Electric hot plates

Electrically heated hot plates can be used and have the advantage of thermostatic controls, although there is a time lag involved in heating and cooling the plate.

MANIPULATIVE TECHNIQUES

Selection of the correct equipment and using it appropriately is fundamental to good compounding. There are, in addition, several basic manipulative techniques which must be practised.

Mixing

The goal of any mixing operation should be to ensure that even distribution of all the ingredients has occurred. If a sample is removed from any part of the final preparation it should be identical to a sample taken from any other part of the container (see Ch. 13; Aulton, 2002).

Mixing of liquids

Simple stirring or shaking is usually all that is required to mix two or more liquids. The degree of stirring or shaking will be dependent on the viscosities of the liquids. Thus mixing liquids of low viscosities will require only minimal stirring, while mixing two liquids, both with a high viscosity, will need more vigorous agitation.

Mixing solids with liquids

Particle size reduction is also of paramount importance. This will either speed up the dissolution process or improve the uniform distribution of the solid throughout the liquid. When a solution is being made, a stirring rod will be adequate. However, a suspension will require a pestle and mortar.

Mixing solids with solids

As well as the correct use of a mortar and pestle, the amounts of material being mixed together must be considered. Where the quantity of material to be mixed is small and the proportions are approximately the same, the materials can be added to an appropriately sized mortar and effectively mixed. Where a small quantity of powder has to be mixed with a large quantity, in order to achieve effective mixing, it must be done in stages.

- The ingredient with the smallest bulk is placed in the mortar.
- A quantity of the second ingredient, approximately equal in volume to the first, is added and carefully mixed, using the pestle.
- A further quantity of the second ingredient, approximately equal in volume to the mixture in the mortar, is now added.
- This process, known as ‘doubling-up’, is continued until all the powder has been added.

Mixing semi-solids

This usually occurs in the preparation of ointments where two or more ointment bases may be mixed together. If all the ingredients are semi-solids or liquids, they can be mixed together by rubbing them down on an ointment slab, using a spatula. If there is a significant difference in the quantities of the ingredients, a ‘doubling-up’ process should be used. An alternative method is the fusion method.

Table 7.3 Some substances which occur in a variety of forms

Substance/form	Use
Light magnesium carbonate	Because of its lightness and diffusible properties, it is used in suspensions
Heavy magnesium carbonate	Normally used in bulk or individual powders
Light kaolin	Used in suspensions
Heavy kaolin	Used in the preparation of kaolin poultice
Precipitated sulphur	This has a smaller particle size than sublimed sulphur and is preferred in preparations for external use, e.g. suspensions, creams and ointments
Sublimed sulphur	Slightly gritty powder which does not produce such elegant preparations as precipitated sulphur
Yellow soft paraffin	Used as an ointment base
White soft paraffin	Bleached yellow soft paraffin normally used when the other ingredients are not strongly coloured

The fusion method

- Place the bases in a porcelain evaporating basin and gently heat them over a water-bath until they have just melted. Excess heat should not be used as overheating may cause physical or chemical changes in some materials.
- The basin is then removed from the heat and the contents are stirred continuously, but gently, until the mixture has cooled and set. Stirring at this stage is of vital importance as otherwise the components may segregate on cooling.

When using the fusion method do not be tempted to add any solid active ingredients to the basin before the bases have set. Addition of any further ingredients is best done by rubbing down on an ointment slab. Further details of methods used in the preparation of ointments can be found in Chapter 20.

SELECTION OF INGREDIENTS

When dispensing, selection of the correct product is vital. Dispensary shelves are filled with an increasing number of products and the label on each container must be read carefully and checked to ensure that it contains the required product. There are many examples of manufactured preparations where names may be misread if care is not taken; examples include Atrovent inhaler and Alupent inhaler, Danol and De-Nol, folic acid and folinic acid, cefuroxime and cefotaxime. Further examples are given in Chapter 15. Problems

and errors can also occur in extemporaneous dispensing. Extemporaneously dispensed medicines may contain several ingredients, so the potential for error is increased.

Pharmacy undergraduates may encounter difficulties when an ingredient occurs in a variety of forms or a synonym is used.

Variety of forms

The following item has to be prepared: Coal Tar Paste BP.

This paste consists of 7.5% strong coal tar solution in compound zinc paste. Coal tar is available as:

Coal tar solution
Strong coal tar solution
Coal tar.

If all three containers are sitting together on a shelf the wrong item may be selected by accident. Some other materials where confusion can occur are listed in Table 7.3. This list is not meant to be comprehensive. The only foolproof method of avoiding errors is to read the container label carefully.

Synonyms

Some substances used in dispensing may be known by more than one name. An awareness of this is useful when selecting ingredients. Some examples of commonly used materials are given in Table 7.4. This table is not intended to be comprehensive.

Table 7.4 Example of substances with synonyms

Substance	Synonym
Wool fat	Anhydrous lanolin
Hydrous wool fat	Lanolin
Hard paraffin	Paraffin wax
Compound benzoic acid ointment	Whitfield's ointment
Macrogol 2000	Polyethylene glycol 2000 PEG 2000
Theobroma oil	Cocoa butter

Concentrated waters

Liquid preparations for oral use are often flavoured to make them more palatable for the patient. In extemporaneously prepared products the flavouring is frequently a flavoured water, e.g. peppermint water, aniseed water. These flavoured waters are available in a concentrated form and are either used as such, or are diluted to provide the vehicle for the preparation. All concentrated waters have the same dilution factor, i.e. 1 part of concentrate plus 39 parts of water to give 40 parts of flavoured water.

EXAMPLE 7.2

In 200 mL of a particular suspension there is 100 mL of peppermint water. The peppermint water is only available as concentrated peppermint water. The dilution factor 1 + 39 is used.

$$1 \text{ mL concentrate} + 39 \text{ mL water} = 40 \text{ mL peppermint water}$$

If 40 mL of peppermint water contains 1 mL of concentrated peppermint water then:

100 mL of peppermint water will contain 2.5 mL of concentrated peppermint water.

Therefore to 2.5 mL of concentrated peppermint water is added 97.5 mL of water to produce the 100 mL of peppermint water required.

PROBLEM SOLVING IN EXTEMPORANEOUS DISPENSING

For extemporaneous dispensing, it is helpful if a method detailing how to prepare the product is available. Methods for 'official' preparations can sometimes be found in reference sources such as the *Pharmaceutical Codex*. However, on many occasions no method is available. When faced with an extemporaneous preparation and no method, students are often perplexed and unsure of where to start. The application of simple scientific knowledge, especially of physical properties, is often all that is needed. The following gives an example of how this is done.

Putting theory into practice

Solubility

Always check the physical properties of the ingredients being used. This provides some very useful information. Always check the solubility of any solid materials. If they are soluble in the main vehicles, then a solution is likely to be produced. If solubility is limited to one liquid, this will assist in achieving uniform dose distribution. Solution will be achieved more quickly if the particle size is small and so size reduction should be considered for any soluble ingredients which are presented in a lumpy or granular form. If the substance is not soluble, a suspension will be produced. If not already in a finely divided form, it should always be size reduced. Whether a suspending agent will be required should be considered (see Ch. 18). Where one material is an oil and another aqueous, it is likely that an emulsifying agent will be required to produce an emulsion (see Ch. 19).

Volatile ingredients

If an ingredient is volatile then it should be added near the end of the dispensing process. If it is added too early much may be lost due to evaporation.

Viscosity

The viscosity of a liquid will have a bearing on how it is measured, i.e. is a pipette or measure suitable, or should it be measured by difference, and how will it be incorporated?

The following example illustrates how some very simple facts can be applied to develop an accurate method of preparation.

EXAMPLE 7.3

The following prescription is received:

Sodium Bicarbonate Ear Drops BP
Send 10 mL

Formula:

Sodium bicarbonate	500 mg
Glycerol	3 mL
Freshly boiled and cooled water to	10 mL

Points to note:

- Solubility of sodium bicarbonate is 1 in 11 of water.
- Glycerol is a viscous liquid.
- The quantity of water in the ear drops is approximately 6.5 mL.

Method:

1. The sodium bicarbonate should be size reduced in a mortar and pestle, if necessary.
2. 500 milligrams of sodium bicarbonate is then weighed and put into a 10 mL conical measuring cylinder.
3. The sodium bicarbonate is soluble, requiring a minimum of 5.5 mL in which to dissolve. Add about 6 mL of water, ensuring that the volume of ingredients does not go beyond the 7 mL mark.
4. Stir the contents of the measure until the sodium bicarbonate is dissolved.
5. Make the volume up to 7 mL with water.
6. The glycerol is viscous and trying to pour 3 mL from a measure is inaccurate. The 3 mL of glycerol can now be added by pouring it into the 7 mL of sodium bicarbonate solution and carefully making the volume in the measure up to 10 mL.

Expiry date

All extemporaneously prepared products should be awarded an expiry date. Ideally stability studies should be undertaken in order to predict an accurate shelf life for all products. This is not usually possible for 'one-off' preparations and most hospital pharmacies have guidelines based on previous stability studies. Further information on stability and appropriate expiry dates is found in Chapter 10.

COUNTING DEVICES

Tablets and capsules form a large proportion of the medicines which are dispensed today. Many are now presented in patient packs or original packs, but in many

instances drugs are supplied in bulk packs and the prescribed amount is counted from them.

Various methods can be used for this counting:

- The manual method
- A counting triangle or capsule counter
- A counting tray
- An electronic counter.

These methods all have their advantages and disadvantages and it is up to each pharmacist to select the most appropriate for the task. Whichever method is selected it must be noted that the medicines must not be touched by hand. The equipment should also be carefully cleaned before use, as powder left from one product could cause contamination of the next one.

The manual method

This consists of pouring the product onto a piece of clean white demy paper which overlaps another piece. The products are then counted off in tens, using a spatula, onto the second piece of paper. This is formed into a small funnel and the tablets or capsules poured into the appropriate container.

Initially this can be a rather slow method but an experienced pharmacist or dispenser can count very quickly. However, concentration must be maintained or the wrong quantity may be counted. The other problem is that white demy paper is becoming increasingly expensive and difficult to obtain.

Counting triangles and capsule counters*Counting triangles*

This is a fast, accurate and simple way to count tablets. The triangles are made either of metal or plastic. Two rows of figures are printed or etched along the edge. The top row of figures refers to the number of rows and the numbers below refer to the number of tablets contained in that number of rows. This is illustrated in Figure 7.3. Tablets are poured into the triangle and rows completed using a spatula. Any excess of tablets is returned using the spatula and the correct number poured into a tablet bottle.

Capsule counters

Because of their shape, capsules cannot be counted on triangles. A capsule counter, illustrated in Figure 7.4, is a metal tray which consists of 10 rows of grooves. The capsules are poured onto the tray and using a spatula, lined up in the

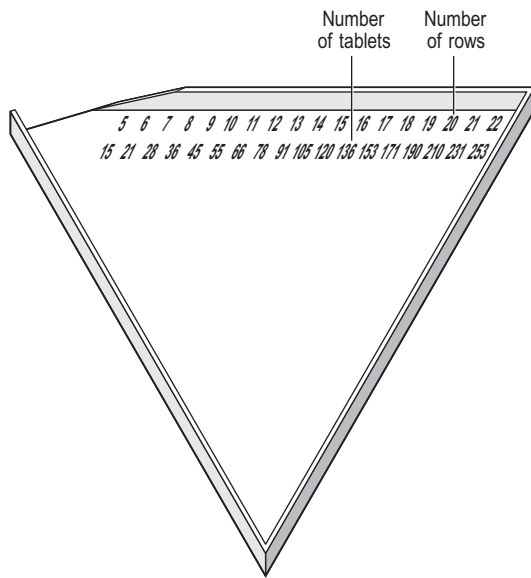


Fig. 7.3 Counting triangle.

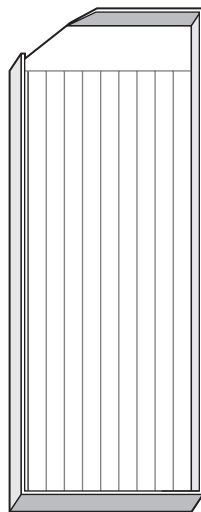


Fig. 7.4 Capsule counter.

grooves. Each complete row will contain 10 capsules so the number of complete rows multiplied by 10 gives the number of capsules.

Capsule counters are not as easy to manipulate as triangles but are an efficient method for counting capsules. Studies testing the accuracy of the various counting methods have shown these two devices to be the best.

Perforated counting trays

These are normally made of clear perspex. They consist of a rectangular box with a sliding lid, on top of which is placed a perforated tray. Each box is supplied with several trays with different-sized perforations to accommodate different sizes and types of products (Fig. 7.5). These trays can be used to count tablets or capsules.

An experienced operator can count quickly and accurately using this type of device. The main disadvantage is the necessity to change the trays for different products.

Electronic counters

There are two types of electronic counter, those which use the weight of the product to count and those which count using a photoelectric cell.

Electronic balances

Between 5 and 20 of the required dosage form is put on a balance pan or scoop. From the weight of this reference sample, a microprocessor within the device calculates the total number of dosage forms, as they are added. The main problem with this type of device is that for accurate counting, it requires consistent uniformity of the weight of the tablets or capsules. There can be problems with accuracy when counting sugar-coated or very small tablets.

Photoelectric cell counters

The product to be counted is poured through a hopper on the top of the machine. The tablets or capsules are then channelled into a straight line and counted as they interrupt the beam of light to the photoelectric cell. This is an efficient method of counting and these devices are widely used. They are not without their problems, however.

- They do not discriminate between whole or broken tablets.
- As the beam of light from the photoelectric cell must be interrupted for counting to occur, these devices cannot count clear capsules.
- The speed at which the dosage forms are poured through the hopper must be controlled. If pouring becomes too fast the system will not cope.
- They are difficult to clean.

Because of this last point the Council of the Royal Pharmaceutical Society of Great Britain issued the following advice concerning the use of electronic counters:

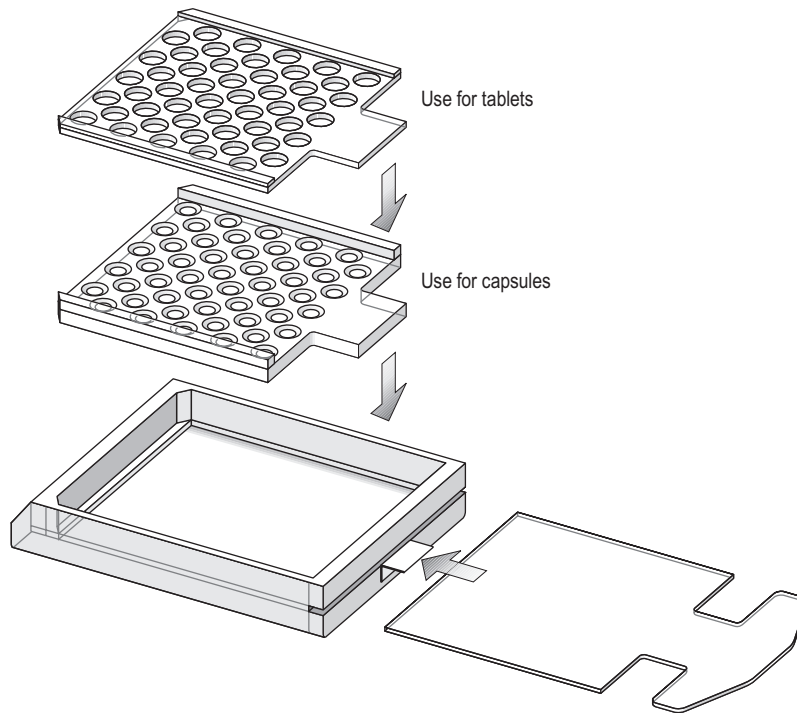


Fig. 7.5 Perforated counting tray.

Severe allergic reactions can be initiated in previously sensitized persons by very small amounts of certain drugs and of excipients and other materials used in the manufacture of tablets and capsules. In order to minimize that risk, counting devices should be carefully cleaned after each dispensing operation involving any uncoated tablet, or any coated tablet or capsule from a bulk container holding damaged contents. As cross-contamination with the penicillins is particularly serious, special care should be taken when dispensing products containing those drugs.

This type of device should therefore be reserved for counting only coated tablets or capsules or for prepacking operations.

AUTOMATED DISPENSING SYSTEMS

There are a number of automated dispensing systems available of varying degrees of sophistication. They are linked

to a computer, which is used for label production and creation of the patient medication record. The computer 'orders' counting of loose tablets or capsules (using a photoelectric cell counter) into a suitable container, or retrieval of a prepackaged medicine. Some incorporate bar-coding technology to improve speed and accuracy. Tests indicate that these machines are less prone to error than human dispensing.

CONCLUSION

Developing good practice takes time and requires attention to detail. During the undergraduate course, students should develop the habit of working on their own. Once established, this can be relied upon throughout your career.

Key Points

- Extemporaneous dispensing should only be used when manufactured medicines are not available.
- Accurate dispensing requires clean, neat methodical work.
- Comprehensive records of extemporaneous dispensing are required to be kept for at least 2 years.
- Class B balances are being replaced by Class II balances.
- Electronic balances are increasingly being used in extemporaneous dispensing.
- Do not use a balance to weigh less than its minimum weighable quantity, which is 100 milligrams for a Class B balance.
- Ensure that liquid measures comply with the Weights and Measures Regulations.
- Always use the bottom of the meniscus when measuring liquids.
- Viscous liquids should be measured 'by difference'.
- Pipettes are used to measure volumes between 0.1 mL and 5 mL.
- Select the smallest measure for the volume of liquid to be measured.
- A glass mortar and pestle can be used for size reduction of friable materials and mixing small quantities of fine powder.
- A porcelain mortar and pestle is used for larger quantities, for mixing solids and liquids, making emulsions and for size reduction.
- 'Doubling-up' is used for mixing a small quantity of powder with a larger quantity.
- Confusion can arise with different forms of the same material and the use of synonyms.
- Concentrated waters are diluted 1 part with 39 parts of water for use as single strength.
- Simple problem-solving techniques can produce a satisfactory method of dispensing a product.
- Tablets and capsules can be counted manually, or by using a triangle, capsule counter, counting tray or an electronic counter.
- Tablets and capsules should not be counted in the hand.