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Tablets

DEFINITION

Tablet is defined as a compressed unit solid dosage form containing medicaments with or without excipients prepared either by compression or moulding methods.

According to the Indian Pharmacopoeia Pharmaceutical tablets are solid, flat or biconvex dishes, unit dosage form, prepared by compressing a drugs or a mixture of drugs, with or without suitable diluents.

They vary in shape and differ greatly in size and weight, depending on amount of medicinal substances and the intended mode of administration. It is the most popular dosage form and 70% of the total medicines are dispensed in the form of Tablet. All medicaments are available in the Tablet form except where it is difficult to formulate or administer diluents.

PROPERTIES OF TABLETS

- Should be elegant product having its own identity while being free of defects such as chips, cracks, discoloration and contamination.
- Should have strength to withstand the rigors of shocks encountered in its production, packaging, shipping and dispensing.
- Should have the physical stability to maintain its physical attributes over time.
- Must be able to release the medicament agent(s) in the body in a predictable and reproducible manner.
- Must have a suitable chemical stability over time so as not to allow alteration of the medicinal agent(s).

Manufacturing of tablets requires number of unit operations like product includes weighing, milling, granulation, drying, blending, lubrication, compression and coating.

Advantages of Tablets

- They are unit dosage form and offer the greatest capabilities of all oral dosage form for the greatest dose precision and the least content variability.
- Cost is lowest of all oral dosage form.
- Lighter and compact.
- Easiest and cheapest to package and strip.
- Easy to swallow with least tendency for hang up
- Sustained release product is possible by enteric coating.
- Objectionable odour and bitter taste can be masked by coating technique.
- Suitable for large scale production.
- Greatest chemical and microbial stability over all oral dosage form.
- Product identification is easy and rapid requiring no additional steps when employing an Embossed and/or monogrammed punch face.

Disadvantages of Tablets

- Difficult to swallow in case of children and unconscious patients.
- Some drugs resist compression into dense compacts, owing to amorphous nature, low density character.
- Drugs with poor wetting, slow dissolution properties, optimum absorption high in GIT may be difficult to formulate or manufacture as a tablet that will still provide adequate or full drug bioavailability.
- Irritant effects on the GI mucosa by some solids (e.g., aspirin).
- Possibility of bioavailability problems resulting from slow disintegration and dissolution.

TYPES OF TABLETS

Compressed Tablets

The tablets are formed by compression of powdered, crystalline, or granular active materials (API), alone or in combination with certain excipients as required, such as binders, disintegrants, sustained release polymers, lubricants, diluents, flavoring agents and colorants.

A. Sugar coated tablets
B. Film coated tablets
C. Enteric-coated tablets
D. Multi compressed tablets: Tablets made by more than one compression cycle.
    i. Layered tablets
    ii. Press coated tablets

E. Sustained release tablets
F. Tablets for solution
G. Effervescent tablets
H. Compressed suppositories or inserts
I. Buccal and sublingual tablets

Molded Tablets or Tablet Triturates (TT)

Tablet triturates usually are made from moist material, using a mold that gives them the shape of cut sections of cylinder. Such tablets must be completely and rapidly soluble. Suitable water-soluble lubricant is many times a constraint.

Dispensing Tablets

These tablets provide a convenient quality of potent drug that can be incorporated readily into powders and liquids, thus circumventing the necessity to weigh small quantities. These tablets are supplied primarily as a convenience for extemporaneous compounding and never dispensed as a dosage form.

Hypodermic Tablets

Hypodermic tablets are soft, readily soluble tablets. Though these tablets are now made for oral administration they are not yet recognized by the official compendia.

Sugar-coated Tablets

Sugar coating is used in immediate release applications to mask unpleasant taste and odour of some drugs or to improve aesthetic qualities of the product. It should be understood that the coating process will add some time to the overall disintegration of the tablet and may impact drug dissolution. This effect should be considered when formulating the core to ensure that the product meets disintegration and dissolution requirements stated in official compendia. For an enteric or sustained-release sugar-coated product, the formulation problem may become more complex to meet USP tablet disintegration and dissolution specifications. The selection of the core tablet and coating materials becomes more important for these applications and requires proper evaluation to assure long-term chemical and physical stability.

Film-coated Tablets

A film coating is a thin polymer-based coat applied to a solid dosage form such as a tablet. The thickness of such a coating is usually between

20–100 μm. It is possible to follow the dynamic curing effect on tablet coating structure by using non-destructive analytical methodologies.

Enteric-coated Tablets

An enteric coating is a polymer barrier applied on oral medication that prevents its dissolution or disintegration in the gastric environment. This helps by either protecting drugs from the acidity of the stomach, the stomach from the detrimental effects of the drug, or to release the drug after the stomach.

Sustained Release Tablets

Sustained release tablets are defined as which maintains the therapeutic blood or tissue levels of drug by continuous release of medication for a prolonged period of time, after administration of a single dose. In case of injectable dosage forms it may vary from days to months.

TABLET PROCESSING METHODS

Pharmaceutical products are processed all over the world using the direct compressing, wet granulation, or dry granulation methods. Method chosen depends on the ingredients' individual characteristics like flow property, compressibility etc. Right choice of method requires thorough investigation of each proposed ingredient in the formula for comprehensive approach for interactions and stability.

Direct Compression

The tablets are made by directly compressing the powdered materials without modifying the physical nature of the materials itself. Direct compression is generally done for the crystalline materials having good physical properties such as flow property, compressibility etc. Main advantages of direct compression are time saving, safety of operations and low cost.

Wet Granulation

This is the most widely used method of tablet preparation. In this method the powders are bound by suitable binder by "adhesion". The binder is added by diluting with suitable solvent prior to addition to the blended powders to form wet granules which in turn are dried suitably to expel the solvent forming dried granules. The surface tension forces and capillary pressure are primarily responsible for initial granules formation. The main advantage being it meets all the requirements for tablet formation though it is multistage, time consuming.

Dry Granulation

The dry granulation process is used to form granules without using a liquid solution. This type of process is recommended for products, which are sensitive to moister and heat. Forming granules without moisture requires compacting and densifying the powders. Dry granulation can be done on a tablet press using slugging tooling. On large-scale roller compactor commonly referred to as a chilsonator. The compacted mass is called slugs and the process is known as slugging. The slugs are then screened or milled to produce a granular form of tablet materials, which have the good flow properties then original powder mixture. The main advantage of dry granulation is it requires less equipment and eliminates the addition of moisture and the application of heat, as found in wet massing and drying steps of the wet granulation method. The manufacture of oral solid dosage forms such as tablets is a complex multi-stage process under which the starting materials change their physical characteristics a number of times before the final dosage form is produced. Traditionally, tablets have been made by granulation, a process that imparts two primary requisites to formulate: compactibility and fluidity. Both wet granulation and dry granulation (slugging and roll compaction) are used. Regardless of whether tablets are made by direct compression or granulation, the first step, milling and mixing, is the same; subsequent step differ. Numerous unit processes are involved in making tablets, including particle size reduction and sizing, blending, granulation, drying, compaction, and (frequently) coating. Various factors associated with these processes can seriously affect content uniformity, bioavailability, or stability.

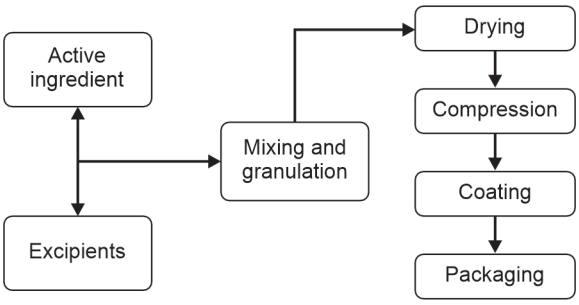

Fig. 1.1: Various unit operation sequences in tablet manufacturing

Dispensing (Weighing and Measuring)

Dispensing is the first step in any pharmaceutical manufacturing process. Dispensing is one of the most critical steps in pharmaceutical manufacturing; as during this step, the weight of each ingredient in the mixture is determined according to dose. Dispensing may be done by purely manual

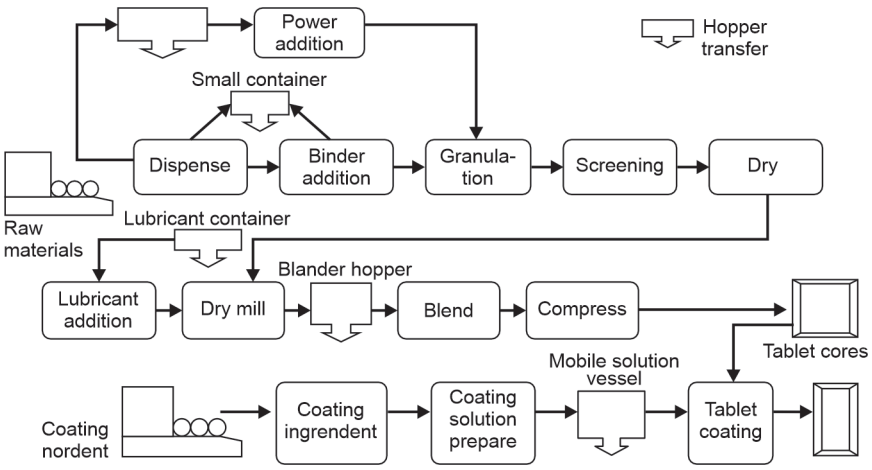

Fig. 1.2: Typical manufacturing process of table

Table 1.1: Comparision of wet granulation, dry granulation and direct compression

Wet granulation	*Dry granulation*	*Direct compression*
Milling and mixing of drugs and excipients	Milling and mixing of drugs and excipients	Milling and mixing of drugs and excipients
Preparation of binder solution	Compression into slugs or roll compaction	Compression of tablet
Wet massing by addition of binder solution or granulating solvent	Milling and screening of slugs and compacted powder	
Screening of wet mass	Mixing with lubricant and disintegrant	
Drying of the wet granules	Compression of tablet	
Screening of dry granules		
Blending with lubricant and dis-integrant to produce "running powder"		
Compression of tablet		

by hand scooping from primary containers and weighing each ingredient by hand on a weigh scale, manual weighing with material lifting assistance like Vacuum transfer and Bag lifters, manual or assisted transfer with automated weighing on weigh table, manual or assisted filling of loss-in weight dispensing system, automated dispensaries with mechanical

devices such as vacuum loading system and screw feed system. Issues like weighing accuracy, dust control laminar air flow booths, glove boxes), during manual handling, lot control of each ingredient, material movement into and out of dispensary should be considered during dispensing.

Sizing

The sizing (size reduction, milling, crushing, grinding, pulverization) is an impotent step (unit operation) involved in the tablet manufacturing. In manufacturing of compressed tablet, the mixing or blending of several solid ingredients of pharmaceuticals is easier and more uniform if the ingredients are approximately of same size. This provides a greater uniformity of dose. A fine particle size is essential in case of lubricant mixing with granules for its proper function. Advantages associated with size reduction in tablet manufacture are as follows:

i. It increases surface area, which may enhance an active ingredient's dissolution rate and hence bioavailability.
ii. Improved the tablet-to-tablet content uniformity by virtue of the increased number of particles per unit weight.
iii. Controlled particle size distribution of dry granulation or mix to promote better flow of mixture in tablet machine.
iv. Improved flow properties of raw materials.
v. Improved color and/or active ingredient dispersion in tablet excipients.
vi. Uniformly sized wet granulation to promote uniform drying.

There are also certain disadvantages associated with this unit operation if not controlled properly. They are as follows:

i. A possible change in polymorphic form of the active ingredient, rendering it less or totally inactive, or unstable.
ii. A decrease in bulk density of active compound and/or excipients, which may cause flow problem and segregation in the mix.
iii. An increase in surface area from size reduction may promote the adsorption of air, which may inhibit wettability of the drug to the extent that it becomes the limiting factor in dissolution rate.

A number of different types of machine may be used for the dry sizing or milling process depending on whether gentle screening or particle milling is needed. The ranges of equipment employed for this process includes Fluid energy mill, Colloidal mill, Ball mill, Hammer mill, Cutting mill, Roller mill, Conical mill, etc.

Powder Blending

The successful mixing of powder is acknowledged to be more difficult unit operation because, unlike the situation with liquid, perfect

homogeneity is practically unattainable. In practice, problems also arise because of the inherent cohesiveness and resistance to movement between the individual particles. The process is further complicated in many system, by the presence of substantial segregation influencing the powder mix. They arise because of difference in size, shape, and density of the component particles.

The powder/granules blending are involved at stage of pre granulation and/or post granulation stage of tablet manufacturing. Each process of mixing has optimum mixing time and so prolonged mixing may result in an undesired product. So, the optimum mixing time and mixing speed are to be evaluated. Blending step prior to compression is normally achieved in a simple tumble blender. The Blender may be a fixed blender into which the powders are charged, blended and discharged. It is now common to use a bin blender which blends. In special cases of mixing a lubricant, over mixing should be particularly monitored. The various blenders used include "V" blender, Oblicone blender, Container blender, Tumbling blender, Agitated powder blender, etc. But now a day to optimize the manufacturing process particularly in wet granulation the various improved equipments which combines several of processing steps (mixing, granulation and/or drying) are used. They are "Mixer granulator" or "High shear mixing machine".

Granulation

Following particle size reduction and blending, the formulation may be granulated, which provides homogeneity of drug distribution in blend.

Drying

Drying is a most important step in the formulation and development of pharmaceutical product. It is important to keep the residual moisture low enough to prevent product deterioration and ensure free flowing properties. The commonly used dryer includes Fluidized – bed dryer, Vacuum tray dryer, Microwave dryer, Spray dryer, Freeze dryer, Turbo – tray dryer, Pan dryer, etc.

Tablet Compression

After the preparation of granules (in case of wet granulation) or sized slugs (in case of dry granulation) or mixing of ingredients (in case of direct compression), they are compressed to get final product. The compression is done either by single punch machine (stamping press) or by multi station machine (rotary press). The tablet press is a high-speed mechanical device. It 'squeezes' the ingredients into the required tablet shape with extreme precision. It can make the tablet in many shapes, although they are usually round or oval. Also, it can press the name of the manufacturer or the

product into the top of the tablet. Each tablet is made by pressing the granules inside a die, made up of hardened steel. The die is a disc shape with a hole cut through its centre. The powder is compressed in the centre of the die by two hardened steel punches that fit into the top and bottom of the die.

The punches and dies are fixed to a turret that spins round. As it spins, the punches are driven together by two fixed cams - an upper cam and lower cam. The top of the upper punch (the punch head) sits on the upper cam edge. The bottom of the lower punch sits on the lower cam edge. The shapes of the two cams determine the sequence of movements of the two punches. This sequence is repeated over and over because the turret is spinning round. The force exerted on the ingredients in the dies is very carefully controlled. This ensures that each tablet is perfectly formed. Because of the high speeds, they need very sophisticated lubrication systems. The lubricating oil is recycled and filtered to ensure a continuous supply.

Common stages occurring during compression

Stage 1: Top punch is withdrawn from the die by the upper cam Bottom punch is low in the die so powder falls in through the hole and fills the die.

Stage 2: Bottom punch moves up to adjust the powder weight-it raises and expels some powder

Stage 3: Top punch is driven into the die by upper cam Bottom punch is raised by lower cam Both punch heads pass between heavy rollers to compress the powder

Stage 4: Top punch is withdrawn by the upper cam Lower punch is pushed up and expels the tablet. Tablet is removed from the die surface by surface plate

Stage 5: Return to stage 1

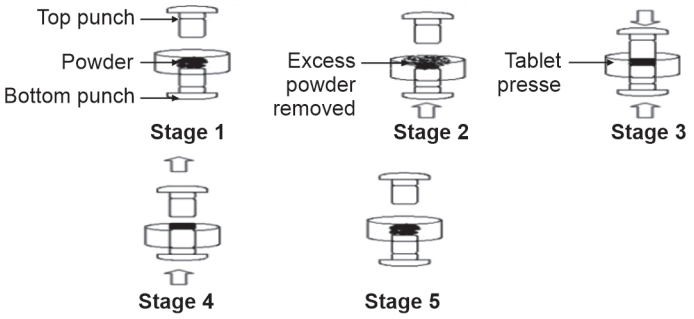

Fig. 1.3: Stage occurring during compression

Tablet Evaluation

Before a tablet is released out into the market it has to pass a few quality checks, which is mandatory. Evaluation of tablet includes the assessment of tablets physical, chemical and biological properties. To studies them the following test are formulated:

- Appearance
- Size and shape
- Organoleptic properties
- Uniformity of thickness
- Hardness
- Friability
- Drug content uniformity
- Weight variation test
- Wetting time
- Water absorption ratio
- *In vitro* disintegration test
- *In vitro* dissolution Studies

Appearance

Appearance is the first most required quality for the acceptance of tablet. General elegance and its identity play a major role for the consumer acceptance. Acceptance of the appearance of batches of the tablet has been done based on the measurement of the following factors like size, color, shape, presence or absence of odor, taste etc. General appearance is the physical appearance of the tablet it has two aspects to address.

First one is the patient compliance, if the tablet is appearance is legible and good, it improves the patient compliance. The second one is for the manufacturer; it helps him in trouble free manufacturing if there is tablet to tablet, batch to batch and lot to lot uniformity of tablet.

General appearance would include a number of aspects like, size, shape, odor, taste, texture, legibility, and identifying marks. For rapid identification of the tablet and consumer acceptance the tablet are given a specific colour, the colour of the tablet will enable the manufacturer form differentiating the tablet lot.

The uniformity of the colour is important parameter here, the tablet should be free from mottling. The colour uniformity and gloss of the tablet is evaluated by using reflectance spectrophotometer, tri stimulus colorimetric measurement, and micro reflectance photometer.

Size and Shape

Size and shape of a tablet has been determined by its thickness. Size and shape of a tables plays an important role in its patient compliance as the

size of the tablet increases it is not much easier for its administration. Micrometer is the devise which is used to determine the thickness of a tablet. It can be acceptable if the batch falls within the ±5% of standard deviation.

Organoleptic Properties

Color should be distributed uniformly without appearance of any signs of mottling. Colour of the tablet should be compared with the standard colour for comparison.

Uniformity of Thickness

To determine the uniformity of thickness random selection of tablets has to be done from each and every batch and need to measure its thickness independently. If the thickness of any single tablet varies then the batch containing that batch will not be dispatched into market

Weight Variation Test

The weight variation test would be a satisfactory method for determining drug content uniformity of drug distribution. In practice this test is performed by taking 20 tablets, from a batch. 20 tablets are weighed at a time and the average weight is taken. Then the tablet is weighed individually.

Average weight	*Percentage difference*
≤130 mg	10
130–324 mg	7.5
>324 mg	5

Thickness and Diameter (Size and Shape)

The thickness of individual tablets is measured with a micrometer, which gives us information about the variation between tablets. Tablet thickness should be within a ±5% variation of a standard value. Any variation in thickness within a particular lot of tablets or between manufacturer's lots should not be clear to the unaided eye for consumer acceptance of the product. In addition, thickness should be controlled to smooth the progress of packaging.

Different shapes and sizes of tablet are available in the market they are manufactured in order to differentiate them based on their purpose of use and quantity of active ingredient, and the age group of the patient who is going to be administered with the drug. Heart shape tablet signify that they are for the cardiac problems, small toy shape, tablet are manufactured in order to attract children etc. The shape and size of a tablet would vary based on tooling used in the tablet manufacturing. The prime consideration

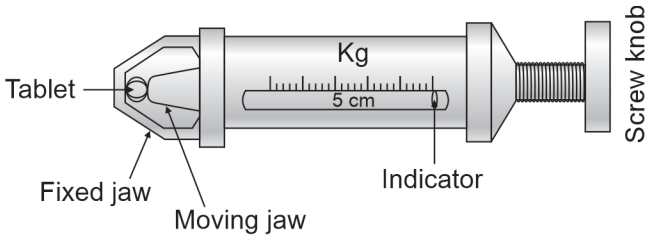

Fig. 1.4: Vernier calipers used to determine the diameter of the tablet

here would be the crown size, because if the concavity is very high it many lead to capping, or chipping problem. The crown size is measured by using micrometer, and sliding caliper scale is used to measure the size of 5 to 10 tablets at a time.

Hardness and Friability

The hardness of the tablet is important for drug products that have bioavailability problem or that are sensitive to altered dissolution release profiles as a function of the compressive force employed. Tablet hardness is the force necessary to break the tablet diametrically. The tablets must be hard enough to withstand mechanical stress during packaging, shipment, and handling by the consumer.

To test the hardness of the tablet Monsanto tester, Strong-cobb tester, the Pfizer tester, the Erweka tester, the Schleuniger testers and stokes hardness testers are used. The principle of measurement involves subjecting the tablet to an increasing load until the tablet breaks or fractures. The load is applied along the radial axis of the tablet. Oral tablets normally have a hardness of 4 to 8 or 10 kg; however, hypodermic and chewable tablets are much softer (3 kg) and some sustained release tablets are much harder (10–20 kg).

Tablet hardness and strength are the essential to see that the tablet can with the shock and stress during manufacturing packing and transportation, and while handled by the patient.

Hardness is sometimes termed the tablet crushing strength. To perform this test the tablets are located between two anvils and force is applied to the anvils, and the strength required to break the tablet is noted. If the tablet is too hard, the disintegration time is long and cannot meet up the dissolution specification, if its too soft, it cannot withstand handling when dealing with processes such as coating or packaging and shipping operations. The force with which the tablet is broken is expressed in kilograms and a hardness of 4 kg is usually well thought-out to be the minimum for satisfactory tablets. Oral tablets have a hardness of 4 to

10 kg but, hypodermic and chewable tablets have a hardness of 3 kg and sustained release tablets have about 10–20 kg.

Pfizer hardness tester was used for measuring the hardness of the formulated Paracetamol tablets. From each batch 3 tablets were taken at random and subjected to test. The mean of these 3 tablets were calculated.

Friability is the tested for a tablet to see whether the tablet is stable to abrasion or not, it is tested by using Roche friabilator. This is made up of a plastic drum fixed with a machine which rotated at 25 rpm for 100 revolutions. And then the twenty tablets which were weighed prior to the test are taken out of the drum and cleaned with a cloth and weighed once again, the weight variation must not be less than 0.5 to 1.0% for a conventional tablet.

Percentage of friability is calculated as:

$$F = \{(W \text{ initial}) - (W \text{ final})/(W \text{ initial})\} \times 100.$$

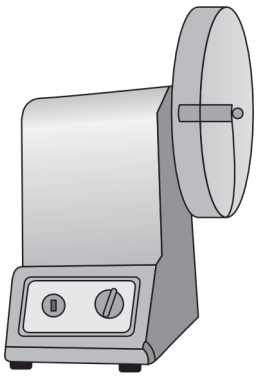

Fig. 1.5: Roche friabilator

Disintegration

Disintegration is the first physical change observed for a drug when it enters into the body, thus to see simulate the disintegration of the tablet in the body the disintegration test is performed. As per USP the disintegration apparatus consist of 6 glass tubes with a 10 number mesh at the bottom, each tube is 3 inch long. This arrangement of 6 tubes is placed in a medium simulated to the disintegration environment which is maintained at 37°C $\pm$ 2°C, in 1 liter vessel? This system is made to move up and down through a distance of 5 to 6 cm at a frequency of 28 to 32 cycles per minute. The disintegration time of the tablet is compared with the values in the monograph.

Dissolution

The dissolution rate of the drug from the primary particles of the tablet is the important factor in drug absorption and for many formulations is the rate-limiting step. Therefore, a dissolution time is more indicative of the availability of a drug from a tablet than the disintegration test. Even though this is an important parameter to measure, most pharmacies do not have the equipment needed to conduct these kinds of tests. The rate and extent of drug release form the tablet is estimated by dissolution test.

Different types of apparatus are used to study the dissolution test of the tablet. As per IP apparatus I (paddle dissolution apparatus) and apparatus II (basket dissolution apparatus) are used.

But as per USP dissolution apparatus used are:

i. Rotating Basket
ii. Paddle
iii. Reciprocating Cylinder
iv. Flow Through Cell
v. Paddle Over Disk
vi. Rotating Cylinder
vii. Reciprocating Holder

Dissolution is the process by which a solid solute enters a solution. In the pharmaceutical industry, it may be defined as the amount of drug substance that goes into solution per unit time under standardized conditions of liquid/solid interface, temperature and solvent composition. Dissolution is considered one of the most important quality control tests performed on pharmaceutical dosage forms. Now it was developing into a tool for predicting bioavailability, and in some cases, replacing clinical studies to determine bioequivalence. Dissolution behaviour of drugs has a significant effect on their pharmacological activity. In fact, a direct relationship between in vitro dissolution rate of many drugs and their bioavailability has been demonstrated. It is generally referred to as *in vitro-in vivo* correlation (IVIVC).

Apparatus-1 (Basket Type): A single tablet is placed in a small wire mesh basket attached to the bottom of the shaft connected to a variable speed motor. The basket is immersed in a dissolution medium contained in a 1000 ml flask. The flask is cylindrical with a hemispherical bottom. The flask is maintained at 37 ± 0.5°C by a constant temperature bath. The motor is adjusted to turn at the specified speed and sample of the fluid are withdrawn at intervals to determine the amount of drug in solutions.

Apparatus-2 (Paddle Type): It is same as apparatus-1, except the basket is replaced by a paddle. The dosage form is allowed to sink to the bottom

of the flask before stirring. For dissolution test U.S.P. specifies the dissolution test medium and volume, type of apparatus to be used, rpm of the shaft, time limit of the test and assay procedure for the API. The test tolerance is expressed as a % of the labelled amount of drug dissolved in the time limit.

EXPERIMENT 1

Preparation of Paracetamol Granules—Wet Granulation Method

Aim

Prepare and submit paracetamol granules by wet granulation method.

Theory

Granulation: Granules are agglomerates of powdered materials prepared into larger, free flowing particles. They typically fall within the range of 850 µm (No. 20 sieve) to 4.75 mm (No. 4 sieve) size. The shape of granules is generally irregular.

Granules are usually made as a step to prepare tablets. Granules flow into the dies more evenly and more freely than particles from the hopper (the funnel-like container holding the drug to guide its flow into the tableting press).

Advantages of Granules

- Granules shows good flow properties. The easy flow characteristics are important in supplying drug materials from the hopper or feeding container into the tableting presses. For this reason powder mixtures are usually granulated if they are intended to be compressed into tablets. Granules also eliminate or control dust.
- Granules increase compressibility.
- Granules have smaller surface area than a comparable volume of powders. This makes granules more stable physically and chemically than the corresponding powders. Granules are less likely to cake or harden upon standing than are powders.
- Granules are more easily wetted by a solvent than are certain powders, so that granules are also preferred in making solutions.
- Granules produce particle-size uniformity, thus content uniformity.
- Granules prevent segregation of constituents of powder mixture.

Wet Granulation

The most widely used process of agglomeration in pharmaceutical industry is wet granulation. Wet granulation process simply involves wet massing

of the powder blend with a granulating liquid, wet sizing and drying. Important steps involved in the wet granulation:

1. Mixing of the drug(s) and excipients
2. Preparation of binder solution
3. Mixing of binder solution with powder mixture to form wet mass screens.
4. Coarse screening of wet mass using a suitable sieve (6-12)
5. Drying of moist granules
6. Screening of dry granules through a suitable sieve (14-20)
7. Mixing of screened granules with disintegrant, glidant, and lubricant.

Limitation of Wet Granulation

1. The greatest disadvantage of wet granulation is its cost. It is an expensive process because of labor, time, equipment, energy and space requirements.
2. Loss of material during various stages of processing.
3. Stability may be major concern for moisture sensitive or thermo labile drugs.
4. Multiple processing steps add complexity and make validation and control difficult.
5. An inherent limitation of wet granulation is that any incompatibility between formulation components is aggravated.

Principle

Paracetamol is widely used as non steroidal analgesic and antipyretic drug. The adult dose of paracetamol is 500 mg three times a day. The dose of drug is 500 mg diluent is not required in the formulation. Magnesium stearate and talc is used as lubricant and glidant respectively.

Wet granulation methodology is widely used for preparation of paracetamol granules/tablets. For the granulation, paracetamol and starch powder is mixed and granulated with starch paste (binder). Granulating Starch powder will be used to disintegrate granules.

Requirements

Chemicals

Paracetamol IP, starch, magnesium stearate, talc, methyl paraben

Glassware

Measuring cylinder, beaker, mortar, pestle, granulating sieve etc.

Formula

Granulation

Sr. No.	*Ingredients*	*Quantity given*	*Quantity taken*	*Use*
1.	Paracetamol IP	500 mg	10 g	Antipyretic
2.	Starch Paste	10 % qs	5 ml (0.5 g)	Binder
3.	Starch Powder	12.5 mg	0.25 g	Disintegrant

Post Granulation

Sr. No.	*Ingredients*	*Quantity given*	*Quantity taken*	*Use*
1.	Granules	~10 g		
2.	Starch powder	5%		Disintegration
3.	Magnesium stearate	5%		Lubricant
4.	Talc	1%		Glidant
5.	Methyl paraben	0.1%	Preservative	21

Procedure

- Weigh and pass paracetamol powder through 100# sieve.
- Mix paracetamol and starch powder uniformly in mortar and pestle.
- Prepare 10% starch paste in boiling water and stir until it becomes translucent.
- Add starch paste drop wise in mortar to get cohesive mass. Record quantity of starch paste used for granulation.
- Screen prepared cohesive mass through 12# granulating sieve and collect it on granulating tray.
- Dry granules in tray at 50°C for 30 min. Pass 50% dried granules through 16# sieve to get uniform particle size and continue drying for 30 min.
- Using 22/44 # sieve separate granules and fine particles. Material on 22# sieve is final granules and on 44# sieve is fines. Record the weight of final granules and fines.
- If the quantity of fines is more than 10% of final granules then recycle the fines.
- Finally take the weight of granules and blend granules with remaining ingredients in a polybag.
- Store prepared granules in well closed and labelled container till evaluation.

Calculations

1. Starch Paste
   Quantity of starch powder in grams = 10 × Volume of starch paste used/100
2. Theoretical yield [TW]
   TW = Sum of weights of all ingredients in granulation
3. Practical yield
   Practical yield = Weight of final granules
4. Percent yield
   Percent yield = Practical yield × 100/Theoretical yield
5. Percent loss
   Percent loss = 100 – Percent yield

Result

Theoretical yield .....
Practical yield .....
Percent yield .....
Percent loss .....

EXPERIMENT 2

Evaluation of Paracetamol Granules

Aim

To determine bulk density, tap density, compressibility index and Hausner's ratio of prepared paracetamol granules.

Theory

The powder properties are divided into fundamental properties such as particle size and particle shape. There are numerous derived properties which are based on these fundamental properties such as bulk volume, granule volume, tap volume, true volume, bulk density, granule density, true density, flow rate, angle of repose, porosity, bulkiness, compactness, consolidation and compression.

Density

Density is universally defined as weight per unit volume. Depending upon different volumes, three types of densities can be defined:

True Density (ρ)

It is the weight of the powder divided by its volume excluding the voids and intraparticle pores of smaller dimensions. It is determined from helium

densitometer. Helium penetrates the smallest pores and crevices but is not adsorbed by powder. Percent porosity is determined from true density.

Granule Density (ρg)

It is the weight of granules divided by its volume.

Bulk Density (ρb)

It is the weight of powder or granules divided by its volume. Bulk density is used to check the uniformity in bulk powdered materials, to decide the size of container, equipments for production, size of packing material and selecting size of empty gelatin capsules.

The reciprocal of bulk density is called as 'bulkiness' or 'bulk'. Based on bulk, powders are classified as light powders (having high bulk volume) and heavy powders (having low bulk volume).

Tapped Density (ρt)

It is the weight of granules divided by its tapped volume.

Compressibility Index (Carr's Index)

The compressibility index (CI) is a measure of tendency of a powder to consolidate (i.e. unite to form a solid form). As such it is a measure of inter-particulate interactions. In a free flowing powder, inter-particulate interactions are generally less significant, and the bulk and tapped densities will be closer in value.

Lower compressibility value indicates better flow.

$$\text{Compressibility index (\%)} = \frac{tb}{t} \times 100$$

where t is tapped density
b is bulk density

Hausner's ratio: Hausner's ratio can be calculated by using following formula

$$\text{Hausner's ratio} = \frac{t}{b}$$

Angle of Repose

Angle of repose is defined as the maximum angle possible between the surfaces of the pile of powder and the horizontal plane

The angle of repose is designated by 'θ' and given by Eq. (1.1)

$$\tan q = \frac{h}{r} = \frac{2h}{D}$$

or
$$q = \tan^{-1}\left[\frac{h}{r}\right] = \tan^{-1}\left[\frac{2h}{D}\right] \quad (1.1)$$

where h = height of the pile
r = radius of the base of the pile
D = diameter of the base of the pile.

The lower the angle of repose, better the flow properties. When granules are placed in the hopper and allowed to slide down on to the die for compression, it forms a pile (Fig. 1.1). The angle of repose may be calculated by measuring the height (h) of the pile and the radius of the base (r) with the ruler.

During the flow through the hopper, the granules exhibit internal flow and demixing (i.e. tendency of the powder to separate into layers of different sizes) Flow of granules is hindered on account of frictional forces. Therefore the tangent of the angle of repose is expressed as coefficient of friction (μ).

Apparatus: Bulk density apparatus, weighing balance and measuring cylinder (100 ml capacity).

Flow character	*Angle of repose*	*Hausner ratio*	*Compressibility index (%)*
Excellent	23–300	1.00–1.11	≤10
Good	31–350	1.12–1.18	11–15
Passable	36–400	1.19–1.25	16–20
Fair	41–450	1.26–1.34	21–25
Poor	46–550	1.35–1.45	26–31
Very Poor	56–650	1.46–1.59	32–37
Very, Very Poor	≥660	≥1.60	≥38

Procedure

- Weigh accurately 10 g of powder/granules (W_1).
- Place it in dried graduated measuring cylinder and note the volume as V_1 ml.
- Place the cylinder containing sample in bulk density apparatus. Adjust the apparatus for 100 tapping and operate it. Record the volume occupied by the powder as V_2 ml.

  Note: Place the sample in both cylinders of apparatus to balance the arms.

Procedure

- Take a clean and dry funnel with a round stem of 20–30 mm diameter and attach it to the burette stand.
- Place a graph paper sheet below the funnel, on a clean dry platform.
- Adjust the distance between lower tip of the funnel and sheet to some specified height (1–2 cm).
- Gently pour the sample in the funnel from top, till a heap of powder forms and touches the lower tip of the funnel.
- Using a pencil draw a circle around the heap covering approximately 90% of total powder.
- Repeat the procedure three times to obtain average reading.

Find out average diameter and radius of each drawn circle.

Observations

1. Weight of powder = ... g
2. Bulk volume of powder = ... ml
3. Tapped volume of powder = ... ml

Calculations

1. Bulk density (ρb)

$$\text{Bulk density (b)} = \frac{\text{Weight}}{\text{Bulk volume}} = \frac{W_1}{V_1}\ \text{gm/ml}$$

2. Tapped density (ρt)

$$\text{Bulk density (b)} = \frac{\text{Weight}}{\text{Bulk volume}} = \frac{W_1}{V_1}\ \text{gm/ml}$$

3. Compressibility index (%)

$$\text{Compressibility index (\%)} = \frac{tb}{t} \times 100$$

4. Hausner's ratio: Hausner's ratio can be calculated by using following formula

$$\text{Hausner's ratio} = \frac{t}{b}$$

5. Height of the pile = ... cm.
   Granules:
   θ_1 = ... θ_2 = ... θ_3 = ...

   Average angle of repose, $\theta = \frac{q_1 + q_2 + q_3}{3} = ...$

Result

Bulk density = ... g/ml
Tapped density = ... g/ml
Compressibility index = ... %
Hausner's ratio = ...
Angle of repose = ...

EXPERIMENT 3

Preparation of Paracetamol Tablets by Wet Granulation Method

Aim

To prepare and submit 20 paracetamol tablets by wet granulation method.

Chemicals Required

Paracetamol, Lactose, Starch, Magnesium stearate, Talc.

Principle

Tablets are the solid unit dosage form containing one or two active ingredients or ingredients with or without excipients prepared by compression technique. They vary in size, shape and weight. Wet granulation technique is required to facilitate the good flow properties for the powder blend and improper the rate of absorption.

Paracetamol is widely used as non steroidal analgesic and antipyretic drug. The adult dose of paracetamol is 500 mg three times a day. The dose of drug is 500 mg diluent is not required in the formulation. Magnesium stearate and talc is used as lubricant and glidant respectively.

Wet granulation methodology is widely used for preparation of paracetamol granules/tablets. For the granulation, paracetamol and starch powder is mixed and granulated with starch paste (binder). Granulating Starch powder will be used to disintegrate granules.

In the given preparation paracetamol act as analgesic and anti pyretic. Lactose acts as diluents. Starch act as a binder and disintegrating agent.

Magnesium stearate acts as a lubricant.

Formula

S. no.	*Ingredients*	*Official formula for single tablet*	*Working formula for 20 tablets*	*Category*
1.	Paracetamol	500 mg		NSAID
2.	Lactose	Q.S		Diluent
3.	Starch	10 %		Binder
4.	Magnesium stearate	3%		Lubricant
5.	Talc	3%		Glidant
	Total	650 mg		

Procedure

1. Weigh all the dried ingredients for required of the number of tablets.
2. Mix paracetamol, lactose and half of the starch paste (10% w/v) in a sufficient quantity so as to make the mixture damp.
3. Pass the damp mass through the sieve number 12 over a big filter paper or sheet.
4. Dry the granules either in open air or in tray dryers at 60°C.
5. Weigh the dried granules.
6. Pass the dried granules through the sieve number 20 and collect over sieve number 30.
7. Shake sieve number 30 and collect the granules retained on it.
8. Add fines (15 % of the weight of the granules) and mix.
9. Add remaining half of the starch and magnesium stearate and talc to the above mixture and mix.
10. Transfer the final granulation mixture in the hopper of compression machine (Tablet mini press) after adjusting its die for the particular weight of a tablet.
11. Rub the tablets gently with a clean cotton cloth.
12. Evaluate the tablets for various parameters.

Label

Paracetamol Tablets—500 mg

Ingredients: .....

.....

.....

Category: .....

Storage: .....

Direction: .....

Lic no: ..... Mfg.dt: .....

Batch no: ..... Exp.dt: .....

Manufactured by: .....

Report

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EXPERIMENT 4

Evaluation of Paracetamol Tablets

Aim

To evaluate the given paracetamol tablets.

Instruments Required

Monsanto hardness tester, Roche friability, electronic balance, disintegration apparatus and UV Spectroscopy.

Procedure

The given paracetamol tablets are evaluated for the following parameters as follows:

- Weight uniformity test
- Tablet dimensions
- Hardness
- Friability
- Disintegration
- Drug content

Weight Uniformity Test

Twenty tablets were weighed individually and all together. Average weight was calculated from the total weight of all (20) tablets. The individual weights were compared with the average weight. The percentage difference in the weight variation should be within the permissible limits.

$$\text{Percentage deviation} = \frac{\text{Individual weight} - \text{Average weight}}{\text{Average weight}} \times 100$$

Average weight	*% deviation*
80 mg or less	10
>80 to <250 mg	7.5
>250 mg	5

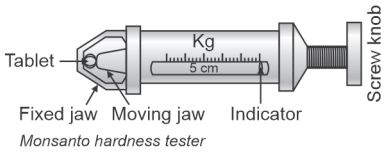
Tablet Dimensions

The dimensions of the tablets are thickness and diameter. Thickness and diameter of a tablet were measured using vernier calipers.

Hardness

The resistance of tablet for shipping or breakage, under conditions of storage, transportation and handling, before usage, depends on its

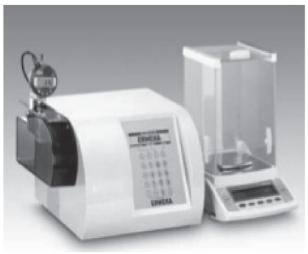
hardness (diametric crushing strength). The hardness of 6 tablets of each formulation was measured by using Monsanto hardness tester.



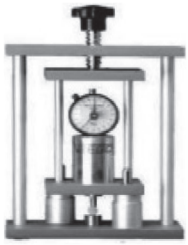
Monsanto hardness tester

Monsanto (Capacity 0 to 20 kg)

Pifizer (Capacity 0 to 20 kg)

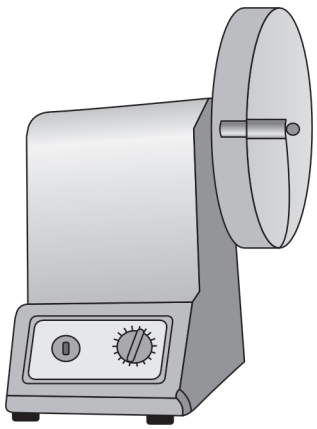


Erwera (capacity 0 to 500 N)



Friability

Friability is a measure of tablet strength. Roche friabilator was used to measure the friability by noticing initial weight of 10 tablets (W1) and placed in a friabilator for 4 min at a rate of 25 rpm dropping the tablets through a distance of six inches with each revolution. After 100 revolutions the tablets were reweighed and noted as (W2). The difference in the weight is noted and expressed as percentage. Permitted friability limit is 1.0%.



$$\text{Percentage friability} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Disintegration

The disintegration time of the tablet was measured in water according to the disintegration test apparatus 3 trails for each batch was performed. The water consisted of 900 ml purified water maintained at 37 + 0.5°C

DRUG CONTENT

The tablet was crushed and powdered. Accurately weigh the powder equivalent to 100 mg of paracetamol, is dissolved in 100 ml of solvent and allows it to filter by using filter paper, the filtrate is analyzed using UV spectrophotometer at a wavelength of 257 nm.

Observations

I. **Weight uniformity:**

S. no.	*Individual weight (mg)*	*Average weight (mg)*	*Percentage deviation (%)*

II. **Tablet dimensions:**
Size:
Shape:
Thickness:

III. **Hardness:**
Trail-I:
Trail-II:
Trail-III:
Average value =

IV. **Friability:**
Initial weight of tablets before friability =
Final weight of tablets after friability =
% Friability =

V. **Disintegration time:**

VI. **Drug content:**
Absorbance =
Concentration = Absorbance/Slope
Amount found = Concentration × Dilution factor
% Drug content = Amount found in 100 ml/Label claim × 100

Report

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EXPERIMENT 5

Preparation of Paracetamol Tablets by Direct Compression Method

Aim

To prepare and submit the paracetamol tablets by direct compression method.

Principle

Tablets are unit dosage form which is intended for use in the administration

for orally that are prepared by adding on medications with excipients, direct compression involves two steps.

Step-I: Mixing the powder

Step-II: Tableting or compression

Paracetamol is used as analgesic. To the formulation micro crystalline cellulose is used as diluents, di calcium phosphate, is used as diluent, starch is used as disintegrate, lactose is also known as diluents. Poly vinyl pyroline is used as binder and magnesium stearate is used as lubricant.

To the direct compression method of tablet production dry ingredients are thoroughly mix and then compressed into tablets.

Stages in the Manufacture of Tablets by Direct Compression Method

The manufacture of tablets by direct compression involves comparatively few steps and they include:

1. Premilling of formulation ingredients (active drug substance and excipients)
2. Mixing of active drug substance with the powdered excipients (including the lubricant)
3. Compression of the mixed powders into tablets.

Formula

S. no.	*Ingredients*	*Official formula*	*Working formula*	*Category*
1.	Paracetamol (equivalent to 125 mg)	156.25		Analgesic
2.	Microcrystalline cellulose	68.75		Diluent & DCV
3.	Starch	20		Diluent
4.	Magnesium stearate	2.5		Lubricant
5.	Talc	2.5		Glidant
	Total weight	250 mg		

Procedure

- All the ingredients are weighed and mixed properly.
- Then the powder is passed through the sieve no. 22.
- Finally add magnesium stearate.
- Evaluate the flow properties of the powder.
- Then compress into tablet.

Label

Paracetamol Tablets—250 mg

Ingredients: .....

.....

.....

Category: .....

Storage: .....

Direction: .....

Lic no: ..... Mfg.dt: .....

Batch no: ..... Exp.dt: .....

Manufactured by: .....

EXPERIMENT 6

Preparation and Evaluation of Aspirin Soluble Tablet

Aim

To prepare and submit the 10 aspirin soluble tablets.

Apparatus Required

Spatula, motor and pestle, measuring cylinder.

Principle

Tablets are the popular solid dosage form meant for oral administration. Tablets have the difficulty of swallowing problems particularly in pediatric and geriatrics patients.

Hence soluble tablets are preferred dosage forms, meant for easy of administration and to difficulty in swallowing and meant for rapid onset of action.

Formula

S. no.	*Ingredients*	*Official formula (mg)*	*Working formula (mg)*
1.	Aspirin	75.0	
2.	Avicel pH-102	55.5	

(Contd.)

S. no.	Ingredients	Official formula (mg)	Working formula (mg)
3.	PVP K-30	4.5	
4.	Sodium starch glycolate	6.0	
5.	Magnesium stearate	4.5	
6.	Talc	4.5	
	Total	150 mg	

Procedure

Aspirin was mixed in geometric proportions with superdisintegrants, sweeteners, diluent, flavors and lubricants.

Various concentrations of superdisintegrants were employed to arrive at an optimum disintegration time and the blend was screened through sieve no:40 and compressed using 16 press rotary punching machine, having flat beveled punches. Composition of fast dissolving tablets of aspirin.

Label

Aspirin Soluble Tablets—75 mg

Ingredients: .....

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Category: .....

Storage: .....

Direction: .....

Lic no: ..... Mfg.dt: .....

Batch no: ..... Exp.dt: .....

Manufactured by: .....

Characterization of Aspirin Soluble Tablets

The prepared formulations were subjected to evaluation parameters like thickness, weight variation, hardness, percentage friability, wetting time, and disintegration time.

Weight Variation

Twenty tablets were taken and their weight was determined individually and collectively on a digital weighing balance the average weight of one tablet was determined from the collective weight.

Hardness

The tablet crushing load, which is the force required to break a tablet by compression in the radial direction was measured using a Monsanto hardness tester (Tab-Machines Ltd., India).

The test was performed on 10 tablets and the average was calculated.

Friability

Friability of the tablets was determined using Roche friabilator (Electrolab, India) at 25 rpm for 4 minutes. Preweighed sample of 20 tablets was placed in the friabilator and were subjected to 100 revolutions. Tablets were dusted using a soft muslin cloth and reweighed. The friability (F%) is given by the following formula:

$$F\% = [1 - W0/W] \times 100$$

W0 = Weight of the tablets before the test

W = Weight of the tablets after the test

Wetting Time

A piece of double folded tissue paper was placed in a Petri plate (internal diameter; 6.5 cm) containing 6 ml of water. The tablet was placed on the paper and the time for complete wetting of the tablet was measured in seconds. The method was slightly modified by maintaining water at 37ºC. Wetting time corresponds to the time for the tablet to disintegrate when kept motionless on the tongue.

Disintegration Time

The disintegration time of the tablet was measured in water according to the disintegration test apparatus 3 trails for each batch were performed. The water consisted of 900 ml purified water maintained at 37 + 0.5°C.

Observations

I. **Weight uniformity:**

S. no.	*Individual weight (mg)*	*Average weight (mg)*	*Percentage deviation (%)*

II. **Hardness:**
Trail-I:
Trail-II:
Trail-III
Average value:

III. **Friability:**
Initial weight of tablets before friability =
Final weight of Tablets after friability =
% Friability =

IV. **Disintegration time:**

Report

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EXPERIMENT 7

Preparation and Evaluation of Paracetamol Effervescent Tablets

Aim

To prepare and evaluate the paracetamol effervescent tablets by dry granulation technique.

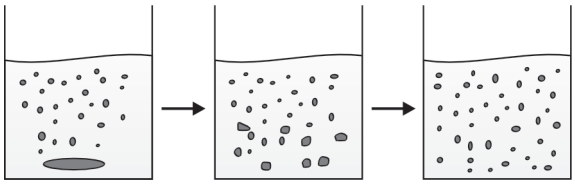
Principle

The oral dosage forms are the most popular way of taking medication despite having some disadvantages like slow absorption and thus onset of action is prolong. This can be overcome by administrating the drug in liquid from but, many APIs have limited level of stability in liquid form. So, effervescent tablets acts as an alternative dosage form. The tablet is added into a glass of water just before administration and the drug solution or dispersion is to be drunk immediately. The tablet is quickly broken apart by internal liberation of CO_2 in water due to interaction between tartaric acid and citric acid with alkali metal carbonates or bicarbonates in presence of water.

Due to liberation in CO_2 gas, the dissolution of API in water as well as taste masking effect is enhanced. The advantages of effervescent tablets compared with other oral dosage forms includes an opportunity for formulator to improve taste, a more gentle action on patient's stomach and marketing aspects. To manufacture these tablets, either wet fusion or

heat fusion is adopted. The tablets are compressed soft enough to produce an effervescent reaction that is adequately rapid. Water soluble lubricants are used to prevent an insoluble scum formation on water surface. To add sweetness to the formulation, saccharin is added since sucrose is hygroscopic and add too much of bulk to the tablet. The manufacturing shall be done under controlled climatic condition to avoid effervescent reaction.

- To enhance the onset of action of paracetamol and increase the solubility of paracetamol.
- To produce faster onset of action
- To achieve better patient compliance.
- To avoid the first pass effect.



PREPARATION OF PARACETAMOL EFFERVESCENT TABLETS

Wet Granulation

The wet granulation process performed into three steps.

1. Dry Mixing and Granulation
2. Lubrication of Granules
3. Compression of Lubricated Granules

Dry Mixing and Granulation

There are two steps in dry mixing and granulation process, i.e. acid granulation and base granulation.

1. **Acid granulation:**
   i. In first step Weight the Citric acid, Tartaric acid were blended and passed through Sieve No. # 40.
   ii. In second step PVP K-30 was dissolved in organic solvent.

   The above organic solvent was mixed with acid portions, i.e. citric acid and tartaric acid. The obtained wet mass passed through sieve no.# 20 and kept in tray dried at 60°C for 1 hr.

2. **Base granulation:**
   i. In base granulation firstly the sodium bicarbonate was blended and passed through sieve no.# 40.
   ii. In the second step the binding agent PVP-K-30 was dissolved in organic solvent. The above organic solvent was mixed with base portions i.e. sodium bicarbonate. The obtained wet mass passed through sieve no. #20 and kept in tray dried at 60°C for 1 hr.
3. **Lubrication of acid and base granules:** After drying at R.T.of both granules i.e. acid granules and base granules were mixed.
   After mixing of both granules then add remaining all the ingredients and mix them thoroughly in geometric dilution manner.

Compression of Lubricated Granules

The lubricated granules were compressed into tablet by using single rotary tablet punching machine, 12 stations, with 24.8 mm punch sets.

Formula

S. no.	*Ingredients*	*Official formula (mg)*	*Working formula (mg)*
1.	Paracetamol	250	
2.	Citric acid (1 part)	39.062	
3.	Tartaric acid (2 parts)	78.125	
4.	Sodium bicarbonate (3.4 parts)	132.81	
5.	Mannitol	46	
6.	PVP K-30	30	
7.	Magnesium stearate	12	
8.	Talc	12	
	Total	600 mg	

(Drug: Effervescent portion) 1:1 (C.acid:T.acid:$NaHCO_3$ is 1: 2: 3.4)

Paracetamol Effervescent Tablets—75 mg

Ingredients: .....

.....

Category: .....

Storage: .....

Direction: .....

Lic no: ..... Mfg.dt: .....

Batch no: ..... Exp.dt: .....

Manufactured by: .....

EVALUATION TESTS

Weight Variation

Twenty tablets were taken and their weight was determined individually and collectively on a digital weighing balance the average weight of one tablet was determined from the collective weight.

Hardness

The tablet crushing load, which is the force required to break a tablet by compression in the radial direction was measured using a Monsanto hardness tester (Tab-Machines Ltd., India).

The test was performed on 10 tablets and the average was calculated.

Friability

Friability of the tablets was determined using Roche friabilator (Electro lab, India) at 25 rpm for 4 minutes. Preweighed sample of 20 tablets was placed in the friabilator and were subjected to 100 revolutions. Tablets were dusted using a soft muslin cloth and reweighed. The friability (F%) is given by the following formula:

$$F\% = [1 - W0/W] \times 100$$

Disintegration Time

The disintegration time of the tablet was measured in water according to the disintegration test apparatus 3 trails for each batch were performed. The water consisted of 900 ml purified water maintained at 37 + 0.5 °C.

Observations

I. **Weight uniformity:**

S. no.	*Individual weight (mg)*	*Average weight (mg)*	*Percentage deviation (%)*

II. **Hardness:**
Trail I:
Trail II:
Trail III:
Average value =

III. **Friability:**
Initial weight of tablets before friability =

Final weight of tablets after friability =
% Friability =

IV. **Disintegration time:**

Report

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EXPERIMENT 8

Preparation of Antacid Chewable Tablet

Aim

To prepare and submit the 10 antacid chewable tablets.

Apparatus Required

Spatula, motor and pestle, measuring cylinder.

Principle

Tablets are the popular solid dosage form meant for oral administration. Tablets have the difficulty of swallowing problems particularly in pediatric and geriatrics patients.

Chewable tablets are the tablets which are required to be broken and chewed in between the teeth before ingestion. These tablets are given to the children who have difficulty in swallowing and to the adults who dislike swallowing. The advantages of chewable tablets include palatability, stability, precise dosing, portability and ease of delivery.

Formula

S. no.	*Ingredients*	*Official formula (mg)*	*Working formula (mg)*
1.	Aluminium hydroxide	400 mg	
2.	Magnesium hydroxide	80 mg	
3.	Lactose monohydrate	120 mg	
4.	Starch	60 mg	
5.	SSG	23.34 mg	
6.	Starch	25 mg	
7.	Isopropyl alcohol	q.s	
8.	Mannitol	100 mg	
9.	Sodium saccharine	10 mg	
10.	Colour	0.5 mg	
11.	Magnesium stearate	6 mg	
12.	Talc	6 mg	
13.	Aerosil	12 mg	

Procedure

1. All the ingredients were separately weighed and sifted using mesh no. 40.
2. Aluminum hydroxide, Magnesium hydroxide, Lactose monohydrate, Starch and Sodium Starch Glycolate was mixed in a poly bag for ten minutes.
3. For the preparation of binder dispersion, isopropyl alcohol was taken in a beaker, stirred with glass rod to disperse starch until no lumps were observed.
4. Then the above dry mixture was granulated with binder solution and dried in the tray drier at the temperature of 40–50°C until the moisture reduce down to NMT-2%.
5. The dried granules were passed through mesh no. 30, Mannitol (Perlitol 200) through mesh no. 30.
6. Sodium Saccharine, Carmofine color and pineapple flavor were passed through mesh no. 100.
7. All these were finally added to the dried granules and blended for ten minutes.
8. The above blend was lubricated with Magnesium stearate, Talc, Aerosil for two minutes.

Label

Antacid Chewable Tablet—400 mg

Ingredients: .....

.....

Category: .....

Storage: .....

Direction: .....

Lic no: ..... Mfg.dt: .....

Batch no: ..... Exp.dt: .....

Manufactured by: .....