MODULE 2:Tablets

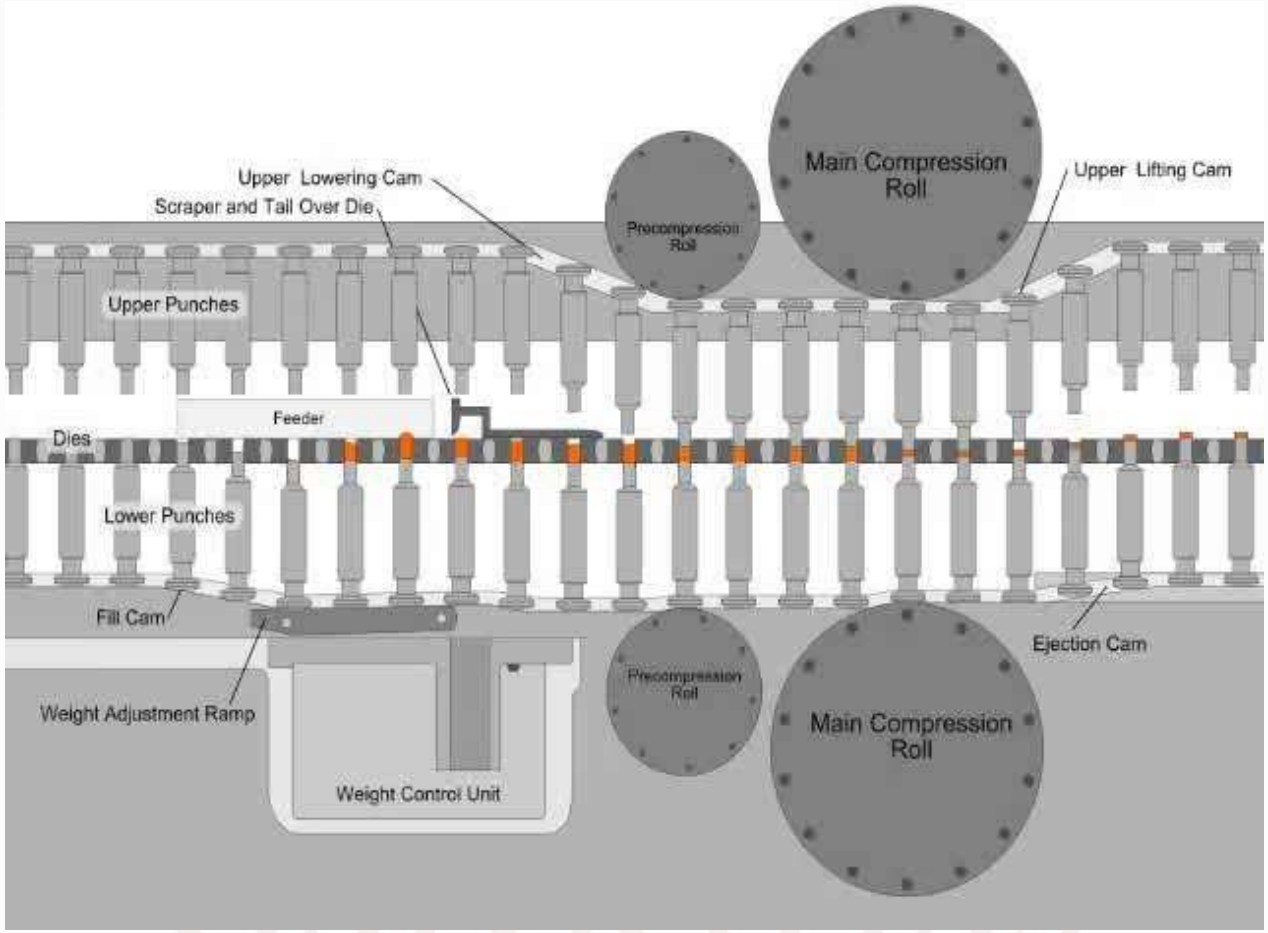
Lecture 1

DISCLAIMER

All the content material provided here is only for teaching purpose

INTRODUCTION

- Tablet is defined as a compressed solid dosage form containing medicaments with or without excipients. According to the Indian Pharmacopoeia Pharmaceutical tablets are solid, flat or biconvex dishes, unit dosage form, prepared by compressing a drug or a mixture of drugs, with or without diluents.


Upper Lowering Cam
Scraper and Tail Over Die
Precompression Roll
Main Compression Roll
Upper Lifting Cam
Upper Punches
Feeder
Dies
Lower Punches
Fill Cam
Ejection Cam
Precompression Roll
Main Compression Roll
Weight Adjustment Ramp
Weight Control Unit

The Advantages of the Tablet dosage form

- Cost is lowest of all oral dosage form.
- Lighter and compact.
- Easiest and cheapest to package and strip.
- Easy to swallowing with least tendency for hang-up.
- Sustained release product is possible by enteric coating.

Disadvantages of Tablet dosage form are:

- 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.
- Bitter testing drugs, drugs with an objectionable odor or drugs that are sensitive to oxygen may require encapsulation or coating. In such cases, capsule may offer the best and lowest cost.

Different types of Tablets

(A) Tablets ingested orally:

1. Compressed tablet, e.g. Paracetamol tablet
2. Multiple compressed tablet
3. Repeat action tablet
4. Delayed release tablet
5. Sugar coated tablet
6. Film coated tablet, e.g. Diclofenac tablet
7. Chewable tablet, e.g. Antacid tablet

(B) Tablets used in oral cavity:

1. Buccal tablet, e.g. Vitamin-c tablet
2. Sublingual tablet, e.g. Vicks Menthol tablet
3. Troches or lozenges
4. Dental cone

(c) Tablets administered by other route:

1. Implantation tablet
2. Vaginal tablet, e.g. Clotrimazole tablet

(D) Tablets used to prepare solution:

1. Effervescent tablet, e.g. Dispirin tablet
2. Dispensing tablet
3. Hypodermic tablet

1. COMPRESSED TABLETS

- In addition to the medicinal agent or agents, compressed tablet usually contain a number of pharmaceutical adjuncts, includin the following:

- Multiply compressed tablets are prepared by subjecting the fill material to more than a single compression.

- The result may be a multiple-layer tablet or a tablet within a tablet, the inner tablet being the *core* and the outer portion being the *shell*..

- Compressed tablets may be coated with a colored or an uncolored sugar layer.

- The coating is water soluble and quickly dissolves after swallowing.

1. **The sugarcoat protects the enclosed drug from the environment and provides a barrier to objectionable taste or odor.**
2. **The sugarcoat also enhances the appearance of the compressed tablet and permits imprinting of identifying manufacturer's information.**

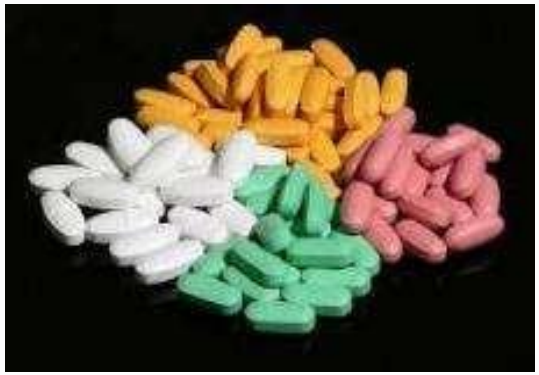
- Among the disadvantages to sugarcoating tablets are the time and expertise required in the coating process and the increase in size, weight, and shipping costs.

- Sugarcoating may add 50% to the weight and bulk of the uncoated tablet.

FILM-COATED TABLETS

- Film-coated tablets are compressed tablets coated with a thin layer of a polymer capable of forming a skin-like film.

The film is usually colored and has the advantage over sugarcoatings in that it is:



1. more durable
2. less bulky
3. less time- consuming to apply.

- By its composition, the coating is designed to rupture and expose the core tablet at the desired location in the gastrointestinal tract.

- A recent innovation is the gelatin-coated tablet.

- The innovator product, the gelcap, is a capsule- shaped compressed tablet that allows the coated product to be about one-third smaller than a capsule filled with an equivalent amount of powder.

- Enteric-coated tablets have delayed-release features.

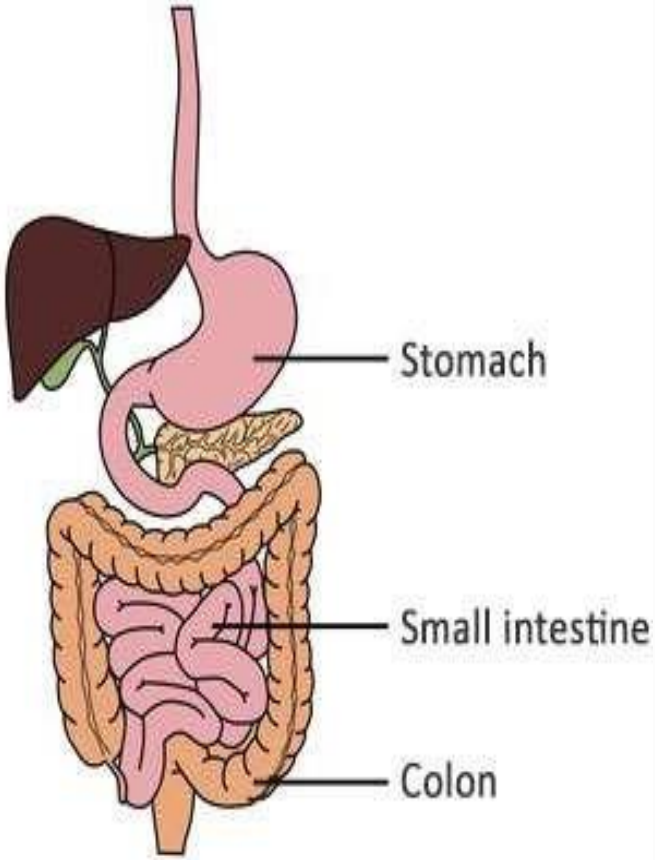
- They are designed to pass unchanged through the stomach to the intestines, where the tablets disintegrate and allow drug dissolution and absorption and/or effect.

- Enteric coatings are employed when the drug substance:

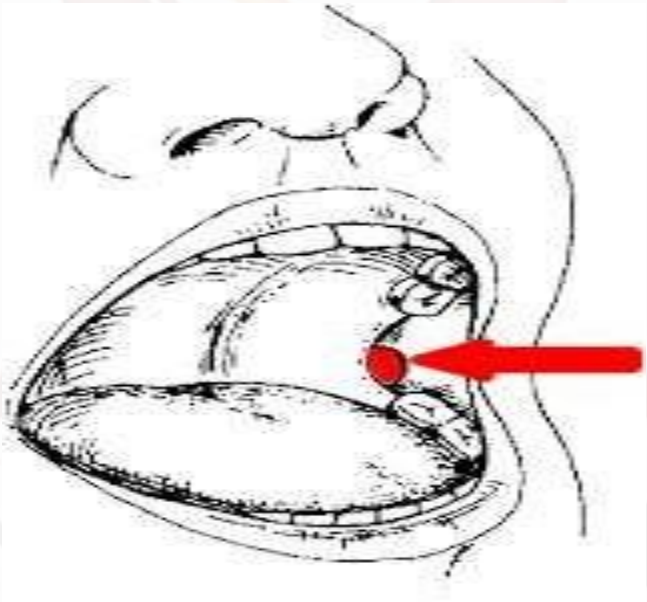
✓ is destroyed by gastric acid or

✓ is particularly irritating to the gastric mucosa or

✓ when bypass of the stomach substantially enhances drug absorption.



- Buccal and sublingual tablets are flat, oval tablets intended to be dissolved in the buccal pouch (*buccal tablets*) or beneath the tongue (*sublingual tablets*) for absorption through the oral mucosa.



- They enable oral absorption of drugs that are destroyed by the gastric juice and/or are poorly absorbed from the gastrointestinal tract.

- Buccal tablets are designed to erode slowly, whereas those for sublingual use (such as nitroglycerin) dissolve promptly and provide rapid drug effects.

- ***Lozenges*** **or** ***troches*** are disc-shaped solid dosage forms containing a medicinal agent and generally a flavoring substance in a hard candy or sugar base.

- They are intended to be slowly dissolved in the oral cavity, usually for local effects, although some are formulated for systemic absorption.

CHEWABLE TABLETS

- Chewable tablets, which have a smooth, rapid disintegration when chewed or allowed to dissolve in the mouth, have a creamy base, usually of specially flavored and colored mannitol.

- Chewable tablets are especially useful for administration of large tablets to children and adults who have difficulty swallowing solid dosage forms.

EFFERVESCENT TABLETS

- Effervescent tablets are prepared by compressing granular effervescent salts that release gas when in contact with water.
- These tablets generally contain medicinal substances that dissolve rapidly when added to water.
- The “bubble action” can assist in breaking up the tablets and enhancing the dissolution of the active drug.

MOLDED TABLETS

- Certain tablets may be prepared by molding rather than b compression. The resultant tablets are very soft and solubl and are designed for rapid dissolution.

- Tablet triturates are small, usually cylindrical, molded or compressed tablets containing small amounts of usually potent drugs.

- Today, only a few tablet triturate products are available commercially, with most of these produced by tablet compression.

- Since tablet triturates must be readily and completely soluble in water, only a minimal amount of pressure is applied during their manufacture.

- Hypodermic tablets are no longer available in the United States.
- They were originally used by physicians in extemporaneous preparation of parenteral solutions.
- The required number of tablets was dissolved in a suitable vehicle, sterility attained, and the injection performed.
- The tablets were a convenience, since they could be easily carried in the physician's medicine bag and injections prepared to meet the needs of the individual patients.
- However, the difficulty in achieving sterility and the availability of prefabricated injectable products, some in disposable syringes, have eliminated the need for hypodermic tablets.

DISPENSING TABLETS

- Dispensing tablets are no longer in use.

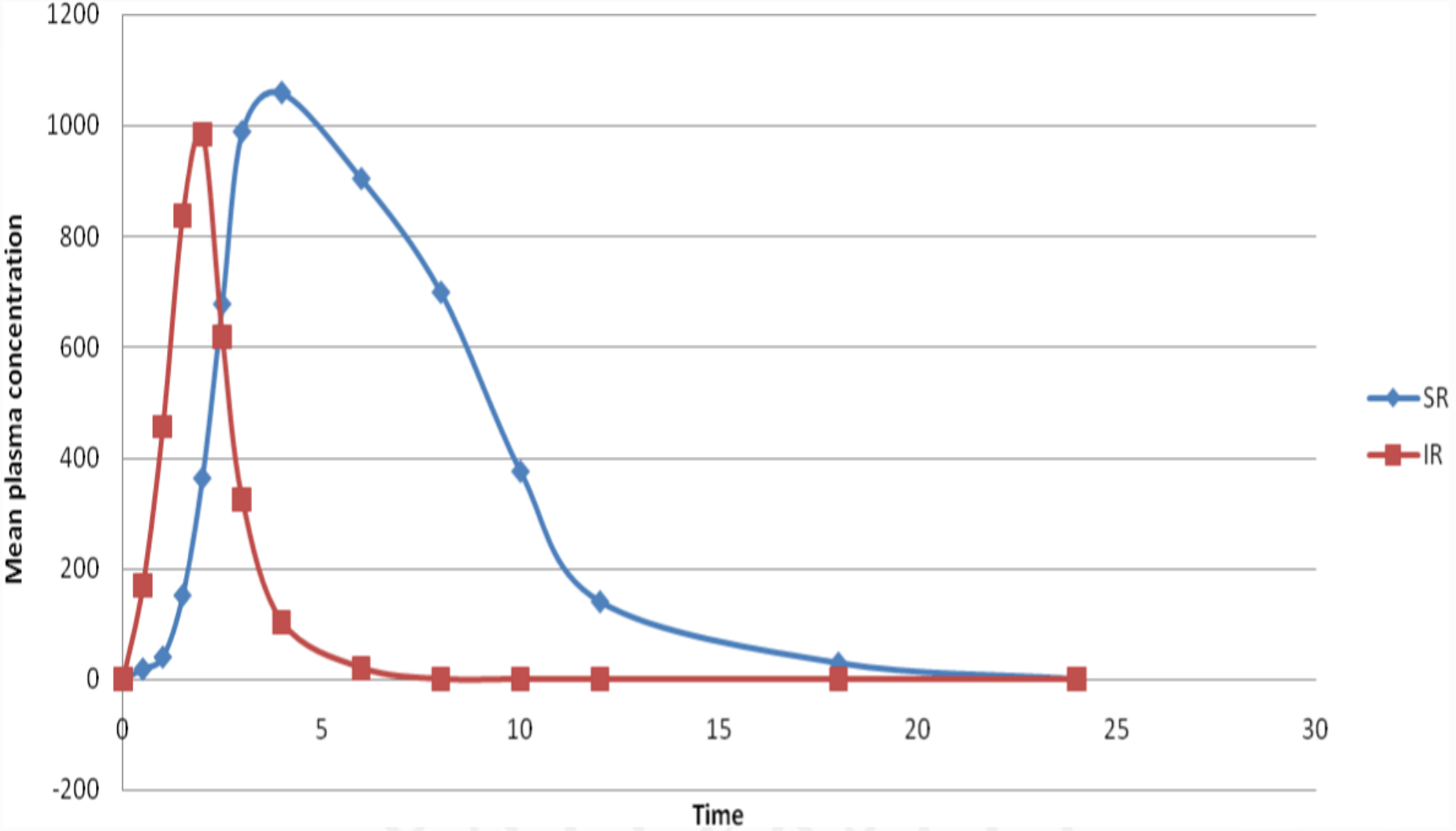
- They might better have been termed *compounding tablets* because the pharmacist used them to compound prescriptions; they were *not* dispensed as such to the patient.

IMMEDIATE-RELEASE TABLETS

- Immediate-release tablets are designed to disintegrate and release their medication with no special rate-controlling features, such as special coatings and other techniques.

EXTENDED-RELEASE TABLETS

- Extended-release tablets (sometimes called controlled-release tablets) are designed to release their medication in a predetermined manner over an extended period.


1200
1000
800
600
400
200
0
-200
Mean plasma concentration
0
5
10
15
20
25
30
Time
SR
IR

VAGINAL TABLETS

- Vaginal tablets, also called *vaginal inserts*, are uncoated, bullet-shaped or ovoid tablets inserted into the vagina for local effects.

- They contain :

✓antibacterials for the treatment of nonspecific vaginitis caused by *Haemophilus vaginalis*

✓antifungals for the treatment of vulvovaginitis candidiasis caused by *Candida albicans* and related species.

INSTANTLY DISINTEGRATING OR DISSOLVING TABLETS

- Instant-release tablets (rapidly dissolving tablets, or RDTs) are characterized by disintegrating or dissolving in the mouth within 1 minute, some within 10 seconds

- Tablets of this type are designed for children and the elderly or for any patient who has difficulty in swallowing tablets.

- They liquefy on the tongue, and the patient swallows the liquid.

- A number of techniques are used to prepare these tablets, including:

✓ Lyophilization

✓ soft direct compression

- These tablets are prepared using very water- soluble excipients designed to wick water into the tablet for rapid disintegration or dissolution. They have the stability characteristics of other solid dosage forms.

- The original fast-dissolving tablets were molded tablets for sublingual use.
- They generally consisted of active drug and lactose moistened with an alcohol–water mixture to form a paste.
- The tablets were then molded, dried, and packaged.
- For use, they were simply placed under the tongue to provide a rapid onset of action for drugs such as nitroglycerin.
- Also, they have been used for drugs that are destroyed in the gastrointestinal tract, such as testosterone, administered sublingually for absorption to minimize the first-pass effect.

- These RDTs are more convenient to carry and administer than an oral liquid.

There are no standards that define an RDT, but one possibility is dissolution in the mouth within approximately 15 to 30 seconds; anything slower would not be categorized as rapidly dissolving.

Packaging

- They are generally packaged in cards or bubble-type packaging with each individual tablet in its own cavity.

- **Not withstanding these advantages, there are a number of disadvantages and difficulties associated with formulating RDTs, including:**

✓drug loading

✓taste masking

✓friability

✓manufacturing costs

✓stability of the product

COMPRESSED TABLETS

The physical features of compressed tablets are well known:

- ✓ Round, oblong or unique in shape
- ✓ thick or thin
- ✓ large or small in diameter
- ✓ flat or convex
- ✓ unscored or *scored* in halves, thirds, or quadrants
- ✓ engraved or imprinted with an identifying symbol and/or code number
- ✓ coated or uncoated
- ✓ colored or uncolored
- ✓ one, two, or three layered.

- Tablet diameters and shapes are determined by the **die and punches** used in compression.

✓The less concave the punches, the flatter the tablets; conversely

✓The more concave the punches the more convex the resulting tablets.

Punches with raised impressions produce recessed impressions on the tablets

Punches with recessed etchings produce tablets with raised impressions or monograms.

Monograms may be placed on one or on both sides of a tablet, depending on the punches

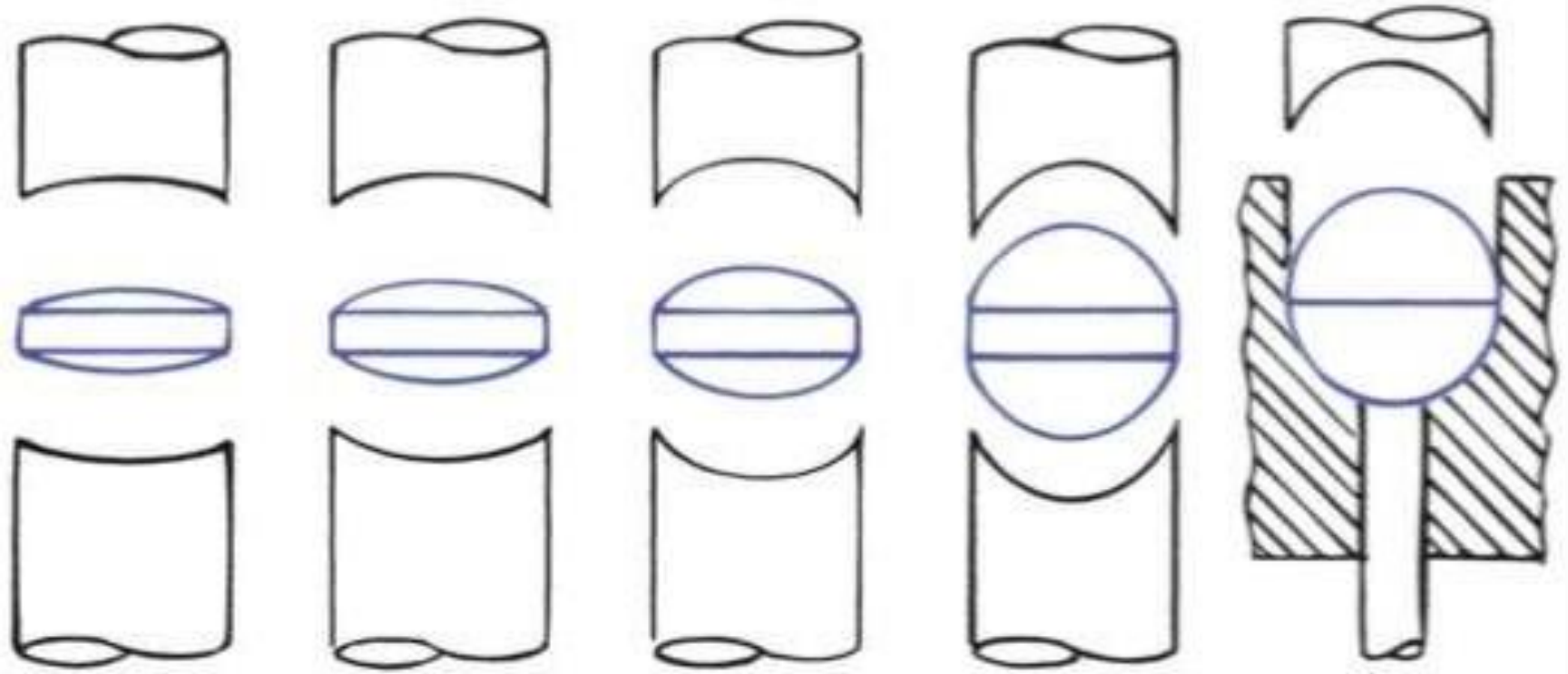


FIGURE 8.7 Contours of the punches determine the shape of the tablets. From left to right: flat face, shallow cup, standard cup, deep cup, and modified ball. (Courtesy of Cherry-Burrell Corporation.)

Tablet Ingredients

In addition to active ingredients, tablet contains a number of inert materials known as additives or excipients. Different excipients are:

1. Diluent
2. Binder and adhesive
3. Disintegrents
4. Lubricants and glidants
5. Colouring agents
6. Flavoring agents
7. Sweetening agents

EXCIEPIENTS- *functions*

- Impart weight, accuracy, & volume(its allow acccuracy of dose)
- Improve solubility
- Increase stability
- Enhance bioavailability
- Modifying drug release
- Assist pdt identification
- Increase patient acceptability
- Facilitate dosage form design

Excipient functions

Component	Function	Examples
Fillers	Increase size and weight of final dosage form	Microcrystalline cellulose, sucrose
Binders	Promote particle aggregation	Pregelatinized starch, hydroxypropyl methylcellulose
Disintegrants	Promote break down of aggregates	Sodium starch glycolate
Flow Aids	Reduce interaction between particles	Talc
Lubricants	Reduce interactions between particles and surfaces of processing equipment	Magnesium stearate
Surfactants	Promotes wetting	Sodium lauryl sulfate, Polysorbate
Modified Release Agents	Influences the release of active	Hydroxypropyl methylcellulose, Surelease,

1. **Diluent:** Diluents are fillers used to make required bulk of the tablet when the drug dosage itself is inadequate to produce the bulk. Secondary reason is to provide better tablet properties such as improve cohesion, to permit use of direct compression manufacturing or to promote flow.

A diluent should have following properties:

1. They must be non toxic
2. They must be commercially available in acceptable grade
3. There cost must be low
4. They must be physiologically inert
5. They must be physically & chemically stable by themselves & in combination with the drugs.
6. They must be free from all microbial contamination.
7. They do not alter the **bioavailability of drug.**
8. They must be color compatible.

Commonly used tablet diluents

1. Lactose-anhydrous and spray dried lactose
2. Directly compressed starch-Sta Rx 1500
3. Hydrolyzed starch-Emdex and Celutab
4. Microcrystalline cellulose-Avicel (PH 101and PH 102)
5. Dibasic calcium phosphate dehydrate
6. Calcium sulphate dihydrate
7. Mannitol
8. Sorbitol
9. Sucrose- Sugartab, DiPac, Nutab
10. Dextrose

2. Binders and Adhesives: These materials are added either dry or in wet-form to form granules or to form cohesive compacts for directly compressed tablet.

Example:

- Acacia, tragacanth- Solution for 10-25% Conc.
- Cellulose derivatives- Methyl cellulose, Hydroxy propyl methyl cellulose, Hydroxy propyl cellulose
- Gelatin- 10-20% solution
- Glucose- 50% solution
- Polyvinylpyrrolidone (PVP)- 2% conc.
- Starch paste-10-20% solution
- Sodium alginate
- Sorbitol

3. Disintegrants: Added to a tablet formulation to facilitate its breaking or disintegration when it contact in water in the GIT.

Example:

- Starch- 5-20% of tablet weight.
- Starch derivative – Primogel and Explotab (1-8%)
- Clays- Veegum HV, bentonite 10% level in colored tablet only
- Cellulose
- Cellulose derivatives- Ac- Di-Sol (sodium carboxy methyl cellulose)
- Alginate
- PVP (Polyvinylpyrrolidone), cross-linked

4. Superdisintegrants: Swells up to ten fold within 30 seconds when contact water.

Example:

- Crosscarmellose- cross-linked cellulose, Crosspovidone- cross-linked povidone (polymer), Sodium starch glycolate- cross-linked starch. These cross-linked products swells with in 30 seconds when in contact with water.
- A portion of disintegrant is added before granulation and a portion before compression, which serve as **glidants or lubricant.**

References

- The theory and practice of Industrial pharmacy, by Leon Lachmann and Herbert A.Lieberman,3rd edition, Page no: 294 to 336.
- The science and practice of pharmacy by Remington, Volume I, Page no: 905 to 916.
- Indian pharmacopoeia 2010, volume-2, Page no: 751 to 754.