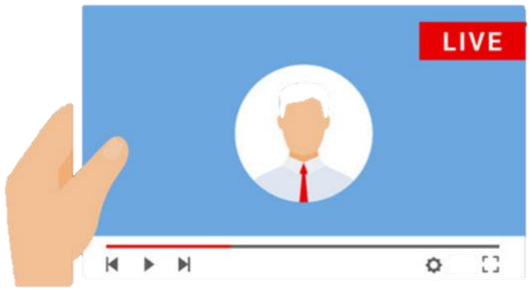


Welcome to "Live online class"

APOMIND

Tablets - 4

Agenda

Today's Topic: **Tablets – 4**

- Recap
- Tablets defects
- Tablet - Revision

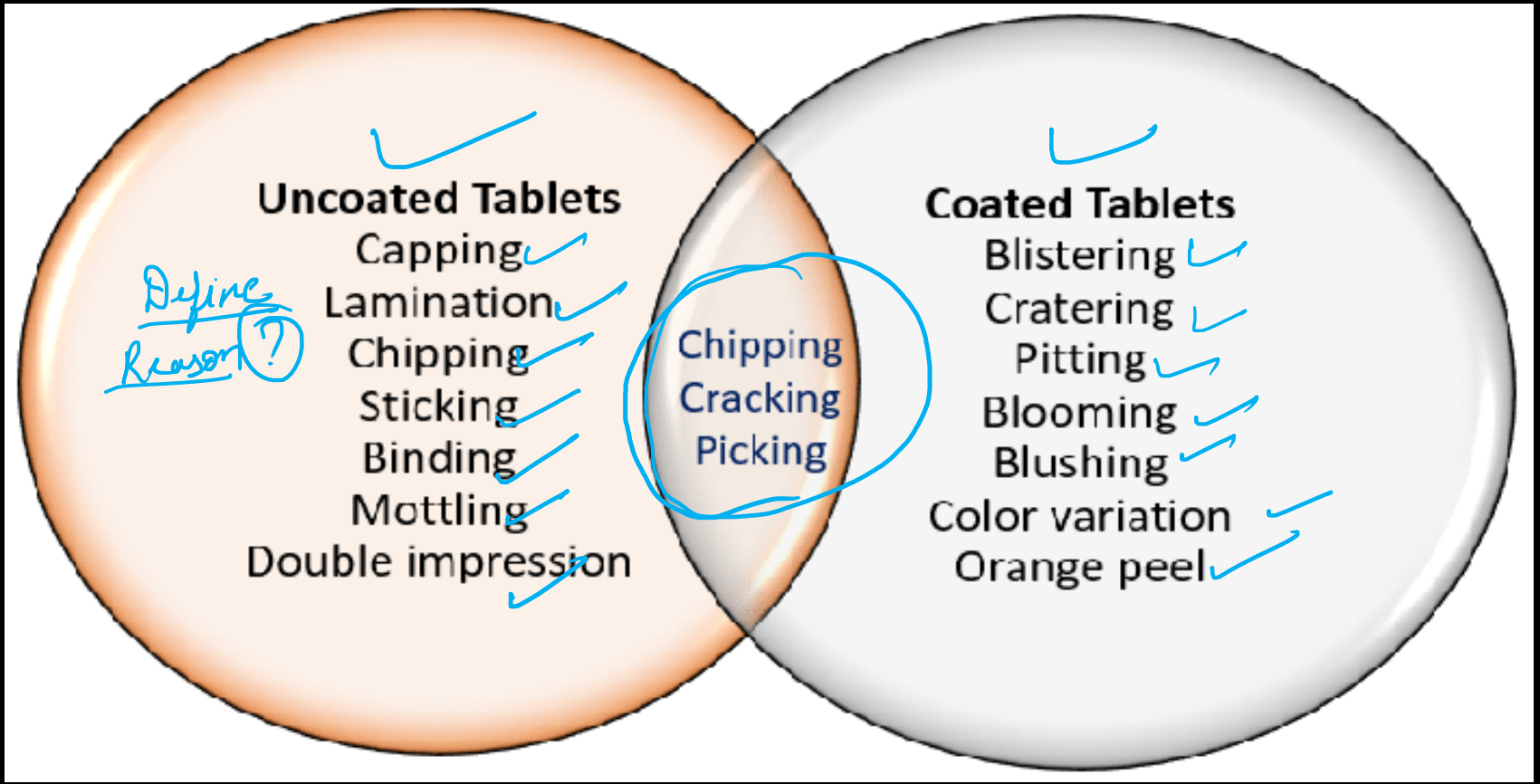
Solve **5-6 GPAT Questions**

Recap

- Introduction
- Advantages and disadvantages
- Formulation of Tablets: Excipients
- Tablet formation machine: theory and operations
- Methods of tableting
- Types of tablets
- Evaluation of tablets
- Tablets coating

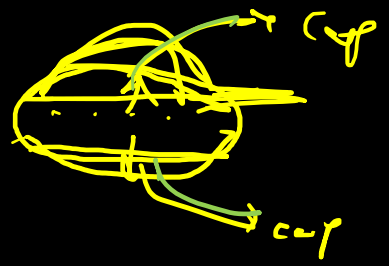
11-12 GPAT Questions

TABLET DEFECTS



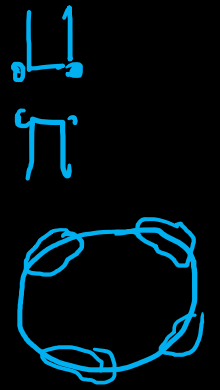
TABLET DEFECTS

Capping → upper or lower segment → tablet separate



Reason → air entrapment ✓

Chipping → breaking of tablet edges

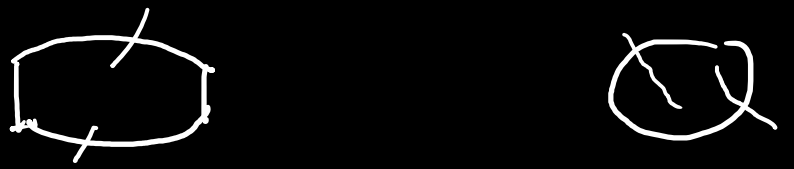


Reason → tablet coating → machine setting ✓

Lamination → separation of tablets in two or more layers ✓

Reason → air entrapment

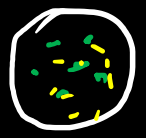
Cracking → small fine cracks → U/L surface



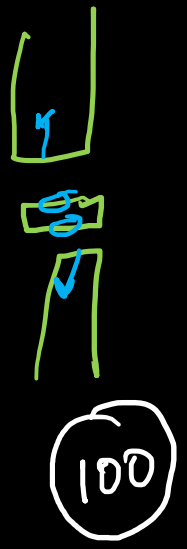
TABLET DEFECTS

Mottling → [unequal distribution of color on tablet]

Reason → API + e1 + e2 + e3



Picking — Small amt of material stick to punch



Reason → embossing / engraving

Granules → dusting (X) → Drying

Sticking → Filming

Reason → die wall, moisture

Sticking → Drying, lubrication (X)

Double impression

impression → 100

Binding → die-bind → cracked crumbled

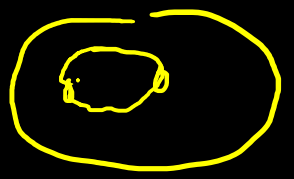
Reas → ① Improper drying ② Lack of Lubrication → ① Dies x

TABLET DEFECTS

Blistering — "Blister"

- local detachment film

Reason → entrapment air



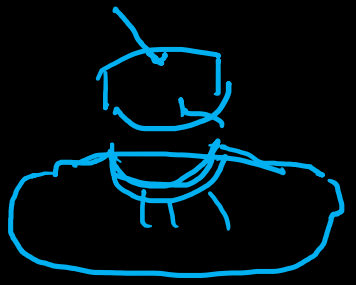
- temp.
- spraying agent

Chipping:- Chip → Chunk → Remove

Reason → air

- Speed of rotation
- Speed of spraying

Cratering — "Crater"



Reason → coating sol" → surface

Blooming

Coating → dull

Reason → coating agent

↓

polymerization

TABLET DEFECTS

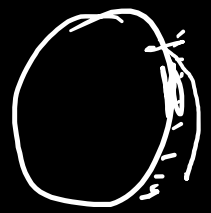
Blushing

→ whitish specks or haziness in film

Reason → coating layer + polymer

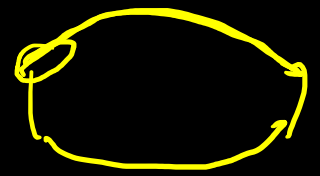
Orange peel effect | Roughness

→ film → rough / non glossy orange



Reason → spraying of coating → faulty

Cracking / splitting



↳ Cracks film

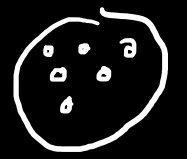
↳ edge part of coat → split

Reason – film → internal stress

Color variation → Color of film vary

Reason → operation → spray → color

Pitting → pits occur in the surface of tablet core



Reason → temp of tablet

GPAT QUESTION

Non uniformity in colour in tablet surface is called _____

A. Orange peel effect

B. Blistering

C. Mottling

D. Pitting

GPAT QUESTION

"Capping" in a tablets occur due to

A. Entrapment of Air

B. Excessive moisture

C. Increased rate of evaporation

D. None

Tablets: Excipients

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Tablets: Excipients

Excipients	Use	Examples (Brand name)	Important points
Diluents/Fillers/ Bulking agents	To make up the required bulk of the tablet when the drug dosage itself is inadequate to produce this bulk. **The most important note is that only diluent is adjusted with the total quantity of active drug after potency calculation.**	Lactose: Anhydrous Lactose; Lactose Monohydrate; Spray-Dried Lactose	Millard's Reaction*(Physical Incompatibility):-- Hydrous lactose + 1 or 2 Amine containing drug forms darkening of tablet or browning due to formation of furfuraldehyde
		Starch: Pregelatinized Starch; Maize Starch; Corn Starch (Star-Rx-1500)	
		Dextrose (Emdex, Celutab, Cerelose)	Replace the lactose to reduce the tablet to darken
		Mannitol (Pearlitol)	Chewable tablets Non reducing sugar (No Millard's reaction)
		Sorbitol	Optical isomer of Mannitol
		Sucrose (DiPac; Sugartab; NuTab)	
		Micro Crystalline Cellulose (Avicel 101, 102, 200; Celex)	Direct compressible Disintegrating agent
		Calcium (Emcompress, Ditab, Fujicalin)	Interaction with tetracycline's API → insoluble complex and salts

Tablets: Excipients

Excipients	Use	Examples (Brand name)	Important points
Binders or Adhesives	They imparts cohesive properties to powdered material to form granules for tableting. **Binders more active as a solution form than solid form**	Natural Gums: Acacia and Tragacanth	Easily attacked by microorganism
		Gelatin	-
		Starch paste	Paste must be translucent Heating starch hydrolyzed to dextrin & glucose
		Liquid glucose	Chewable tablets Non reducing sugar (No Millard's reaction)
		Alginates and cellulose derive: -- Methyl cellulose, Hydroxy propyl methyl cellulose (HPMC), Hydroxy propyl cellulose (HPC)	For direct compression & their aqueous solution is adhesive
		Ethyl Cellulose	Retard the disintegration & dissolution of drugs
		Polyvinylpyrrolidone or Povidone Grade K-15, K-30, K-60, K-90 (Kollidon)	Synthetic polymer

Tablets: Excipients

Excipients	Use	Examples (Brand name)	Important points
Disintegrants	A disintegrant is a substance or a mixture of substances added to a tablet to facilitate its breakup or disintegration into small units/fragments and allow a drug substance to fast dissolution.	Starch	Starch swells in all 3 dimensions whereas cellulose swells in 2 dimensions only
		Clays - Bentonite or Veegum	-
		Super-disintegrant are Crosspovidone (Kollidon CL), Croscarmellose Sodium (Ac-Di-Sol, Primellose), and Sodium Starch Glycolate (Primogel, Explotab)	
Lubricant	They are intended to reduce the friction during tablet ejection between walls of the tablet and walls of the die cavity in which tablet was formed Lubricants based upon fatty acids are insoluble in water & hence can retard the disintegration & dissolution time	Water soluble lubricants: PEG 6000 (Macrogol 6000 or Carbowax), Magnesium Lauryl Sulfate, Fumaric acid Talc: Both Glidant + lubricant activity *(Contains Iron, so carefully used if any formula contains drug which breakdown is catalysed by Fe2+)*	

Tablets: Excipients

Excipients	Use	Examples (Brand name)	Important points
Antiadherent	They are used to reduce the sticking & adhesion of any of tablet granulation/powder to the punches of die wall	Starch and its derivatives, Tale, Mg-stearate, and colloidal Silica	-
Glidant (Flow promoters)	They are intended to promote flow of the tablet granules from hoper & reducing the friction between the particles	Colloidal silicon dioxide (Aerosil, Cab-O-Sil, Syloid); Calcium and Magnesium Stearates; Corn Starch	-
Colours	Disguising of color drugs; Product identification; Production of more elegant product	Dyes (Water-soluble) and Lakes (Insoluble forms) Inorganic pigments: Titanium dioxide or iron oxides Natural colorants: Riboflavin	-
Flavors	Produce a taste or aroma (i.e. fragrance) response when orally consumed or smelled	Flavoured oils	Flavors are vital excipients for chewable tablets, oral disintegrating tablets, dispersible tablets, oral solutions, and oral suspensions
Sweeteners	To mask the unpleasant taste and sweeten oral dosage	Mannitol: 72% sweeter Saccharin: 500 times sweeter Aspartame: 200 times sweeter	-*Compared to sucrose

Tablets: Machine

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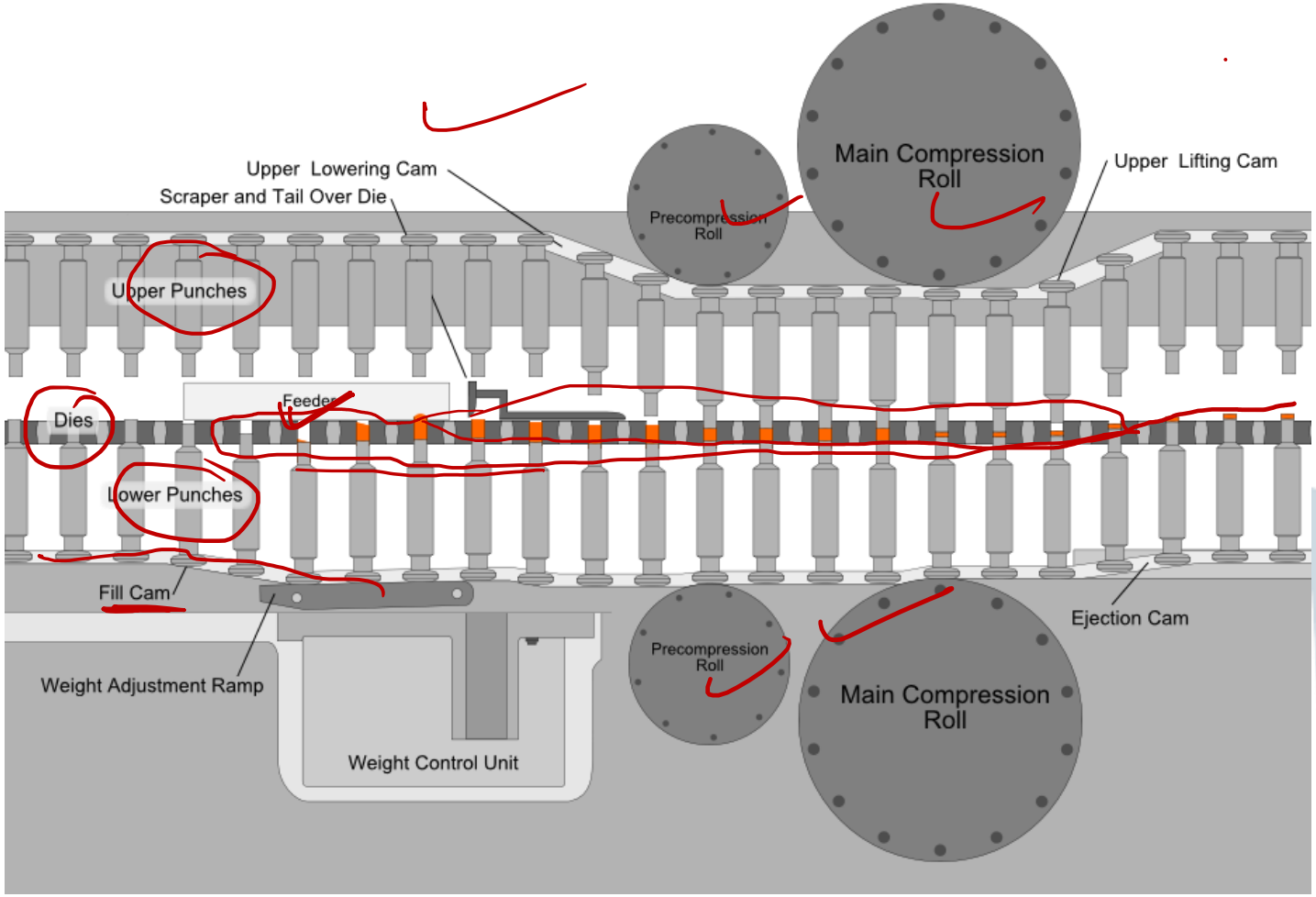
Tablet formation machine

TABLET FORMATION



Component	Purpose
Hopper	For holding feed to be compressed
Dies	Defines shape and size of tablets
Punches	For compression of feed
Cam Tracks	Guides the movement of punches
Feeding Mechanism	For moving feed from hopper to dies
Turrets	For holding the punches
Die table	For holding dies

Tablets: Methods of tableting

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Tablets: Methods of tableting

Methods of Tableting	Definition	Key Advantages	Key Disadvantages
Wet Granulation	Most used method for the manufacture of tablets	- Reduced segregation of formulation components during storage and/or processing - Useful for tablets with low concentrations of therapeutic agents - Uses conventional excipients - Amenable to post-processing unit operations like tablet-coating techniques	- Several processing steps required - Requires solvents, leading to concerns like drug degradation, solubility issues, and the need for heat to remove solvents - Drying is costly, with concerns about solvent recovery and flammability
Dry Granulation	Aggregation of particles into granules facilitated by high stresses without using solvents **Slugging:** Powders are mixed and compressed into oversized tablets (slugs) which are then milled to produce granules **Roller Compaction:** Powders are mixed and compressed by passage between rotating rollers to produce a compressed sheet, which is then milled to produce granules	- Uses conventional grades of excipients - Not generally associated with alterations in drug morphology - No heat or solvents required	- Requires specialist equipment for roller compaction - Segregation of components may occur post-mixing - Issues with powder flow - Final tablets tend to be softer and harder to process using post-tableting techniques - Generation of dust, requiring containment measures and reducing tablet yield

Tablets: Methods of tableting

Methods of Tableting	Definition	Key Advantages	Key Disadvantages
Direct Compression	Involves powder mixing and subsequent compression, avoiding granulation and related unit operations	- Fewer processing steps, making it cost-effective - No use of water/solvents, avoiding stability issues - Heating not required - Reduced wear and tear to dies and punches	- Differences in particle size & bulk density between drug & diluents can lead to stratification, resulting in poor content uniformity - Diluents may interact with the drug (Millard's reaction) - Static charge in dry powder can prevent uniform distribution of the drug in the granulation - Requires specialist (and more expensive) excipients

Tablets: Types of tablets

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Tablets: Types of tablets

Type of Tablet	Definition	Important points
Standard compressed or multiple compressed tablets	Tablets taken by mouth to be swallowed.	**Standard coated tablets:** Manufactured by wet granulation, double compaction, or direct compression; rapid disintegration and drug release. **Multiple compressed tablets:** Layered tablets, for separating incompatible ingredients, repeat action.
Delayed action and enteric-coated tablets	Tablets that release the drug after a delay or in a specific part of the GIT.	Protects acid-labile drugs, intended for local action in the intestine.
Sugar-coated tablets	Tablets coated with sugar to mask taste and odor.	Small tablet coated with enteric coating or cellulose, then multiple syrup layers.
Film-coated tablets	Tablets coated with a polymer film for mechanical strength and taste masking.	Polymer solution in an organic solvent sprayed over tablets.
Chewable tablets	Tablets to be chewed before swallowing.	Ideal for infants, children, and the elderly; not suitable for bitter drugs.

Tablets: Types of tablets

Type of Tablet	Definition	Important points
Buccal and sublingual tablets	Tablets held in the mouth for drug absorption through the oral mucosa. **Buccal tablets** → held between cheek & gums or in cheek pouch **Sublingual tablets** → held beneath the tongue	Avoids first-pass metabolism, rapid drug action, avoids gastric acid decomposition.
Troches and lozenges	Tablets for local effect in the mouth or throat.	Used for sore throat, cough control; contains anesthetics, antiseptics, demulcents. Lozenges were originally termed **pastilles**, but are more commonly called cough drops Lozenges are usually formed by **fusion or by a candy-molding process**
Dental cones	Tablets placed in the gum socket post-tooth extraction to prevent infection or bleeding.	Contains antibacterial or astringent/coagulant properties.
Implantation tablets or depot tablets	Tablets designed for subcutaneous implantation to provide prolonged drug effects.	Used in animals for growth hormones; requires surgical technique for discontinuation (the Kern injector).
Vaginal tablets	Tablets designed for slow dissolution and drug release in the vaginal cavity.	Used with antibacterial, antiseptic, astringent, or steroids; requires a plastic tube inserter.

Tablets: Types of tablets

Type of Tablet	Definition	Important points
Effervescent Tablets	These tablets produce effervescence when added to water, dissolving rapidly due to a chemical reaction between alkali bicarbonate and citric or tartaric acid, or a combination of both.	- Must be protected from atmospheric moisture during storage - Store in well-closed air-tight containers
Dispensing Tablets	These tablets contain an excipient that dissolves quickly to form a clear solution and are commonly used to incorporate medicaments like mild silver proteinate, bichloride of mercury, merbromin, and quaternary ammonium compounds.	- Highly toxic if taken orally by mistake - Great care must be taken in packaging and labeling to prevent misuse
Hypodermic Tablets	These are compressed tablets composed of one or more drugs with readily water-soluble ingredients, dissolved in sterile water or water for injection, and administered by the parenteral route.	- Not preferred nowadays due to the risk of non-sterile solutions
Tablet Triturates	Small, usually cylindrical tablets, molded or compressed, containing a potent medicament with a diluent.	- Prepared on a small-scale using hand-operated molds - Bulk production uses automatic tablet triturate machines

Tablets: Tablet coating

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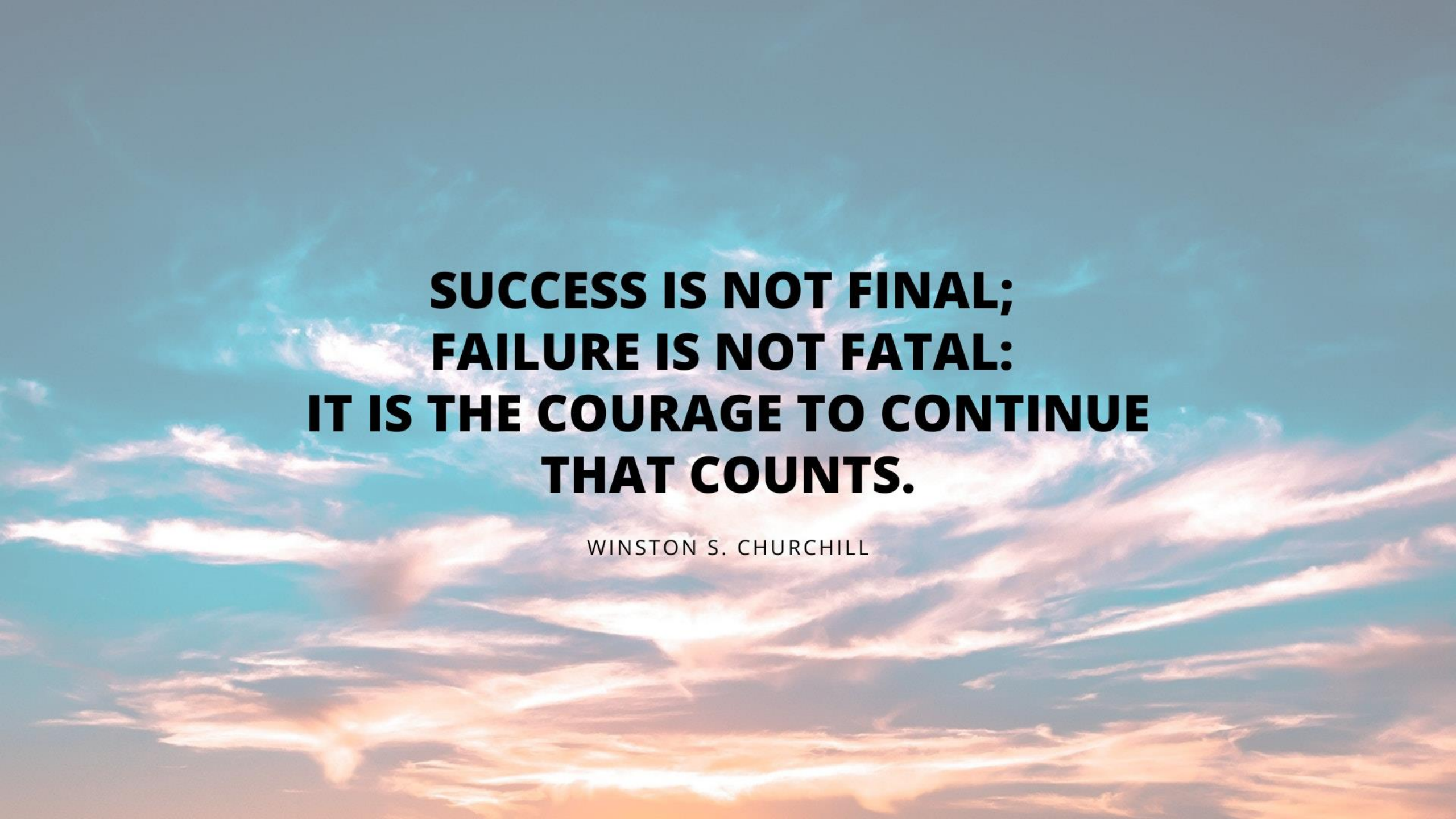
Tablets: Sugar Coating

Step	Definition	Key Points
Sealing	Water-proof coating applied to prevent tablets from absorbing excess moisture, which can lead to softening or disintegration.	- Common sealants: Shellac (prone to aging and polymerization, increasing disintegration time) and Zein (alcohol-soluble protein derivative from corn).
Subcoating	Applied to round the edges and build up the tablet size by 50-52%. This involves the application of a sticky binder solution followed by a dusting of sub-coating powders and drying. This process is repeated 3-4 times.	- Sticky binder: Acacia or gelatin solution. - Sub-coating powders: Talc, $CaCO_3$ - Repeated until desired thickness is achieved (3-4 sub coats).
Syrup Coating/Color Coating	Applied to cover imperfections from the sub-coating step and to impart the desired color to the tablet. The first syrup coats usually contain suspended powders (grossing syrups). No color is added until the tablets are smooth.	- Covers imperfections and adds color. - Requires the most skilled person. - Initial syrup coats contain grossing syrups. - No color is added until tablets become smooth.
Polishing	Final step that involves polishing the tablets using powdered wax (such as beeswax or carnauba wax) or a warm solution of these waxes in naphtha or other suitable volatile solvents.	- Polishes the tablets to a shiny finish. - Polishing agents: Powdered wax (beeswax or carnauba wax) or a warm solution of these waxes in naphtha or other volatile solvents.

Tablets: film Coating

Type	Example	Key Points
Film coating	- Compressed tablets with a thin plastic-like coating	- Maintains original weight, shape, and size
	- Hydroxy propyl methyl cellulose (HPMC)	- More resistant to abrasion than sugar-coated tablets
	- Ethyl cellulose	- Weight gain typically 2-6%
	- Povidone	
	- Hydroxy propyl cellulose (HPC)	Non-enteric film formers
	- Sodium carboxymethyl cellulose (Sodium CMC)	- Various grades based on viscosity; lower grades preferred
	- Polyethylene glycol (PEG)	- Used alone, can fill tablet surfaces
	- Acrylate polymers (e.g., Eudragit)	Combination with other polymers to modify film properties
	- Cellulose acetate phthalate (CAP)	- Ethyl cellulose used for delayed/sustained-release tablets
Enteric Coating	- Phthalate esters (e.g., Shellac, Eudragit L & S)	- Protects acid-labile drugs from gastric fluids
	- Polyvinyl acetate phthalate (PVAP)	- Dissolves or becomes permeable above pH 5
	- Hydroxy propyl methyl cellulose phthalate (HPMCP)	Ideal for drugs intended for local action in the intestine
	CAP	- Combines PEG with cellulose acetate phthalate (CAP) for gastric fluid solubility
		- Enteric coatings dissolve above pH 6 (e.g., CAP)
		- pH-dependent dissolution (e.g., Eudragit L at pH 6, Eudragit S at pH 7)


SUCCESS IS NOT FINAL;
FAILURE IS NOT FATAL:
IT IS THE COURAGE TO CONTINUE
THAT COUNTS.
WINSTON S. CHURCHILL