Dosage Form:

A dosage form is the physical form in which a medication is produced and administered to deliver the active drug effectively to the patient. It includes the drug and other non-active ingredients (excipients) that help in drug delivery.

Types of Dosage Forms:

1. Solid Dosage Forms:

Tablets – e.g., Paracetamol tablet

Capsules – e.g., Amoxicillin capsule

Powders – e.g., Oral rehydration salts

Granules – e.g., Antacid granules

2. Liquid Dosage Forms:

Solutions – e.g., Cough syrups

Suspensions – e.g., Antacid suspension

Emulsions – e.g., Cod liver oil emulsion

3. Semi-Solid Dosage Forms:

Ointments – e.g., Antibiotic ointment

Creams – e.g., Hydrocortisone cream

Gels – e.g., Diclofenac gel

4. Gaseous Dosage Forms:

Inhalers – e.g., Salbutamol inhaler

Aerosols – e.g., Nasal sprays

5. Parenteral Dosage Forms:

Injections – e.g., Insulin injection

Infusions – e.g., IV fluids

Each dosage form is chosen based on the route of administration, drug properties, and patient needs.

Title: Introduction to Tablets in Drug Formulation

Definition:

A tablet is a solid dosage form containing one or more active pharmaceutical ingredients (APIs) with excipients, compressed into a defined shape.

Why Tablets?

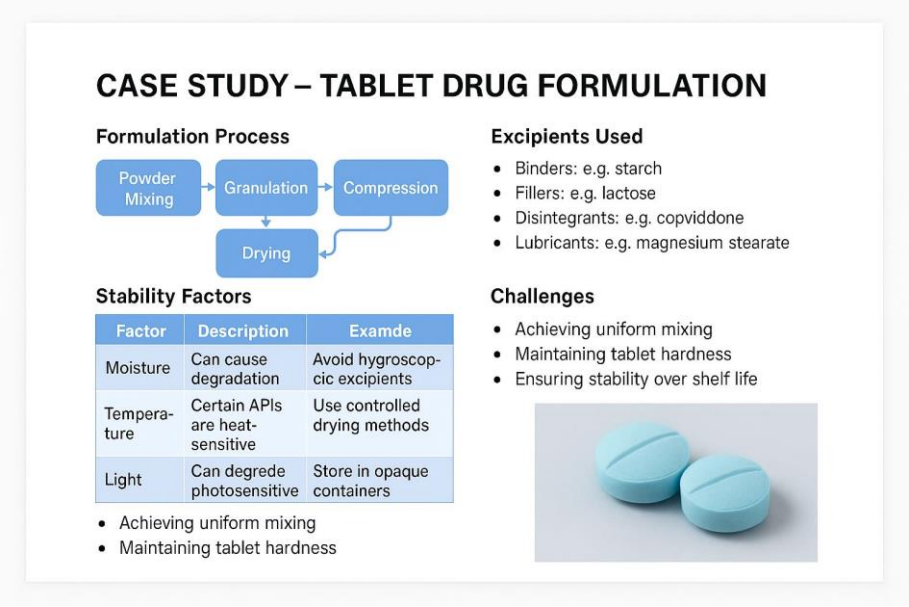
Convenience: Easy to administer, carry, and store.

Accuracy: Delivers a precise dose.

Stability: Generally more stable than liquid forms.

Cost-effective: Economical to produce on a large scale.

Patient compliance: Often preferred by patients due to ease of use.



Title: Types of Tablets in Pharmaceutical Formulation

Tablets are classified based on their route of administration, release profile, and purpose. Here's a breakdown:

1. Immediate-Release Tablets (IR):

Description: Disintegrate and release the drug quickly after administration.

Use: For rapid onset of action.

Example: Paracetamol tablet.

2. Extended-Release Tablets (ER / XR):

Description: Release the drug over an extended period.

Purpose: Maintain therapeutic levels longer, reduce dosing frequency.

Example: Metformin XR.

3. Delayed-Release Tablets (Enteric-Coated):

Description: Resist stomach acid; release drug in the intestine.

Use: For acid-sensitive drugs or to prevent gastric irritation.

Example: Omeprazole tablets.

4. Chewable Tablets:

Description: Meant to be chewed before swallowing.

Use: For pediatric/geriatric patients with swallowing difficulty.

Example: Antacid tablets.

5. Effervescent Tablets:

Description: Contain acids + carbonates that release CO_2 in water.

Use: Dissolved before administration for faster absorption.

Example: Vitamin tablets.

6. Sublingual & Buccal Tablets:

Description: Placed under the tongue (sublingual) or in cheek pouch (buccal).

Use: Rapid absorption through oral mucosa.

Example: Nitroglycerin (sublingual).

7. Orodispersible Tablets (ODTs):

Description: Disintegrate rapidly in the mouth without water.

Use: Convenient for patients with swallowing issues.

Example: Ondansetron ODT.

8. Coated Tablets:

Types: Sugar-coated, film-coated, or enteric-coated.

Purpose: Mask taste, protect drug from environment, or modify release.

9. Multiple-Compressed Tablets:

Description: Prepared by compressing more than one layer.

Use: Separate incompatible drugs or for dual-release.

Example: Bilayer tablets.

Table Format Suggestion:

Type	Route	Purpose	Example
Immediate-Release	Oral	Rapid action	Paracetamol
Extended-Release	Oral	Long-lasting	Metformin XR
Sublingual	Under tongue	Fast absorption	Nitroglycerin
Effervescent	Dissolved in water	Faster onset	

Title: Tablet Formulation Process

Tablet formulation involves converting active pharmaceutical ingredients (APIs) into a stable, effective, and manufacturable dosage form. It includes two main phases: pre-formulation and formulation.

A. Pre-Formulation Studies

Before actual formulation, pre-formulation is done to understand:

Physicochemical properties of the API (solubility, stability, particle size, flow).

Compatibility with excipients.

Dose requirements.

B. Main Steps in Tablet Formulation

1. Weighing and Blending of Ingredients

Purpose: Ensures accurate dosing and uniform mixing.

Materials: API + excipients (diluents, binders, lubricants, etc.)

Equipment: Tumblers, V-blenders, ribbon mixers.

Challenges: Segregation, poor flow, content uniformity.

2. Granulation

Converts powder mixture into granules for better flow and compression.

a) Wet Granulation:

Process: Add granulating fluid → wet massing → screening → drying.

Binders used: PVP, starch paste, HPMC.

Drying: Tray dryer or fluid bed dryer.

b) Dry Granulation:

For moisture-sensitive drugs.

Process: Compress into slugs/rolls → mill into granules.

c) Direct Compression:

No granulation needed.

Used when API + excipients have excellent flow/compression.

3. Lubrication

Purpose: Prevent sticking to punches/dies.

Common lubricants: Magnesium stearate, talc.

Timing: Done post-granulation (but before compression).

4. Tablet Compression

Process: Granules are compressed into tablets using punches and dies.

Equipment: Rotary tablet press or single-punch machine.

Key Parameters: Compression force, hardness, thickness.

5. Coating (Optional)

Purpose: Mask taste, improve appearance, modify release.

Types: Sugar coating, film coating, enteric coating.

Coating materials: HPMC, CAP, EC, colorants.

6. Packaging

Protects tablets from moisture, light, and contamination.

Types: Blister packs, strip packs, bottles.

Importance: Maintains product stability and compliance.

Tablet Manufacturing Flowchart

Weighing → Mixing → Granulation → Drying → Sieving → Lubrication → Compression → Coating → Packaging.

Title: Excipients in Tablet Formulation

Excipients are inactive substances added to tablets along with the active drug to improve manufacturing, stability, bioavailability, and patient acceptability.

1. Diluents (Fillers)

Definition: Increase the bulk of the tablet to ensure proper size for handling and dosing.

Example 1: Lactose

Example 2: Microcrystalline Cellulose (MCC)

2. Binders

Definition: Promote adhesion of powder particles, improving tablet strength.

Example 1: Starch paste

Example 2: Polyvinylpyrrolidone (PVP)

3. Disintegrants

Definition: Help the tablet break down into smaller fragments in the digestive tract for drug release.

Example 1: Sodium starch glycolate

Example 2: Crospovidone

4. Lubricants

Definition: Reduce friction between tablet material and die wall during compression and ejection.

Example 1: Magnesium stearate

Example 2: Stearic acid

5. Glidants

Definition: Improve flow properties of powders or granules by reducing inter-particulate friction.

Example 1: Colloidal silicon dioxide

Example 2: Talc

6. Coating Agents

Definition: Used to coat tablets to improve appearance, taste, and modify drug release.

Example 1: Hydroxypropyl methylcellulose (HPMC) – film coating

Example 2: Cellulose acetate phthalate (CAP) – enteric coating

7. Sweeteners and Flavoring Agents

Definition: Enhance taste for better patient compliance, especially in chewable or ODTs.

Example 1: Aspartame (sweetener)

Example 2: Menthol (flavor)

8. Colorants

Definition: Provide aesthetic appeal and help in identification.

Example: FD&C Yellow No. 6

Title: Stability Factors Affecting Tablets

Tablet stability is crucial to ensure drug efficacy, safety, and shelf life. Various environmental and formulation-related factors can degrade tablets over time.

1. Moisture (Humidity)

Description: Moisture can cause hydrolysis, swelling, microbial growth, and loss of hardness.

Example: Aspirin undergoes hydrolysis in high humidity, forming salicylic acid.

Prevention: Use of desiccants, moisture-proof packaging (e.g., blister packs).

2. Temperature

Description: High temperatures may cause degradation, melting of ingredients, or altered drug release.

Example: Nitroglycerin loses potency at elevated temperatures.

Prevention: Store at controlled room temperature; use thermostable formulations.

3. Light (Photodegradation)

Description: Exposure to light can degrade photosensitive drugs.

Example: Nifedipine undergoes photodegradation under UV light.

Prevention: Use amber-colored bottles or light-resistant blister packs.

4. Oxygen (Oxidation)

Description: Oxygen can oxidize certain APIs, reducing efficacy.

Example: Ascorbic acid oxidizes to dehydroascorbic acid.Prevention: Use of antioxidants (e.g., BHT), nitrogen flushing, airtight containers.

5. pH

Description: pH can influence chemical stability of the drug and excipients.

Example: Erythromycin degrades in acidic conditions.

Prevention: Use enteric coating to avoid gastric pH; buffer systems.

6. Microbial Contamination

Description: Although tablets are low in moisture, some ingredients may support microbial growth.

Example: Natural binders or sweeteners can be contaminated.

Prevention: Use preservatives, GMP practices, proper storage.

7. Mechanical Stress

Description: Excessive pressure or vibration during processing or transport can cause cracking, capping, or lamination.

Example: Fragile tablets may break during packaging.

Prevention: Optimize compression force, use robust excipients.

Conclusion – Tablet Formulation Case Study

Tablet formulation is a complex yet essential process in pharmaceutical development. It transforms active pharmaceutical ingredients (APIs) into stable, effective, and patient-friendly dosage forms. Each stage — from pre-formulation to packaging — plays a critical role in ensuring product quality, efficacy, and safety.

Key points:

- Proper excipient selection and formulation techniques ensure consistent performance.
- Stability must be addressed by considering environmental and chemical factors.
- Manufacturers face various technical challenges, such as poor flow, compressibility, and drug-excipient incompatibility.
- Overcoming these challenges requires scientific understanding, process optimization, and quality control.

In conclusion, successful tablet formulation demands a multidisciplinary approach, integrating pharmaceutics, chemistry, engineering, and regulatory knowledge to meet both therapeutic and manufacturing goals.