

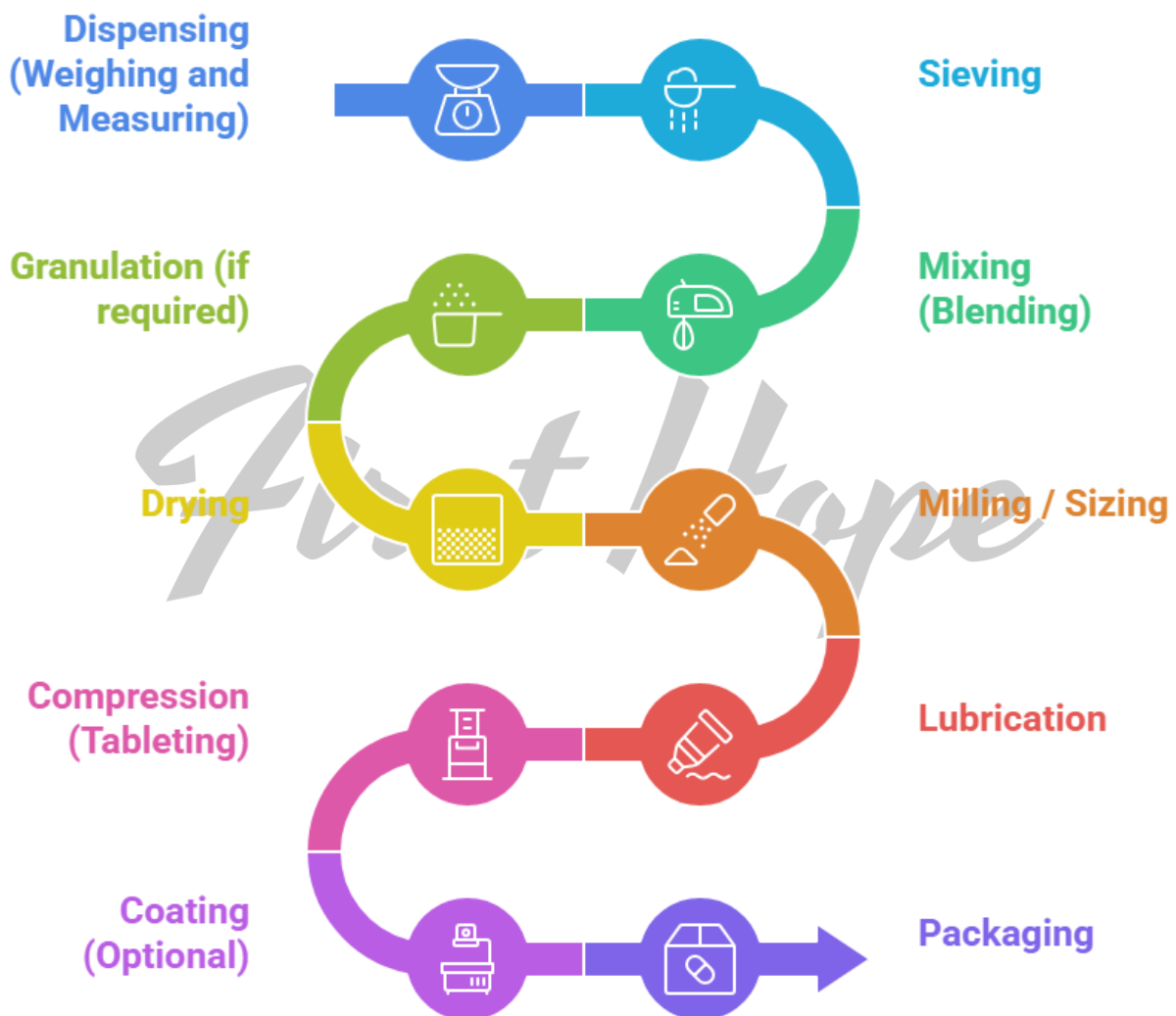
Improved Tablet Production

Tablet Production Process

- Tablet production is a step-by-step method used in pharmaceutical industries to convert powders or granules into solid dosage forms (tablets).
- Each step is carefully controlled to ensure quality, uniformity, and stability.

Steps Involved:

Pharmaceutical Tablet Manufacturing Process



A. Dispensing (Weighing and Measuring)

- All raw materials (API + excipients) are accurately weighed.
- Errors at this stage can lead to incorrect dosage.

B. Sieving

- Materials are passed through sieves to remove lumps and ensure uniform particle size.
- Improves flow and mixing efficiency.

C. Mixing (Blending)

- API is mixed with excipients like diluents, binders, disintegrants.
- Ensures uniform distribution of drug throughout the batch.

D. Granulation (if required)

- Convert fine powders into granules.
- Improves flow, compressibility, and reduces dust.

E. Drying

- Removes moisture from granules.
- Excess moisture can cause sticking; low moisture can cause poor binding.

F. Milling / Sizing

- Granules are resized to uniform size for better compression.

G. Lubrication

- Lubricants (e.g., magnesium stearate) are added.
- Prevents sticking to punches and dies during compression.

H. Compression (Tableting)

- Granules are compressed into tablets using tablet press machines.
- Key parameters: pressure, speed, weight uniformity.

I. Coating (Optional)

- Tablets may be coated for protection, taste masking, or controlled release.

J. Packaging

- Final tablets are packed in blister packs or bottles to maintain stability.

Unit Operation Improvements

- Unit operations are individual steps in the manufacturing process.
- Improvements aim to enhance efficiency, consistency, and product quality.

Key Improvements:

1. Automation

- Use of automated systems reduces human error.
- Ensures consistent quality and reduces contamination risk.

2. Process Analytical Technology (PAT)

- Real-time monitoring of parameters like moisture, particle size.
- Helps in immediate adjustments during manufacturing.

3. Closed System Processing

- Prevents contamination and exposure to environment.
- Important for potent or sensitive drugs.

4. Improved Material Handling

- Use of vacuum transfer systems instead of manual transfer.
- Reduces loss of material and contamination.

5. Uniform Mixing Techniques

- Advanced mixers ensure homogeneity.
- Prevents dose variation.

6. Controlled Granulation Techniques

- Precise control over binder addition and mixing time.
- Leads to consistent granule quality.

7. Energy Efficiency

- Modern equipment reduces power consumption.
- Improves sustainability in production.

8. Reduced Processing Time

- Faster equipment like high-speed mixers and dryers.
- Increases production capacity.

Granulation and Pelletization Equipments

- Granulation and pelletization improve flow, compressibility, and uniformity of powders.

Granulation Equipments

A. Rapid Mixing Granulator (RMG)

- High-speed impeller mixes powder and binder.
- Chopper breaks lumps.
- Produces dense and uniform granules quickly.
- **Working Principle:**
 - Powder is mixed → binder added → granules formed by agitation.

B. Fluidized Bed Granulator (FBG)

- Air is passed upward to fluidize particles.
- Binder is sprayed onto fluidized powder.

- Simultaneous mixing, granulation, and drying.
- **Advantages:**
 - Uniform granules
 - Faster process
 - Less handling

C. Oscillating Granulator

- Converts wet mass into granules by passing through mesh.
- Simple and widely used.

Pelletization Equipments

Pellets are small, spherical particles used for controlled release.

1. Extruder

- Wet mass is pushed through a die to form cylindrical shapes.

2. Spheronizer (Marumerizer)

- Converts cylindrical extrudates into spherical pellets.
- Uses rotating friction plate.
- **Working:**
 - Extrudates collide and round off into spheres.

3. Rota Granulator (Rotary Granulator)

- Uses rotating drum or plate.
- Produces uniform granules or pellets.
- Often used for large-scale production.

4. Marumerizer

- A type of spheronizer.
- Produces smooth and uniform pellets.
- Important for modified-release formulations.

5. Spray Dryer

- Convert liquid into dry particles instantly.
- Used when drug is in solution form.

Advantages of Granulation and Pelletization:

- Improves flow and compressibility
- Reduces dust generation

- Ensures uniform drug distribution
- Enhances stability

Continuous and Batch Mixing

- Mixing is a critical step to ensure uniform drug distribution.

Batch Mixing

Definition:

- Mixing is done in fixed quantities (batches).

Process:

- Load materials → mix → unload → repeat.

Common Equipment:

- V-blender
- Double cone blender
- Ribbon mixer

Advantages:

- Easy to control
- Suitable for small-scale production
- Flexible for different formulations

Disadvantages:

- Time-consuming
- Batch-to-batch variation possible
- Scale-up challenges

Continuous Mixing

Definition:

- Materials are continuously fed and mixed without stopping.

Process:

- Raw materials enter → mixing occurs → product exits continuously.

Equipment:

- Continuous blenders
- Twin-screw mixers



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