

# Tablets design and manufacture

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# Tabletting formulations

- ✦ In the tablet-pressing process, it is important that all ingredients be fairly dry, powdered or granular, somewhat uniform in particle size and freely flowing.

- ✦ Mixed particle sized powder can segregate during manufacturing operations, which can result in tablets with poor drug or active pharmaceutical ingredient (API) content uniformity.

Content uniformity ensures that the same API dose is delivered with each tablet.

- ✦ Most tablet formulations include excipients.

Binder is added in the formulation to help hold the tablet together and give it strength e.g. lactose and hydroxypropylmethylcellulose.



✱ Often, an ingredient is also needed to act as a disintegrant to aid tablet dispersion once swallowed releasing the API for absorption.

✱ Some amounts of lubricants are usually added as well. The most common of these is magnesium stearate. These help the tablets once pressed to be more easily ejected from the die.

# Tablet production

Powders intended for compression into tablets must possess two essential properties:

## Powder fluidity

- ✦ The material can be transported through the hopper into the die.
- ✦ To produce tablets of a consistent weight.
- ✦ Powder flow can be improved mechanically by the use of vibrators, incorporate the glidant.

## Powder compressibility

- ✦ The property of forming a stable intact mass when pressure is applied.

Important technical properties of powders must be controlled to ensure success of tableting operation such as,

- homogeneity,
- good flowability,
- good compressibility,
- cohesiveness,
- avoidance of sticking to the die surface or punch tips.

Since most materials have none or some of these properties, methods of tablet formulation (addition of tablet excipients) and preparation (three methods; wet granulation, dry granulation and direct compression) have been developed to impart the materials to be compressed these characteristics.

# Tableting is a compaction process and Involves two steps:

## Compression

- ▶ Reduction in bulk volume by eliminating voids and bringing particles into closer contact.

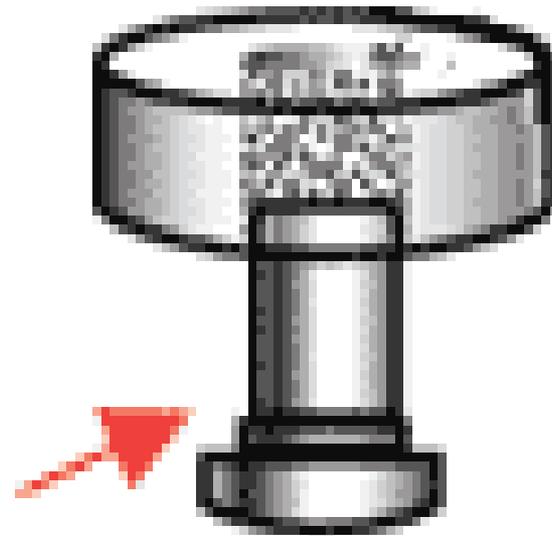
## Consolidation

- ▶ Increased mechanical strength due to interparticulate interactions.

top punch

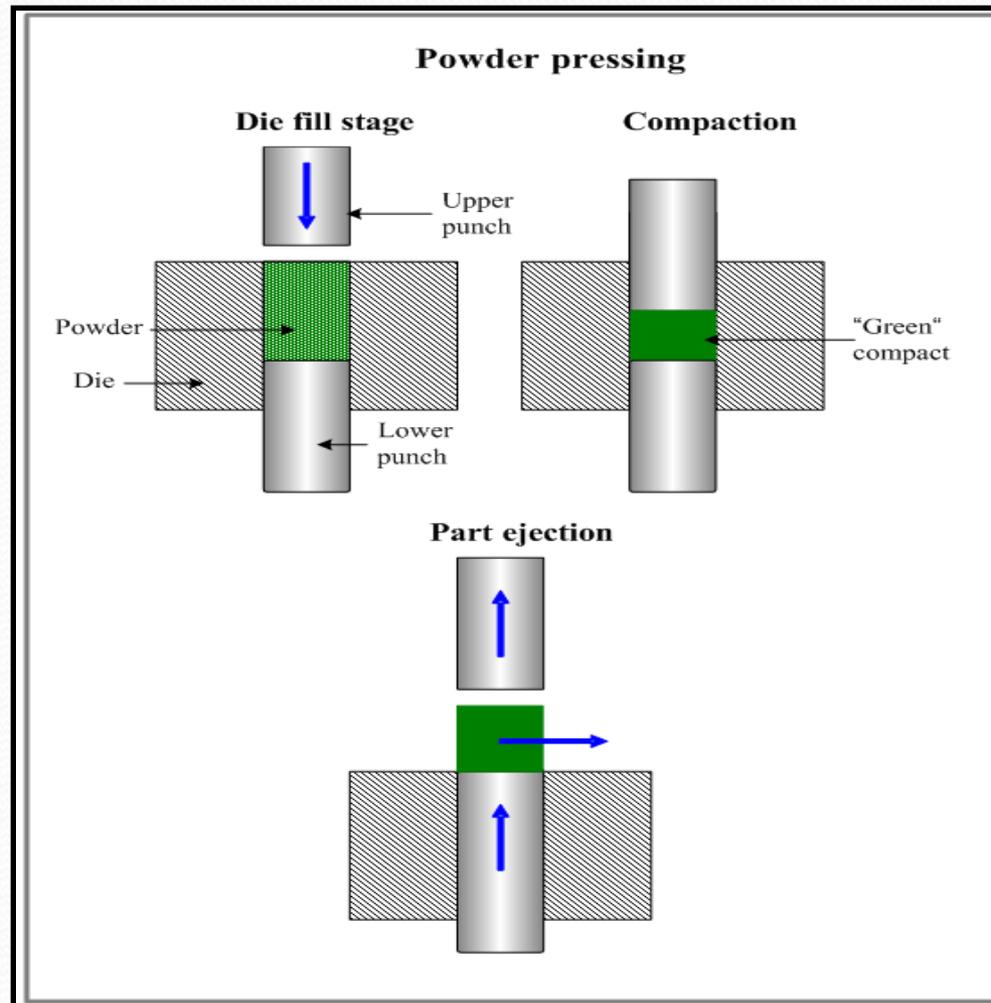


bottom punch



# Tablet manufacturing

Tablets are prepared by forcing particles (drug and excipients) into a closed compartment (die cavity) followed by (powder or granules) compression (by punches), to allow the particles to cohere into a porous solid mass (tablet).



# Tablet machines

Hopper



Machines built to compress tablets consist of:

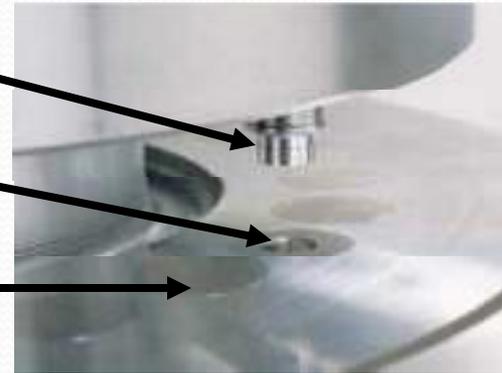
- 1- Hopper: for holding granulations for compressing.
- 2- Feed frame: for distributing the materials into the dies.
- 3- Dies: for controlling the size and the shape of the tablet.
- 4- Punches: for compressing the granulations within the dies.
- 5- Cam tracks for guiding the movement of the punches.

# Tablet machines cont.

Upper punch

Die cavity

Die

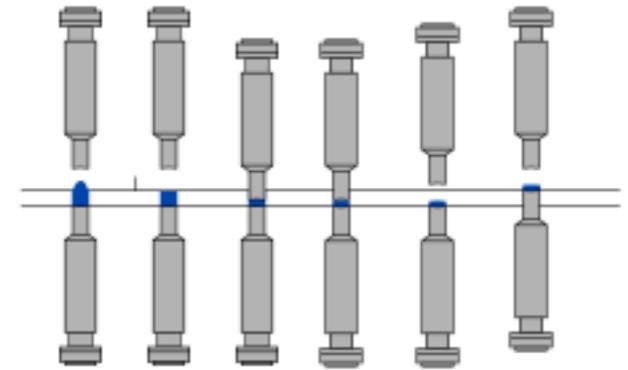


Dies: for controlling the size and the shape of the tablet

# Stages in tablet formation

## "Compaction cycle"

- 1- Die filling.
- 2- Tablet formation.
- 3- Tablet ejection.



## 1- Die filling:

Flow of powders (or granules) of the drug and excipients from a hopper into the die. N.B. the die is closed at its lower end by the lower punch.

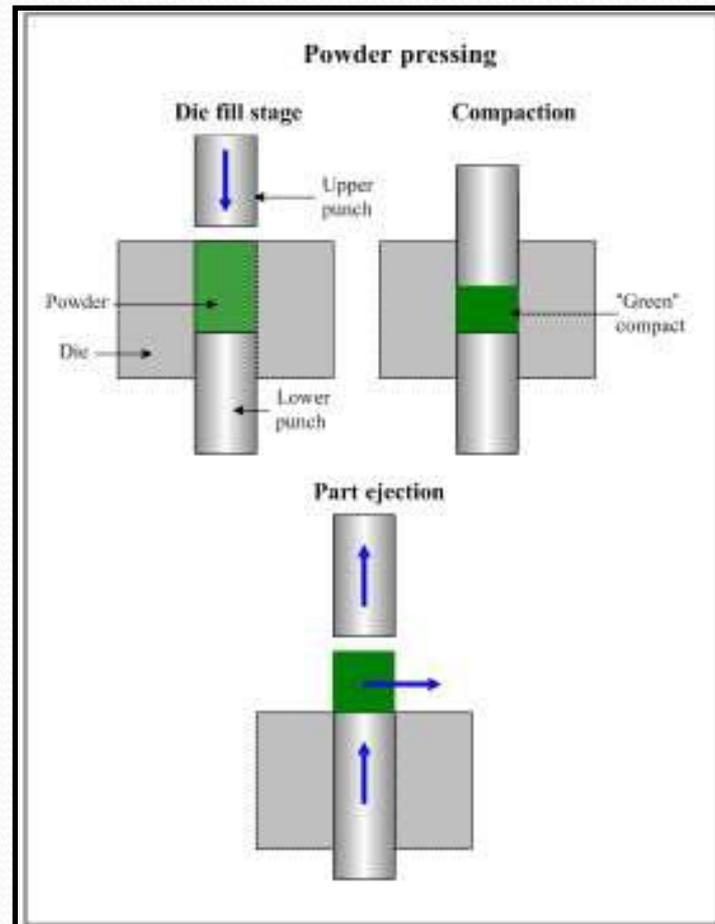
## 2- Tablet formation:

The upper punch descends powder and enters the die and the powder is compressed until a tablet is formed. N.B. lower punch may be stationary or moving upward in the die. After maximum applied force is reached, the upper punch leaves the die by moving upward.

## 3- Tablet ejection:

The lower punch rises up until its tip reaches the die top. The tablet is subsequently removed by a pushing device.

# Stages of tablet formation



## Types of Tablet press

They differ in their rate of production:

- 1- Single-punch press: It is composed of one die and one pair of punches (up to 100 tab/ min).
- 2- Rotary tablet press: It contains  $\geq 60$  dies (10,000 tablets/min). It is used for large scale production.
- 3- Hydraulic press: For research work (computerized).

## Single punch machine:

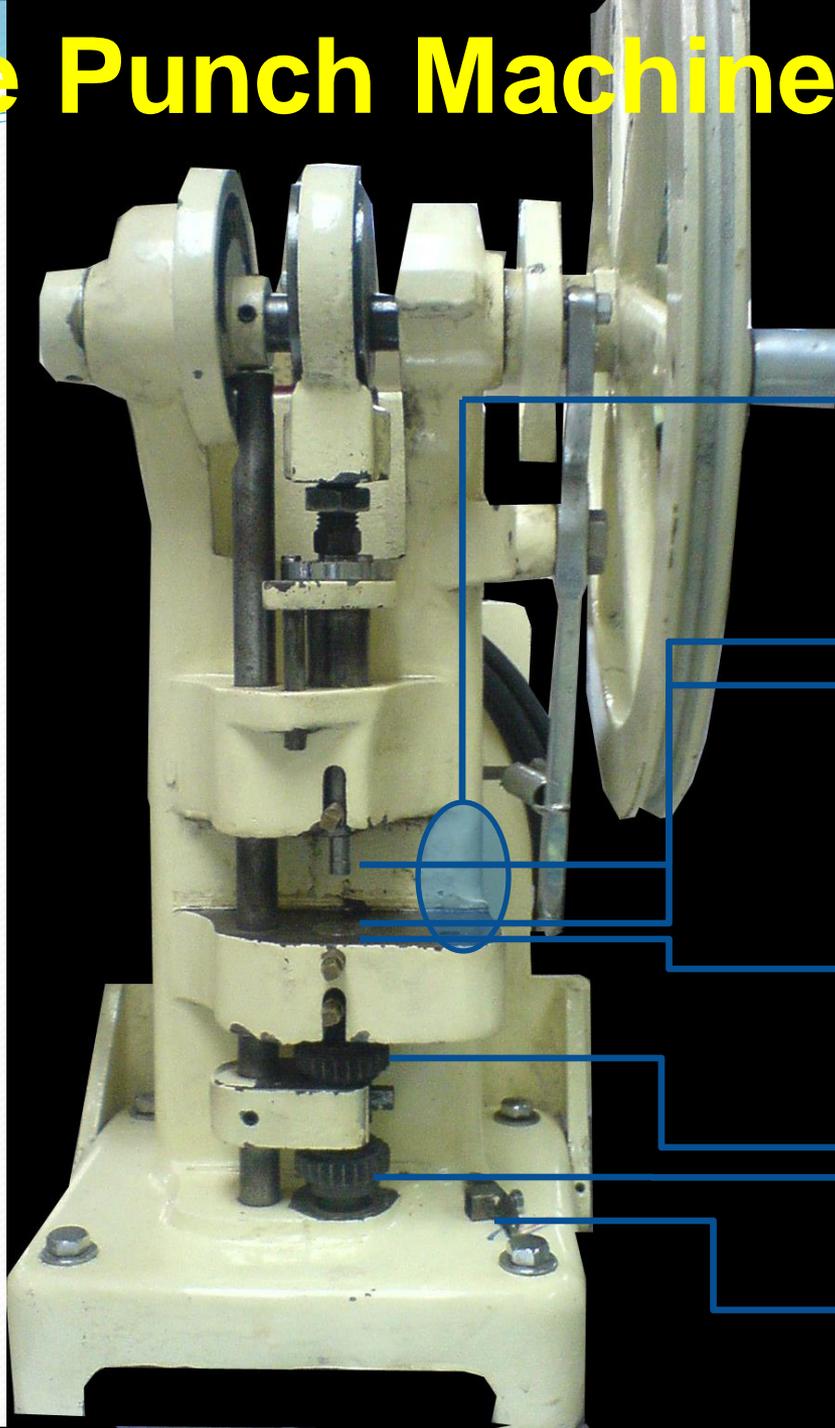
- ◆ The compression is applied by the upper punch
- ◆ Stamping press



Single punch machine

The weight of the tablet is determined by the volume of the die cavity, the lower punch is adjustable to increase or decrease the volume of granulation, thus increasing or decreasing the weight of tablet.

# Single Punch Machine (Tablets)



Upper and  
Lower Collar

Collar locker

# Tablet Ingredients (excipients)

- Active
  - Drug Substance
- Non-Active
  - Diluents
  - Binders
  - Lubricants
  - Disintegrants
  - Coloring
  - Flavoring
  - Antiadherents
  - Glidants