# MIXING

Lab 7

# DEFINITION

Mixing

**A process that results in a randomization of dissimilar particles within a system.**

# Solid Mixing and their mechanisms

# The variables effecting solid mixing:

**NOTE:**

- ❑ **Free flowing powders tend to segregate during or after mixing.**
- ❑ **Highly cohesive powders are difficult to mix owing to agglomeration.**

**1- Particle size and particle size distribution**

**2- Particle density, elasticity, surface roughness and shape.**

# MIXING MECHANISMS

**Solid mixing proceeds by the combination of one or more mechanism:**

1. **Convective mixing**
2. **Shear mixing**
3. **Diffusive mixing**

# 1. CONVECTIVE MIXING

## (NON- SEGREGATING)

**Mechanism analogous to bulk transport**

**Convective (bulk) mixing occurred by:**
**Inversion of powder bed**

**By the aid of:**
**A- Blades or paddles**
**B- Revolving screw**
**C- Any method of moving large mass of material from one part of powder bed to another.**


# 2. SHEAR MIXING
## (segregating)

**As a result of forces within mass**

↓

**slip planes**

**Depending on the flow characteristic of powder, that can occur in such a way to give rise to [laminar flow]**

**When shear occurs between regions of different composition and parallel to their interface.**

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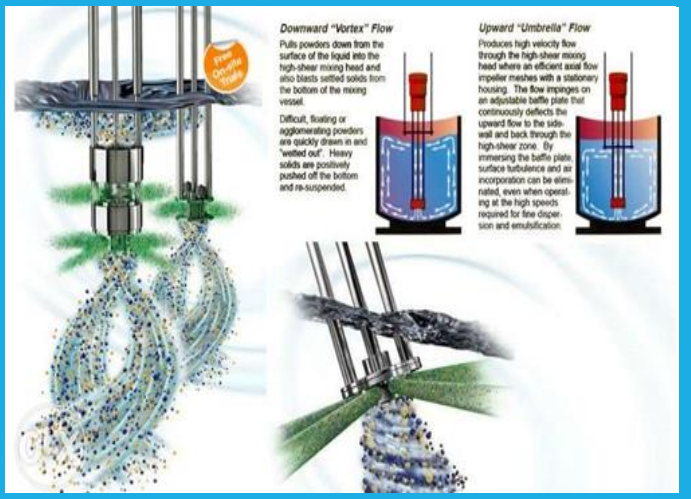
**Reduce the scale of segregation by thinning the dissimilar layers**



# 3- Diffusive mixing

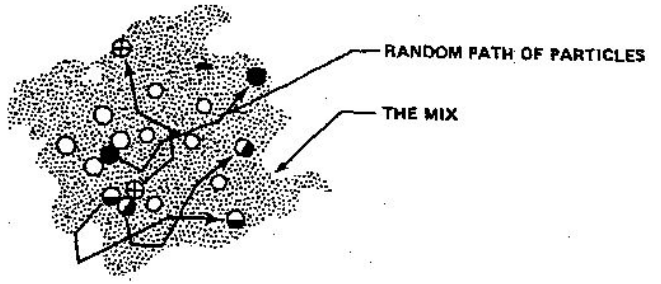
(segregating)

**Random motion of particles within a powder bed**

**Change position by single particles relative to one another**

**Reduction intensity of segregation**

- **It occurs at the interface of dissimilar particles in shear mixing or any form of agitation that cause random motion of individual particles.**



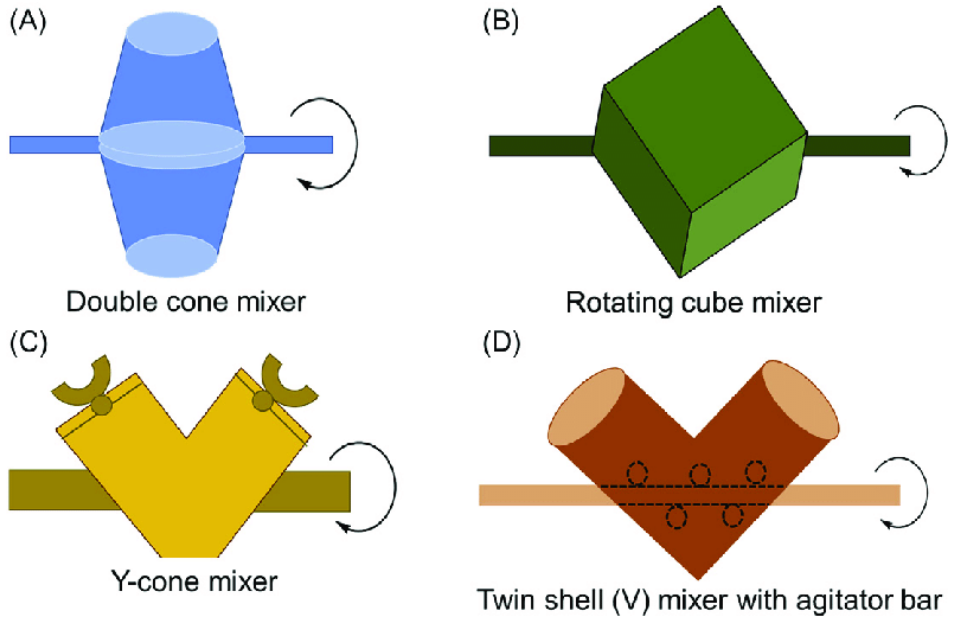

# EQUIPMENTS FOR SOLID MIXING

## Batch Mixing

### 1- tumbling mixers

**Mixers consist of containers of one or several geometric forms (mounted and rotated about an axis).**

**Tumbling motion by baffles or by virtue of shape of container**




# TWIN-SHELL BLENDER (FORM V-SHAPE MIXERS)

**Effective because it's mechanism of mixing is:**

**Bulk transport and shearing.**

- **Efficiency is dependent on speed of rotation.**
- **Optimum rotation (30 - 100 rpm).**
- **Used for dry solid mixing.**

# 2- STATIONARY CONTAINER TYPE:

Employs stationary container to hold the material and bring mixing by moving screws, paddles or blades.

**Useful in mixing solids that have been wetted and therefore are in sticky or plastic state.**

# WELL KNOWN STATIONARY MIXERS INCLUDE:

## A. Ribbon blender

- Consist of horizontal cylindrical tank usually opening at the top and fitted with helical blades.
- Blades mounted on the shaft through the long axis of tank and have both right and left hand twist.

## B. Helical flight mixers

**Powders are lifted by a centrally located vertical screw and allowed to cascade to the bottom of the tank.**

# MIXER SELECTION

Mixer selection and evaluation depend on:

1- **Measuring degree of mixing**

[according to the uniformity of powder bed that indicates the function of mixer ].

2- **Power requirements**

[power required to produce good mixture with appropriate time].

**NOTE:-** Unmixing and segregation might result from:

1- Improper mixing operation or wrong mixer or both,

2- After prolong mixing the milling occur because of abrasion of particles.

3- Powder properties that affecting solid mixing process.

# FOR MORE INFORMATIONS, FOLLOW THE UNDERLYING LINKS

- https://www.youtube.com/watch?v=WRhCYNolq-4
- https://www.youtube.com/watch?v=jRkRLPnAWh0
- https://www.youtube.com/watch?v=Aja9xbzcuG0
- https://www.youtube.com/watch?v=DFUheo3bilc

Thank You
Everyone