powder mixing - industrial pharmacy I lab manual

Saturday, 21 October 2023 8:53 AM

powder mixing -...

EXPERIMENT (2)
MIXING OF POWDERS

INTRODUCTION:

Aim of Mixing:

The main aim of powder mixing in pharmaceutical practice is to achieve dose uniformity within the solid dosage form (tablets, capsules & powders), particularly so important in case of very potent drugs like Digoxin.

→ additive, active ingredient مثل ما بتعرفوا كل دواء فيه

• powder mixing لازم أعمل dose uniform → homogenous Mixture حتى احصل ع

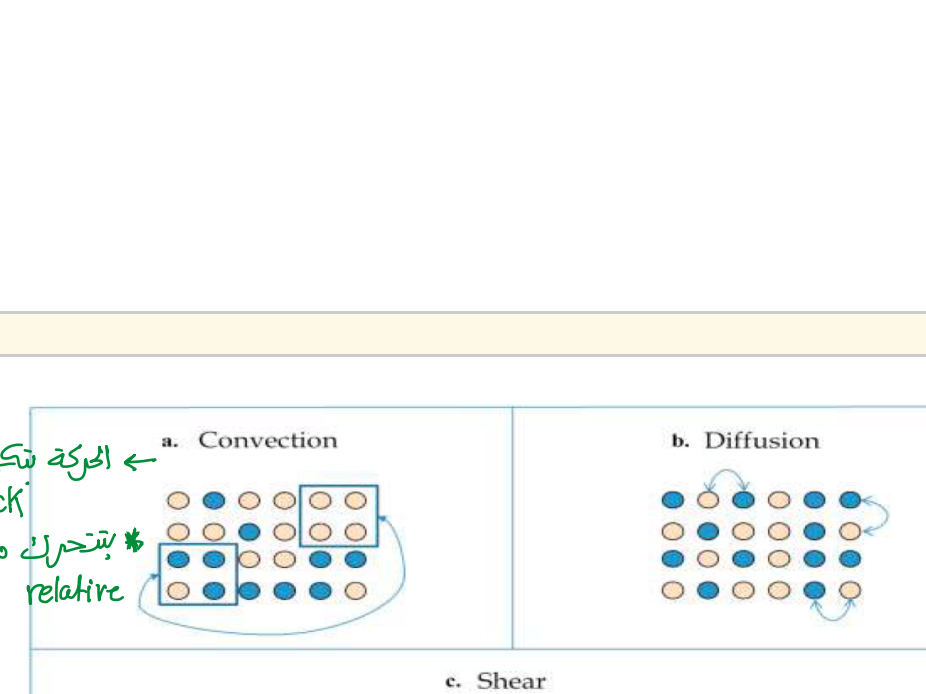
– وهاي العملية كثير مهمة الأدوية الـ very potent انه اختلاف بسيط بتركيز الدواء بأدي الى تغير كبير بالـ theraputic effect مثل Digoxin.

Factors affecting mixing of solids:

- Parameter related to the particles: like particle size, particle shape, size distribution, particle density, Cohesive forces and Hygroscopic properties.
- Mixer type and properties: Movement type of mixer, Presence of Blades The addition of baffles or rotating bars will also cause convective mixing, for example the V-mixer with agitator bar.
- Speed of mixing (Agitation Speed): Too high a rotation speed will cause the material to be held on the mixer walls by centrifugal force, and too low a speed will generate insufficient bed expansion and little shear mixing.
- Filling Volume
- Segregation tendency of individual components (based on density difference).

Mechanisms of Mixing:

1. Diffusion: It is redistribution of particles by random movement of particles relative to each other.
2. Convection: Movement of a group of adjacent particles from one place to another within the mixture.
3. Shear: It is the change in configuration of ingredients through the formation of slip planes in the mixture (Layer of powder flows over another layer) or (Sliding of particles in planes over each other).



Tumbling Mixer ← الأجهزة المستخدمة للـ Mixing

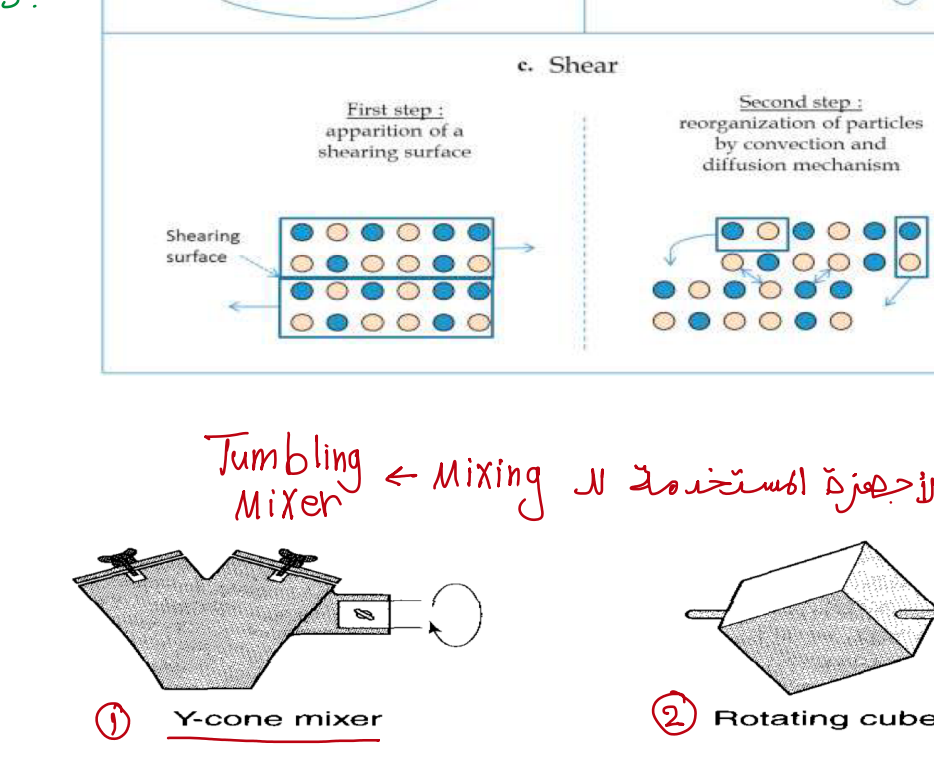


Fig. 13.6 Different designs of tumbling mixers.

Tumbling mixers are rotating vessels of variable shapes. The container is designed in a way to avoid symmetry (symmetry gives poor mixing) ?!

In this Experiment Cube mixer or V-mixer will be used:-

- **Cube mixer**:
  - motor drive mixer
  - The housing in the Cube Mixer is manufactured from glass.
  - Equipped with Baffles but not Blades
  - Tumbling movement, in which ingredients are tilted by the rising side of the drum until they exceed their normal angle of repose, hence they will fall over their selves.
  - Cube mixer provides the three mechanisms of mixing, but in different ratios … shear is the predominant.
  - Cube mixer is problematic due to the presence of corners, why?
- **V- mixer**:
  - motor drive mixer
  - The housing in the V- Mixer is manufactured from stainless steal
  - The function is based on a special 3D blending effect in the pant-leg region, which is generated through a combination of: dividing, cascading and an intermeshing mixing mechanism.
  - During blending, materials tumble periodically towards the apex and the legs, while they move along the horizontal rotation at the same time.

OBJECTIVE:

1. To study the efficiency of "Revolvo-Cube Mixer or V- Mixer" in preparation of 5% wlw mixture of Sodium Salicylate in Lactose (Particle Size < 1mm), when operated at 25 rpm.
2. To study the Effect of time on the homogeneity of 5% wlw mixture of Sodium Salicylate in Lactose (Particle Size < 1mm) prepared using Revolvo-Cube Mixer V- Mixer operated at 25 rpm.
3. To estimate the "Optimal Mixing Time" for 5% wlw mixture of Sodium Salicylate inLactose (Particle Size < 1mm) prepared using Revolvo-Cube Mixer or V- Mixer operated at25 rpm.

→ Fixed rotational speed ح نشتغل ع ⇒ 25 rpm.

EXPERIMENTAL PART :

a. **Materials:**
   Lactose, Sodium Salicylate,
b. **Apparatus:**
   Cube Mixer or V- mixer, UV/VIS Spectrophotometer.
c. **Method:** by dry cleaning.
   NB: all equipment and tools should be cleaned prior to use.

1. Prepare 500gm of 5% w/w Na-Salicylate in Lactose (25 gm Na-Salicylate(500gm*5 % w/w) with 475 gm Lactose (500gm -25gm)).
   N.B.: Pass all powders before weighing using 1mm pore size sieve, why?
2. Place the powders in the mixing chamber of the Revolvo-Cube Mixer (place powder of the largest quantity (lactose) first then Na-Salicylate)
3. Start mixing (operating speed = 25 rpm), commence mixing and timing simultaneously.
4. Take 5 samples (200 mg = 0.200 gm each) at 5, 10, 20 & 30 minutes, (such that 5 samples at each time).
   a. Samples should be taken randomly from 5 different places of the powder mixture → Random Spot Samples.
   b. The weights of samples should be close to each others (±10% → 0.200±0.02 gm) otherwise results will be affected, why? Explain. 180 – 210 mg
5. Determine the content of Na-Salicylate in each sample at each time (all samples will be analyzed at each time interval. Follow the analytical technique described below:
   a. Put each sample in 100 mL Volumetric Flask.
   b. Add 10 – 15 mL of distilled water and mix until all powders are completelydissolved.
   c. Complete the volume by D.Water up to the 100 mL mark then mix well.
   d. Measure the samples absorbance using UV/VIS spectrophotometer:

254 nm ← λmax لازم أعرف

* لحتى احسب كم لازم اوزن من 5% Sodium Salicylate.
500 g * 5/100 = 25 g.
اللي ضل هو وزن الـ lactose 500 – 25 = 475 g.

– أول اشي بضيف الـ largest quantity. بعدين الأقل.
– to avoid losing of ingredient of smallest quantity to getting intrapt in the corner.

- Blank should be 0.20% w/v Lactose in D.Water (200 mg Lactose in 100 mL V.Flask, dissolve lactose in 10 - 20 mL of D.Water, then complete up to the100 mL mark using D.Water.

λmax for absorbance measurement is 254 nm

NOTE: Absorbance linear range is (0.200 - 1.200) solutions of absorbance out of this range should be diluted.

NOTE: Sampling is an integral part of mixing because at anytime, spot samples generate the data necessary to evaluate the quality of the mixture. The data for statistics are generated by assaying the active ingredient(s) in a number of random samples taken from the blend at a specified time.

The mean assay value of a group of random samples taken from the mixture is a measure of the central tendency of the batch population (active ingredient content).

In addition to the mean, the spread or dispersion of individual samples about the mean can be calculated by using the Standard Deviation or the Variance.

Standard Deviation can be calculated by using the following equation:

$$S = \sqrt{\sum_1^n \frac{(Y_i - \bar{Y})^2}{n-1}}$$

Variance:

$$V = \sum_1^n \frac{(Y_i - \bar{Y})^2}{n-1} = S^2$$

Coefficient of Variation (C.V.) (Relative Standard Deviation, RSD):

$$C.V. = \frac{Standard\ Deviation}{mean} * 100\%$$

indication بعطيني SD / V / C.V قديش samples قراءاتهم قريبة من بعض.

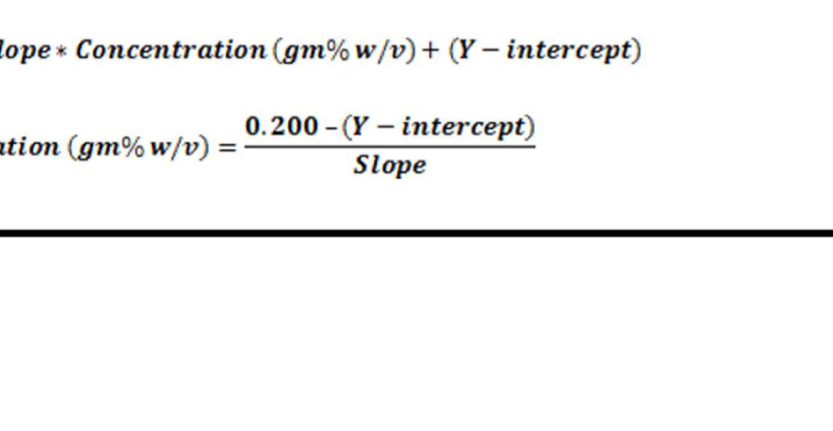
Results and Data Analysis

Results - Mixing Sample

Mixing Time minutes	Sample Absorbance 1	2	3	4	5
5					
10					
20					
30					

Data Analysis

A) Calibration Curve Equation:



Y = 0.0193X + 0.0017

Example:

Absorbance read of the first sample at 5 minutes is equal to 0.200, calculate this solution concentration.

- Using the calibration curve equation:
  $Y = Slope * X + (Y - intercept)$
  Which means:
  $Absorbance = Slope * Concentration\,(gm\%\,w/v) + (Y - intercept)$
- Substitute:
  $0.200 = Slope * Concentration\,(gm\%\,w/v) + (Y - intercept)$
- Now:
  $Concentration\,(gm\%\,w/v) = \frac{0.200 - (Y - intercept)}{Slope}$

Dilution factor = Final Volume / Initial volume

Abs → concen. mg% w/v. by Callibration Equation.

mg% w/v → X mg of Na Salisylate in 100 ml.
mg% w/w → X mg of Na Salisylate in 100 mg in total powder

C mg% w/v / amount (200 mg) * 100%

C mg% w/v / amount (250 mg) * 100%

500 mg → 200 ml, ? → 100 ml, 500/2 = 250 mg.

2) Mixing Samples Analysis

1. Use calibration curve equation to calculate the concentration of each sample in mg% w/v
2. Calculate the concentration of each sample in mg% w/w.
   e.g. Sample no. 1 concentration mg% w/w = $\frac{mg\%\,w/v}{200\,mg}$ * 100% ⟸ 200 mg is the sample weight
3. Calculate: mean, Standard Deviation (S), Variance (V) (V= S^2), and Coefficient of Variation (C.V.) (Relative Standard Deviation, RSD) of the samples concentrations in mg% w/w at each sampling time.

$$C.V. = \frac{Standard\ Deviation}{mean} * 100\%$$

⟸ Always use Excel tables and equations

Mixing Time minutes	Sample Number	Absorbance	Concentration mg% w/v	Concentration mg% w/w	Mean	Standard Deviation	Variance	Coefficient of Variation, %
5	1	A1			=Average	=STD	S^2	S/mean
	2	A2						
	3	A3						
	4	A4						
	5	A5						

4. Construct the Mixing Profile by plotting Coefficient of Variation vs Mixing Time in minutes.

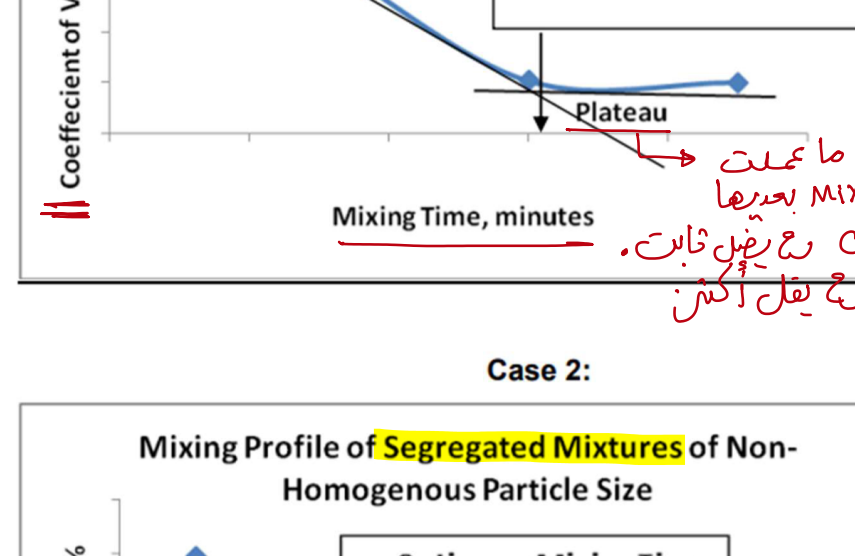
Mixing Time minutes	Coefficient of Variation CV
5	CV_5
10	CV_{15}
20	CV_{30}
30	CV_{45}

Use Excel sheets, tables, and equations to perform all required data analysis

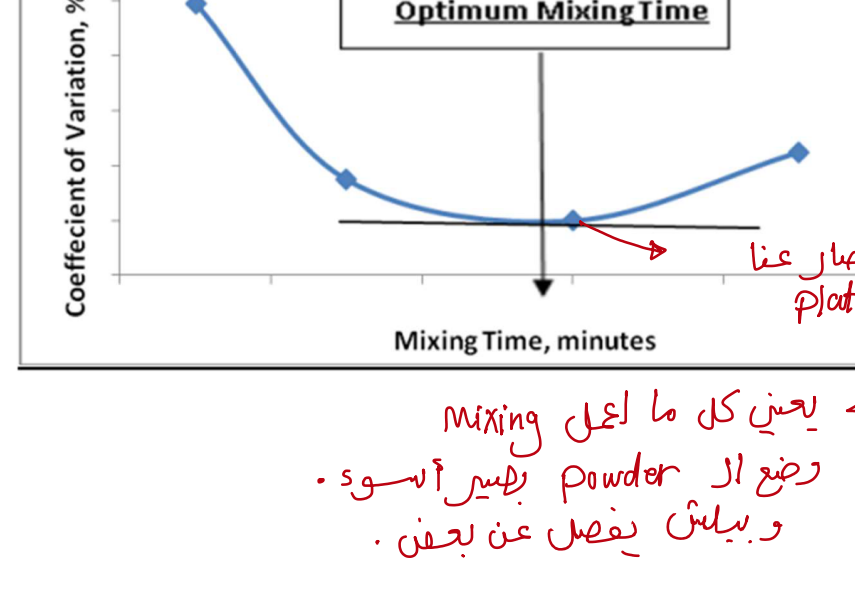
Examples on Mixing Profiles:

① من هاد الـ profile بقدر اعرف اذا الـ powder هو segregated أو لا
② وكمان أحدد الـ optimum Mixing time.

Case 1:



Case 2:



Done by :- Yasmine Robin..... بالتوفيق

Artery Academy

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