SEGREGATION

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SEGREGATION

- DEMIXING / POWDER SEGREGATION
- REQUIREMENTS FOR SEGREGATION
- PARTICLE PROPERTIES THAT PRONE TO SEGREGATION
- APPROACHES TO RECTIFY SEGREGATION
- ORDERED MIXING
- SEGREGATION IN ORDERED MIXING

POWDER SEGREGATION (DEMIXING)

- Particulate solids tend to segregate by virtue of difference in size,density.shape…

- Occurs during mixing as well as handling of completed mix, more in free flow Powders

- More severe with free flowing, cohesionless / nearly cohesionless particles

- Segregation attributed to various types of mixers,
  - Principally convective motion , non-segregating
  - shear / diffusive mixing,segregating

- Opposite to mixing
- Imp in pharma pdt's –random to non random,or none
- Care to taken during handling (later mixing of powders) transfer to filling machines / hopper in tab,capsule..
- Cause in increase in content variation in samples of mix,fail
- If this occurs in filling machine.,variation in weight
- Mainly due to monosized
- To some extent in powder bed ..vibration, or when great flowability

REQUIREMENTS FOR SEGREGATION

- Necessary and sufficent conditions…….
  - various mixture components exhibit mobilities for Interparticulate relative displacement,which differ.
  - mixture faces a field which exerts a directional motive force on particles.or a gradient capable of inducing / modifying interparticulate movement

- Requirements for segregation can arise in many ways….
  - differences in mixture component mobilities ….. different sizes,densities and surface characteristics
  - earth's gravitational force,centrifugal,electrical magnetic field generated during processing

PARTICLE PROPERTIES THAT PRONE TO SEGREGATION

- Chances of segregation by……..
  - particle size effects
  - particle density effects
  - particle shape effects

PARTICLE SIZE EFFECTS

Percolation segregation….

- occur in static powders……greater when powder bed dilates / disturbed
- Domestically in cereal packets,coffee jars..smaller congregate to bottom
- Powder bed disturbed…..
  (vibration,stirring or pouring)

TRAJECTORY SEGREGATION

during mixing larger particles will have high K.E..,
Seperation of particles of different sizes

TRAJECTORY SEGREGATION + PERCOLATION SEGREGATION

occurence of larger particles at the edge of heap
when poured from container.

ELUTRIATION SEGREGATION / DUSTING OUT

small particles as dust due to air currents,after
discharge get sedimented over coarser particles

PARTICLE DENSITY EFFECTS

- morer denser ..move downwards,even of similar size
- trajectory segregation also occur with diff densities
- If denser particles are smaller, density has an effect on Percolation segregation
- Size and density effects cancel eachopther..when larger Particles are more dense.

PARTICLE SHAPE EFFECTS

- Spherical particles….more flow…easy mix..more seggregate
- Irregular/needle shaped particles…interlocked,reduce the tendency to seggregate
- Non spherical particles have surface area to wt ratio(specific surface area),decrease seggregation by cohesive forces(greater contact area),also increase dusting out

APPROACHES TO RECTIFY SEGGREGATION

- Selection of particle size fractions(sieving to remove fines)
- to achieve drugs and excipients of same narrow particle size range
- Milling of components, followed by sieving…at 30um , no Serious seggregation
- Controlled crystallization of drug/ Excipient for same range
- Selection of excipients similar to active components
- Granulation of powdered mix…evenly distributed reduce the extent of vibration
- Limit the powder residence time
- Use euipment where no transfer of mass (FBD , high speed mixer,granulator for mixing and Granulating)
- Production of an ordered mix

ORDERED MIXING

- Micronised particles ,adsorbed onto active sites of larger carrier particles….
  this has an effect of minimising segregation while
- maintaining good flow properties…….ORDERED MIXING

- Mainly used in production of dry antibiotics….where water added

- Pharmaceutical mixes..partly ordered.partly random

- Degree of mixing superior to random mix

- Mainly in direct compressible formulations in prevention of

- Seggregation from directly compressible bases

SEGREGATION IN ORDERED MIXES

Carrier particle vary in sizes---

diff size particles..diff surface area to wt ratio,contain different Amounts of adsorbed material per unit area

drug areas where smaller carrier particles congregate…

……**ORDERED UNIT SEGREGATION**

Competition for active sited on carrier molecules

displacement of adsorbrd material,which may congregate Owing to small size…

……**DISPLACEMENT SEGREGATION**

Insufficient carrier molecules

excess material can't be absorbed and gets seperated

…….. **SATURATION SEGREGATION**