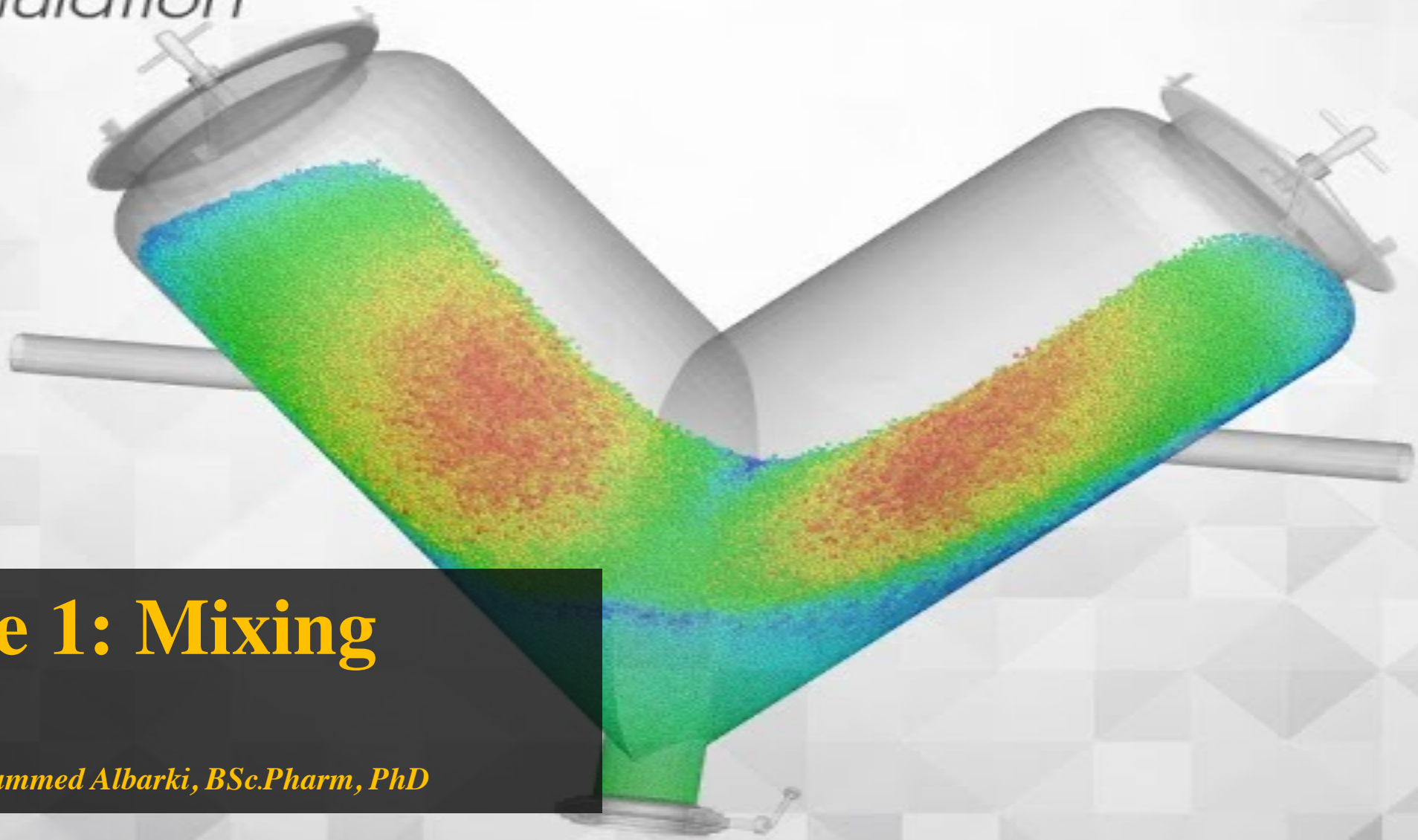
ThreeParticle™ Simulation



Module 1: Mixing

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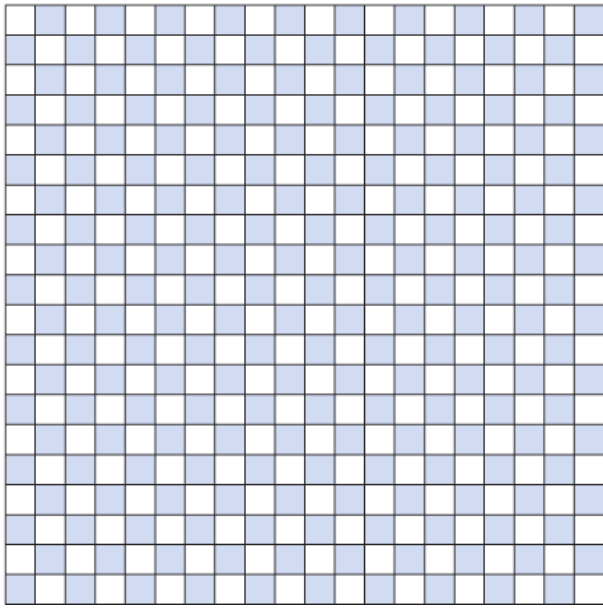
Mixing

- This is a crucial step in the formulation of the pharmaceutical dosage form.
- The majority of pharmaceutical products contain more than one component so they do need a mixing or blending stage.
- Mixing can be **defined** as a process in which two or more ingredients in separate or roughly mixed conditions are treated so that each particle of any one ingredient is as nearly as possible adjacent to a particle of each other ingredient.
- Good mixing is needed in all pharmaceutical products but it is of special importance in some conditions such as drugs with narrow therapeutic indexes.
- **In this lecture**:
- Mixing or blending **opposite** to demixing or segregation



Mixing

- Mixing tends to result in a **randomization** of dissimilar particles within a system. This is to be **distinguished** from an **ordered system** in which the particles are arranged according to some iterative rule and thus follow a repetitive pattern.

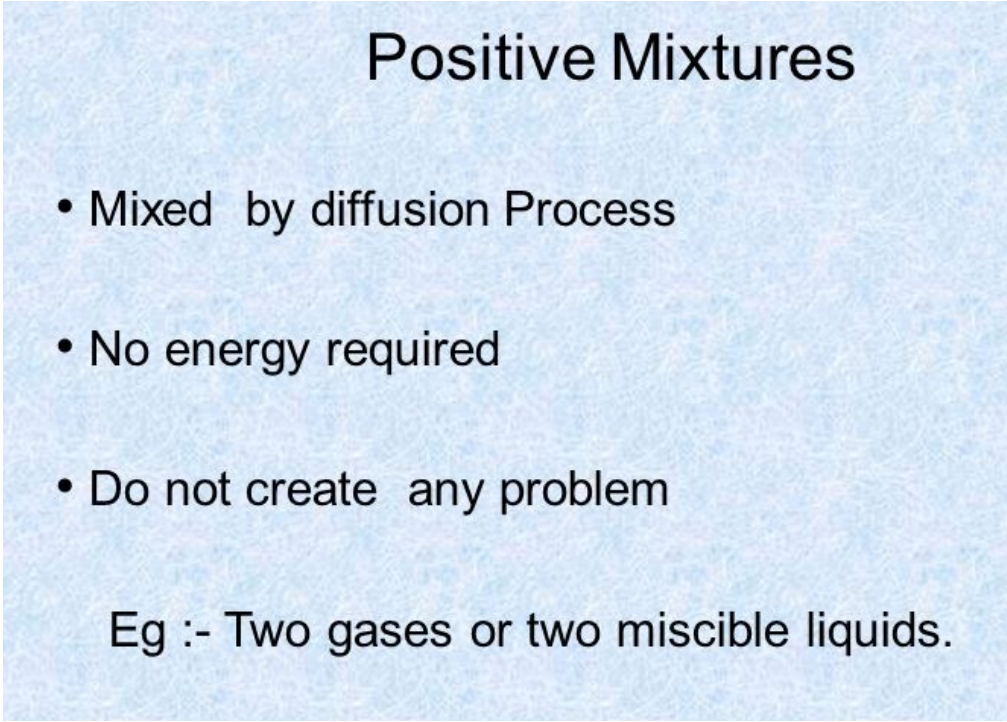
Mixing is a fundamental step in most process sequences and is normally **carried out to:**

1. **Control heat** and mass transfer.
2. Ensure the **even appearance** of the final dosage form. This is to improve single-phase and multiphase systems.
3. Secure the **uniformity of the composition** so that small samples withdrawn from a bulk material represent the overall composition of the mixture. (even distribution of components)
4. **Promote** physical and chemical reactions, such as dissolution, in which natural diffusion is supplemented by agitation.

Types of mixture

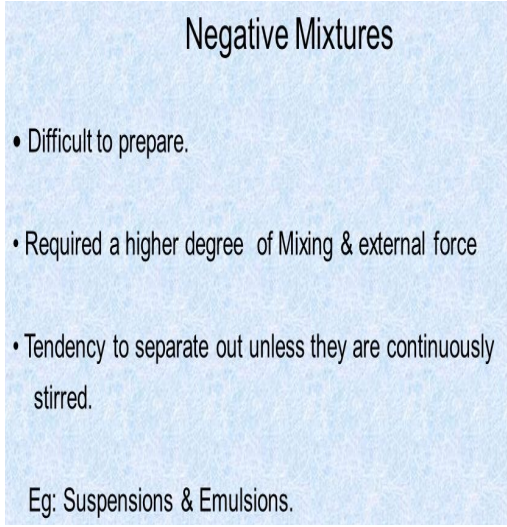
- **Mixture are three types:** positive, negative, and neutral mixture.

- **Positive mixtures**:
- Such as **gases and miscible liquids.**
- Where spontaneous, irreversible, and complete mixing would take place by **diffusion**, **without** the expenditure of energy to keep the mixing state.
  - This type of material will cause **no** problems during manufacturing.



Types of mixture

- **Negative mixtures**:
- They are demonstrated by biphasic systems (**suspension, emulsion**).
  - Negative mixtures are generally **more difficult to form and maintain** and require a higher degree of mixing as compared to positive mixtures.
  - Any two-phase systems such as suspensions of solids in liquids, emulsions, and creams tend to separate quickly unless energy is **continually expended** on them.
- **Neutral mixtures**: type of mixtures that are static in behavior, that will **not** mix spontaneously but when mixed will **not** segregate spontaneously such as powders, paste, and **ointments**.
- Occurs when neither **mixing nor de-mixing** takes place unless the system is acted upon by an **external energy input**.



Dosage Form Classification

- Dosage forms can be classified based on their physical form into four types:

1. Gaseous
2. Liquids
3. Semisolids
4. Solids