

DID YOU KNOW?

Some technical facts about powder
handling and bulk density



What is Bulk Density & its importance in powder handling

- Bulk density is the mass of powder per unit volume, including void spaces
- Affects storage, transportation, blending, and processing efficiency
- Bulk density is different from particle density because particle density don't increase by compaction
- Measured in two forms:
 - A) Loose (as poured)
 - B) Tapped (after settling)
- The difference, quantified as the Hausner ratio, determines a powder's compressibility and flowability. Powders with a Hausner ratio >1.25 indicate poor flow, requiring flow aids



Challenges in Powder Handling

1. Segregation:

- Occurs when particles separate due to differences in size, shape, or density
- Can lead to inconsistent product quality

2. Caking:

- Powders agglomerate due to moisture, temperature changes, or pressure
- Affects flowability and process efficiency

3. Dust Generation:

- Fine particles create dust, posing health and safety risks
- Requires appropriate dust control measures



Bulk Density and Equipment Design



- Bulk density directly influences the design of conveyors, silos & hoppers and Sieves & classifiers
- Critical flow parameters to consider for smooth flow under gravity or vibration:
 - A) Angle of repose
 - B) Compressibility index
 - C) Cohesive strength

WHY?

- To predict flow rates and shear stress in bulk solids
- Helps engineers design hoppers and silos with optimal outlet sizes and flow patterns

Correlation With Bulk Modulus



Bulk density is a foundational parameter in calculating the **bulk modulus of particulate materials**

WHY?

- A) To measure compressibility under isotropic stress
- B) To design resilient packing materials
- C) To understanding deformation properties in granular systems

Dynamic Bulk Density in Vibrational Environments



Engineers use **dynamic testing methods** to predict **powder behavior** under vibrational loads

WHY?

- During vibrational processing environments (transportation or sieving), bulk density changes dynamically
- To prevent density-driven segregation or agglomeration



Tips for Effective Powder Handling

- Understand Powder Characteristics
- Prevent Segregation
- Minimize Caking
- Control Dust
- Regular Maintenance
- Efficient powder handling and understanding bulk density are essential for process optimization and product quality
- **Challenges can be addressed by** selecting appropriate equipment and implementing preventive measures

OUR EXPERTISE

- PMG Engineering specializes in delivering end-to-end engineering solutions across diverse industries, with a focus on food processing, pharmaceuticals, and manufacturing.
- Our expertise includes factory design, project management, and process optimization, ensuring efficient and sustainable operations.
- We have successfully executed various projects in powder based factories by combining innovative solutions, delivering efficiency, safety, and superior product quality.

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