



SNS COLLEGE OF TECHNOLOGY

AN AUTONOMOUS INSTITUTION

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UGC

DEPARTMENT OF FOOD TECHNOLOGY

**COURSE CODE & NAME: 23AGT207 & ENGINEERING PROPERTIES
OF AGRICULTURE PRODUCE**

II YEAR / IV SEMESTER

UNIT : III THERMAL PROPERTIES

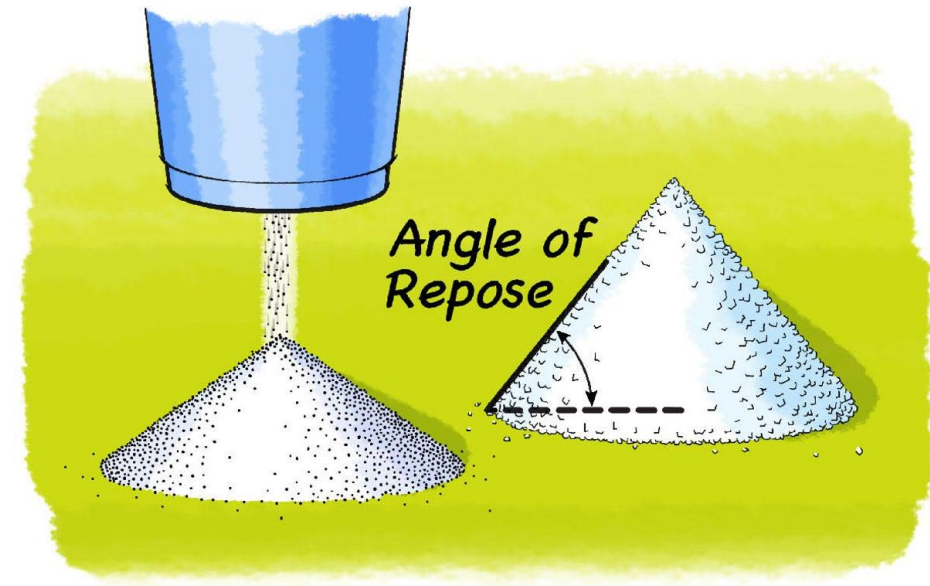
TOPIC 4 : Angle of repose and flow of bulk granular materials



Angle of Repose

The angle of repose is the angle between the horizontal and the sloping side of a pile of granular material formed when it is poured or dropped onto a surface.

it's a measure of the **material's flowability**.





Angle of Repose –Measurement

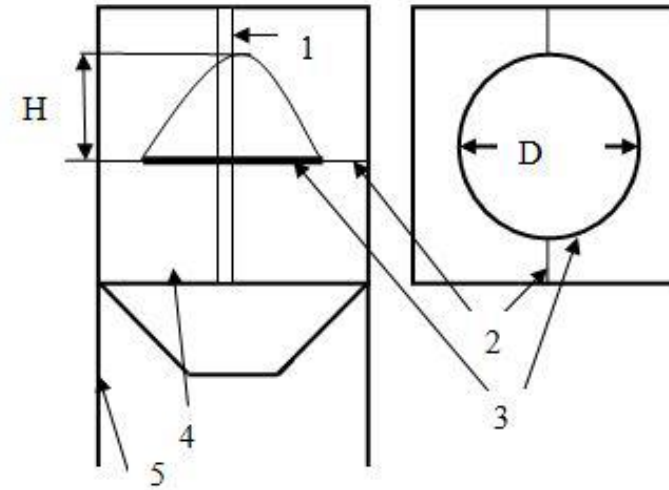
The angle of repose is measured with a square box, which is filled to the top and then removing lid, by allowing the granular material to fall freely, resulting in a conical shape of the sample

By measuring the base and height of the cone, angle of repose is calculated as per the following equation:

$$\theta = \tan^{-1} \left(\frac{h}{r} \right)$$

where:

- h= height of the pile,
- r = horizontal radius (or base length/2 for a symmetric pile).



1. Scale
2. Base holder
3. Circular base
4. Transparent face
5. Stand



Static angle of friction: Angle of friction takes up by granular solid to about slide upon itself. Angle repose depends on **Size, shape, Moisture content** and orientation of the particles.

Dynamic angle of repose: It arises when bulk of the material is in motion.



Flow of Bulk Granular Material

It is a complex phenomenon that involves the movement of individual particles, often in a non-uniform and chaotic manner

In general, the flow of bulk granular materials can be categorized into different regimes, including:

- A-type flow (easy flowing): characterizes the smooth, laminar flow of materials
- C-type flow (difficult flowing): describes the irregular, chaotic flow of materials
- B-type flow (transition): represents the intermediate flow regime,

•Granular Materials:

- These are materials composed of discrete particles, like sand, powders, or grains.

Flowability:

This refers to a material's ability to flow freely and consistently



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Factors Influencing Flow:

- **Particle Properties:** Shape, size, surface texture, and density all play a role in how granular materials flow.
- **Container Geometry:** The shape and size of the container, as well as the presence of obstacles or openings, can significantly impact flow.
- **External Forces:** Gravity, vibration, and shear stress can induce or alter granular flow.

Flow Regimes:

Granular flows can exhibit different behaviors, including:

- **Dense Flow:** Where particles are in close contact and the material behaves more like a solid.
- **Dilute Flow:** Where particles are more spread out and the material behaves more like a gas.
- **Liquid-like Flow:** Where the granular material can flow like a liquid under certain conditions



- **Internal Force Transmission:**

Granular materials transmit forces through inter-particle contacts, which can lead to phenomena like arches and segregation.

- **Segregation:**

The separation of different types of particles within a mixture during flow, like the "Brazil nut effect".

- **Flow Rate:** The amount of material that flows through a given area in a certain time, which is influenced by the factors mentioned above.



Activity

Write an assignment on AI /ML aided flow of a granular materials in food industries



THANK YOU...