



Unit I - Topic 2

Size, volume, density, porosity Production and processing scenario of fruits and vegetable: India and World.

Size and shape are important physical attributes of foods that are used in screening, grading, and quality control of foods. They are also important in fluid flow and heat and mass transfer calculations. Sieve analysis can be used to determine the average particle diameter and specific surface area of granular material. Volume, which affects consumer acceptance, can be calculated from the measured dimensions or by using various methods such as liquid, gas, or solid displacement methods and image processing. Volume measurement methods can also be used for measuring the density of solids. Volume/density can be expressed in different forms such as solid, apparent, and bulk volume/density depending on pores. Porosity is a physical property characterizing the texture and the quality of dry and intermediate moisture foods. Total porosity of particulate materials includes the voids within and among the particles. Porosity can be determined from the difference between bulk volume of a piece of porous material and its volume after destruction of all voids by compression, optical methods, density methods, or by using a pycnometer or porosimeter. Internal pores may be in three different forms: closed pores that are closed on all sides, blind pores in which one end is closed, and flow-through pores that are open at both ends so that flow can take place.



SIZE

Size is an important physical attribute of foods used in screening solids to separate foreign materials, grading of fruits and vegetables, and evaluating the quality of food materials. In fluid flow, and heat and mass transfer calculations, it is necessary to know the size of the sample. Size of the particulate foods is also critical. For example, particle size of powdered milk must be large enough to prevent agglomeration, but small enough to allow rapid dissolution during reconstitution. Particle size was found to be inversely proportional to dispersion of powder and water holding capacity of whey protein powders. Decrease in particle size also increased the steady shear and complex viscosity of the reconstituted powder. The powder exhibited greater intrinsic viscosity as the particle size increased. The size of semolina particles was found to influence mainly sorption kinetics.

The importance of particle size measurement has been widely recognized, especially in the beverage industry, as the distribution and concentration ratio of particulates present in beverages greatly affect their flavor.

It is easy to specify size for regular particles, but for irregular particles the term size must be arbitrarily specified.

Particle sizes are expressed in different units depending on the size range involved. Coarse particles are measured in millimeters, fine particles in terms of screen size, and very fine particles in micrometers or nanometers. Ultrafine particles are sometimes described in terms of their surface area per unit mass, usually in square meters per gram.

Size can be determined using the projected area method. In this method, three characteristic dimensions are defined:

1. Major diameter, which is the longest dimension of the maximum projected area;



2. Intermediate diameter, which is the minimum diameter of the maximum projected area or the maximum diameter of the minimum projected area; and
3. Minor diameter, which is the shortest dimension of the minimum projected area.

Length, width, and thickness terms are commonly used that correspond to major, intermediate, and minor diameters, respectively.

The dimensions can be measured using a micrometer or caliper. The micrometer is a simple instrument used to measure distances between surfaces. Most micrometers have a frame, anvil, spindle, sleeve, thimble, and ratchet stop. They are used to measure the outside diameters, inside diameters, the distance between parallel surfaces, and the depth of holes. Particle size of particulate foods can be determined by sieve analysis, passage through an electrically charged orifice, and settling rate methods. Particle size distribution analyzers, which determine both the size of particles and their state of distribution, are used for production control of powders.

Volume:

- Volume is the amount of space that a substance or object occupies.
- It is often measured in cubic units (e.g., cubic meters, cubic centimeters, liters).
- The volume of regular shapes can be calculated using specific formulas, while irregular shapes may require more complex methods such as displacement.

Density:

- Density is the mass of an object or substance per unit volume.
- It is expressed as mass/volume and is typically measured in units such as kilograms per cubic meter (kg/m^3) or grams per cubic centimeter (g/cm^3).
- Denser materials have more mass packed into a given volume.

Porosity:

- Porosity is a measure of the open spaces or voids within a material.



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- It indicates the percentage of the total volume that consists of open spaces, often referred to as pores.
- Porosity is crucial in various fields, such as geology and material science, as it influences factors like fluid flow through rocks or the insulation properties of materials.

Production Scenario:

1. **Global Production Centers:** Major global producers of fruits and vegetables include China, the United States, Brazil, and Spain. Each country has its specialization based on climate and agricultural practices.
2. **Seasonal Variation:** Unlike India, many countries face seasonal constraints, leading to a focus on certain crops during specific times of the year.
3. **Commercial Farming:** Large-scale commercial farming is more prevalent in many developed countries, utilizing advanced technologies and practices for increased productivity.

Processing Scenario:

1. **Advanced Processing Technologies:** Developed countries often employ advanced processing technologies, including sophisticated cold storage, canning, and freezing facilities.
2. **Value-Added Products:** There is a trend towards producing value-added products, such as pre-cut fruits and vegetables, packaged salads, and ready-to-eat meals.
3. **Strict Quality Standards:** Global markets demand adherence to strict quality standards, driving the use of advanced processing and packaging techniques.

Challenges and Opportunities:

Challenges:

1. **Post-Harvest Losses:** Both India and the world face challenges related to post-harvest



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losses due to inadequate storage and transportation facilities.

2. Infrastructure: Developing and maintaining proper infrastructure for storage, transportation, and processing is crucial.
3. Market Access: Ensuring access to global markets requires compliance with international standards and certifications.

Opportunities:

1. Technology Adoption: Both India and other countries can benefit from adopting modern agricultural and processing technologies.
2. Value Addition: There is an opportunity for both Indian and global producers to focus on value-added products to meet changing consumer preferences.
3. Export Potential: Enhancing export capabilities can be a significant opportunity for both India and other countries, given the global demand for fruits and vegetables.



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