SYSTEM

A **system** is any region prescribed in space or a finite quantity of matter enclosed by a **boundary**, real or imaginary. The boundary of a system can be real, such as the walls of a tank, or it can be an imaginary surface that encloses the system.

The composition of a system is described by the components present inside the system boundary. Once we choose the boundaries of a system, then everything outside the boundary becomes the **surroundings**.

A system can be either **open** or **closed**. In a **closed system**, the boundary of the system is impervious to flow of mass. In other words, a closed system does not exchange mass with its surroundings. A closed system may exchange heat and work with its surroundings, which may result in a change in energy, volume, or other properties of the system, but its mass remains constant.

In an **open system** (also called a control volume), both heat and mass can flow into or out of a system boundary (also called control surface).

When a system does not exchange mass, heat, or work with its surroundings, it is called an **isolated** system. An isolated system has no effect on its surroundings. For example, if we carry out a chemical reaction in an insulated vessel such that no exchange of heat takes place with the surroundings, and if its volume remains constant, then we may consider that process to be occurring in an isolated system.

If either in a closed or an open system, no exchange of heat takes place with the surroundings, it is called an **adiabatic** system. Although we are unlikely to achieve perfect insulation, we may be able to approach near adiabatic conditions in certain situations. When a process occurs at a constant temperature, often with an exchange of heat with the surroundings, then we have an **isothermal** system.

PROPERTIES OF SYSTEM

a) DENSITY

Density is defined as mass per unit volume, with dimensions (mass)/(length)^3. The SI unit for density is **kg/m^3**. Density is an indication of how matter is composed in a body. Materials with more compact molecular arrangements have higher densities

Density of a given substance may be divided by density of water at the same temperature to obtain **specific gravity**.

There are three types of densities for foods: **solid density, particle density, and bulk density.** The values of these different types of densities depend on how the pore spaces present in a food material are considered.

Particle density accounts for the presence of internal pores in the food particles.

Bulk density accounts for the void space between the particles. The void space in food materials can be described by determining the **porosity**, which is expressed as the volume not occupied by the solid material.

Thus,

$$\text{Porosity} = 1 - \frac{\text{Bulk density}}{\text{Solid density}}$$

The interparticle porosity may be defined as follows

$$\text{Interparticle porosity} = 1 - \frac{\text{Bulk density}}{\text{Particle density}}$$