FREQUENTLY ASKED QUESTIONS

1) **Define hysteresis?**

Ans) As moisture adsorbs to the product surface, the product structure may be modified by work done on the surface. This results in an effect called hysteresis, in which desorption isotherms differ from adsorption.

2) **What are the various factors affecting the drying rate of food material?**

Ans) Factors affecting the drying rate will vary slightly depending upon the type of drying system used. However, in general, the following factors must be considered:

1. Nature of the material: physical and chemical composition, moisture content, etc.;

2. Size, shape, and arrangement of the pieces to be dried;

3. wet-bulb depression (t – twb), or relative humidity, or partial pressure of water vapor in the air (all are related and indicate the amount of moisture already in the air);

4. Air temperature; and

5. Air velocity (drying rate is approximately proportional to $u^{0.8}$).

3) **Define moisture content and water activity of the food material?**

Ans) Water content, or moisture content, is a measurement of the total water contained in a food. It is usually expressed as a percentage of the total weight:

$$M_{w\ (wet\ basis)} = \frac{W-d}{\text{----------}} \times 100$$

W

Where: Mw is moisture content on wet basis

W is wet weight

D is dry weight

Water activity is a measurement of the availability of water for biological reactions. It determines the ability of micro-organisms to grow. If water activity decreases, micro-organisms with the ability to grow will also decrease. Water activity (a_w) is expressed as the ratio of the vapour pressure in a food (P) to the vapour pressure of pure water (P_0). It predicts whether water is likely to move from the food product into the cells of micro-organisms that may be present.

$a_w = P/P_0$

4) **What are the various factors affecting the water activity of the food material?**

Ans) **Drying:** Water activity is decreased by physically removing water (Ex: beef jerky).

Solutes: Water activity is decreased by adding solutes such as salt or sugar (Ex: jams, cured meats).

Freezing: Water activity is decreased by freezing (Ex: water is removed in the form of ice).

Combination: One or more of the above can be combined for a greater influence on water activity (Ex: salting and drying fish).

5) **Define moisture sorption isotherm?**

Ans) The relationship between water content and water activity (a_w) is complex. An increase in a_w is usually accompanied by an increase in water content, but in a non-linear fashion. This relationship between water activity and moisture content at a given temperature is called the moisture sorption isotherm. These curves are determined experimentally and constitute the fingerprint of a food system.

6) **What is the relationship between moisture content on dry weight basis and moisture content?**

Ans) If M_w, the wet basis moisture content in percent is known, the dry basis moisture content can be calculated using

$$M_d = \left(\frac{M_w}{100 - M_w}\right) \times 100$$

If $M_{d,}$ the dry basis moisture content in percent is known, the wet basis moisture content can be calculated using

$$M_w = \left(\frac{M_d}{100 + M_d}\right) \times 100$$

7) **What is the difference between freeze-dried and dehydrated foods?**

Ans) Dehydration is a process that includes heating the food and using a fan to

maintain airflow to remove the moisture from the food. On the other hand, the Freeze-drying process places frozen foods in a vacuum chamber, and uses low atmospheric pressure to remove the moisture from the food in a vapor state. Because the freeze-drying process does not require hot temperatures, the nutrient level and flavor are of higher qualities than dehydrated products. Freeze-dried foods maintain their structure and texture. The removal of moisture gives it a longer shelf life.

8) **What is the difference between diffusion and radiation heat transfer?**

Ans) Diffusion heat transfer is due to random molecular motion. Neighboring molecules move randomly and transfer energy between one another - however there is no bulk motion. Radiation heat transfer, on the other hand, is the transport of heat energy by electromagnetic waves. All bodies emit thermal radiation. In particular, notice that unlike diffusion, radiation heat transfer does not require a medium and is thus the only mode of heat transfer in space. The time scale for radiative heat transfer is much smaller than diffusive heat transfer.

9) **How does water evaporate?**

Ans) Energies in liquid have a Gaussian distribution. Only high energy molecules have sufficient energy (in excess of the intermolecular bond energy) to escape. As they leave the average remaining energy per molecule is reduced, and hence the product cools. This is called evaporative cooling.

10) **Discuss theories of falling rate period.**

Ans) There are several possible diffusion mechanisms:

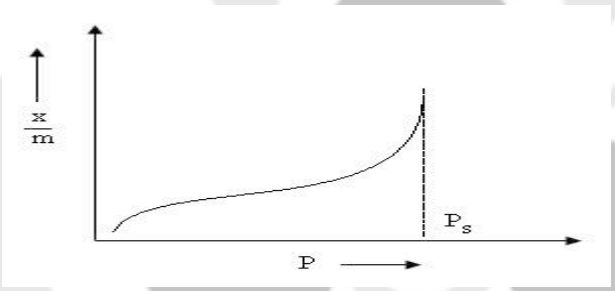
• Liquid diffusion. Moisture moves through the product in proportion to the liquid water gradient at any point. This model gives poor prediction of moisture profiles.

• Vapor diffusion. This assumes that the product is porous, so that vapor can diffuse through the material. This model predicts moisture profiles well.

• Capillary movement. Liquid water moves by capillary action through pores. This is a good model when the water activity is 1, and the model works well in combination with the liquid diffusion model.

11) **Explain Type II adsorption isotherm?**

Ans)



Type II Adsorption Isotherm shows large deviation from Langmuir model of adsorption.

The intermediate flat region in the isotherm corresponds to monolayer formation.

In BET equation, value of C has to be very large in comparison to 1

12) **What is meant by heat transfer process?**

Ans) Heat transfer, also referred to simply as heat, is the movement of thermal energy from one thing to another thing of different temperature. These objects could be two solids, a solid and a liquid or gas, or even within a liquid or gas.

13) **What do you mean by absolute humidity?**

Ans) The absolute humidity, sometimes called the humidity ratio, is the mass of water vapour per unit mass of dry air and the units are therefore kg kg^{-1}.

14) **What is convective heat transfer?**

Ans) Convective heat transfer is one of the major types of heat transfer, and convection is also a major mode of mass transfer in fluids. Convective heat and mass transfer take place both by diffusion, the random Brownian motion of individual particles in the fluid and by advection, in which matter or heat is transported by the larger-scale motion of currents in the fluid. In the context of heat and mass transfer, the term “convection” is used to refer to the sum of advective and diffusive transfer.

15) **What are the disadvantages of food dehydration?**

Ans) The disadvantages of food dehydration include the time and labor involved in rehydrating the food before eating. Moreover, rehydrated food typically absorbs only about two-thirds of its original water content, making the texture tough and chewy