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FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES

Principles of Food Science and Nutrition- AHD-321

Lecture 1

Concepts inFood Science

DEFINITIONS

FOOD: Food is the material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy; also: such material together with supplementary substances (as minerals, vitamins, and condiments)

NUTRITION: Nutrition is an art and also a science. Nutrition is defined as "the science of foods, the nutrients and other substances, they are in action, interaction and balancing in relation to health and disease.

HEALTH: Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. – World Health Organization

NURSING: Nursing is the unique function of the nurse is to assist he individual, sick or well, in the performance of those activities contributing to health or its recovery that he would perform unaided if he had the necessary strength, will, or knowledge, and to do this in such a way as to strength, will or knowledge, and to do this is such a way as to help him ga in independence as rapidly as possible.

Food is defined as anything solid or liquid which when swallowed, digested and assimilated, nourishes the body.

Food science: Food is a mixture of many different chemical components. The study of food science involves an understanding of the changes that occur in these components during food preparation whether natural or included by handling procedures. Many physical and chemical reactions occur during food preparation. These reactions may be result of the interaction between components, with the medium of cooking, study of food science also includes understanding the nutritive value of different foods and methods of preserving them during cooking. This information provides a foundation of theory and method on which to build the study of food preparation.

Food additive: is defined as non-nutritive substances added intentionally to food, generally in small quantities to improve its appearance, flavour, texture or storage properties.

Fermented food: is produced by the action of bacteria or moulds which act on carbohydrates and proteins present in foods and hydrolyse them to simpler products yielding pre-digested foods.

Food technology: is the application of principles of food science and engineering to the processing and perspective large quantities of food.

Food fortification: is defined as the process whereby nutrients are added to foods in relatively small quantities to maintain or improve the quality of the diet of a group, a community or a population (WHO).

Non-nutrients of foods: are organic compounds having no nutritional function. They may be toxins or beneficial substances like fibre or compounds that may improve palatability or pharmacological importance.

Functional food: provides health benefits beyond the nutrient contribution.

Phytochemicals: are non-nutrient compounds found in plant derived food that have biological activity in the body.

Food safety and regulation: is related to food sanitation in public health and rules and regulation governing it.

Antioxidants: include compounds that protect biological systems against the potentially harmful effects of processes or reaction that can cause excessive oxidations (USDA).

DIFFERENT MEASUREMENTS IN FOOD SCIENCE

DENSITY

- A material's density is defined as its mass per unit volume.
- Si unit of density is kilogram per cubic meter
- $\rho = m/v$
- Represented by the Greek letter "ρ".
- Hydrometer is an instrument used for determining the density of a liquid.

PHASE CHANGE:

• Phase change refers to a change in matter from one state to another.
• the most familiar phase changes are seen in the different states of water, such as freezing liquid water to create ice or boiling liquid water to create a gas.
• The heat plays major role in changing matter from one phase to another

pH:

- pH is defined as the negative logarithimic of H^+ ion concentration.
- ph scale ranges from 0 to 14 in the scale.
- ph has direct role in prolonging shelf life of products.
- The ph meter measures acid and base concentration.
- Yeast-4-4.5ph, moulds- 4ph, bacteria-7ph.

The pH above 4.5 required processing at a temperature of 118-121°c to keep it fit for consumption and avoids microbial activity.

Classification of foods on the basis of ph:

a. HIGHLY ACIDIC FOODS: ph is 3.7 and below. This includes pickles, citrus juices, rhubarb, prune, chutney etc.

b. ACID FOODS: pH OF 4.5 TO 3.7. These include include tomatoes, pears, pineapple, banana, mango etc.

c) Medium acid foods: ph of 5 to 4.5.this class includes meat and vegetable mixtures,soups,sauces,fish carrot, okra, cabbage etc.

D) Low acid foods: ph of 5 and higher. This includes peas, maize, cauliflower, potato, spinach, beans etc.

OSMOSIS AND REVERSE OSMOSIS

Osmosis Example: when plant roots absorb water from the soil

If two solutions of different concentrations are separated by a semi-permeable membrane which is permeable to the smaller solvent molecules but not to the larger solute molecules, then the solvent will tend to diffuse across the membrane from the less concentrated to the more concentrated solution. This process is called osmosis.

REVERSE OSMOSIS:

Reverse osmosis is the process of osmosis in reverse.In reverse osmosis there is a need to 'push' the liquid through the reverse osmosis membrane by applying pressure that is greater than the naturally occurring osmotic pressure whereas osmosis occurs naturally without energy required. • example: when pressure is applied to the concentrated solution, the water molecules are forced through the semi-permeable membrane and the contaminants are not allowed through.

SURFACE TENSION

It is defined as the dragging force in the given liquid per unit length. Surface tension is expressed in Newton per meter specific gravity:

t=f/l

f=force per unit length, t=surface tension, l=length over which the force acts.

SPECIFIC GRAVITY

It is the ratio of density of a substance to the density of reference material which means it is expressed as multiples of density of other standard materials usually water for solid materials and air fir gases.

=density of gas/density of air (for gas)

SPECIFIC GRAVITY =density of material/density of water (for solids).

It is expressed as the dimensionless quantity and is also called as relative density.

An object with a specific gravity less than 1 will float in water; while a specific gravity greater than 1 means it will sink. Air has density of 1.29kg/m3 at 0°c and the value is 0.94kg/m3 at 100°c. Density of water at 0°c is 1000kg/m3 and at 50°c it is 987kg/m3. It is this which allows, for example, a balloon filled with hot air to float in relation to the rest of the air.

COLLOIDAL SYSTEMS

When the diameter of the particles of a substance dispersed ina solvent ranges from about 10A°to 2000A°.the system is termed a colloidal solution, colloidal dispersion or simply a colloid.

The colloidal systems or colloidal dispersions are intermediate between true solutions and suspensions.

In a true solution as sugar or salt in water the solute particles are dispersed in the solvent as single molecules or ion. Thus the diameter of the dispersed particles ranges from 1A°to 10A°. In other words, the diameter of the dispersed particles in a colloidal dispersion is more than that of solute particles in a true solution and smaller than of suspension.

On the other hand in a suspension as sand stirred into water, the dispersed particles are aggregates of millions of molecule. The diameter of these particles is of the order of 2000 or more. Hydrophilic colloids make water unavailable.

A system with at least one dimension of the dispersed particles in the range 10A°-2000A°,is classed as a colloidal dispersion.

Example for a colloidal solution: fat globules in milk

Fat- dispersed phase, milk-dispersion medium

FOAM, SOLS, EMULSIFICATION:

FOAM: A colloidal system with a liquid or solid continuous phase and a gaseous dispersed phase.

SOLS: Sols are colloidal systems in which a solid is dispersed in a liquid. These are sub divided into two classes.

A) Lyophilic sols (solvent loving): these are those in which the dispersed phase exhibits a definite affinity of the medium or solvent. EXAMPLES: dispersions of starch gum and protein in water

B) Lyophobic sols (solvent hating): these are those in which the dispersed phase has no attraction for the medium or the solvent EXAMPLE: sulphur in water

EMULSIFICATION: creation of an emulsion by the dispersion of one immiscible liquid in the form of small droplets in a second immiscible liquid. There are two types of food emulsions: oil-in-water and water-in- oil.