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Physical Characteristics of Foods



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Properties of Foods

- Components are in the form of solids, liquid(in solution), or in the form of emulsions
 - milk, fruit juices – liquids
 - Liquid portion of canned foods – solutions
 - Eggs – ingredients in solution

Undergo physical and chemical changes when exposed to various conditions



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Solutions

- Homogeneous mixture of two or more different substances
 - Molecules of the dissolved substances (solutes)
 - Medium in which they are dissolved (solvent)
- Solubility is the amount of solute that are uniformly distributed throughout the solution
- The degree of dissolving of a solute in the solution depends on the attractive forces between the solute and the solvent molecules



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Hydrogen Ion Concentration

- pH is defined as hydrogen ion concentration
 - pH scale measures the degree of acidity of a substance
 - Scale ranges from 0 to 14 with 7 being neutral
 - $\text{pH} < 7$ is acidic and $\text{pH} > 7$ is basic
- Used to express the degree of acidity or alkalinity of food
 - Strong acid is one that is 100% ionized in solution
 - Weak acid doesn't ionize fully when dissolved
 - Strong base dissociates completely (NaOH, KOH)
 - Weak base (NH_4OH)



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pH and pK scales

- Water is neutral and amount of H^+ is equal to OH^- ions in water (ionisation of water)
- pH and pK scales measure acid strength
- pKa is defined as the logarithm to the base 10 of the reciprocal of Ka
- pH of a solution is defined as the negative logarithm to the base 10 of the hydrogen ion concentration
- $pKa = -\log Ka$
- **Henderson – Hassel Bach equation**
 - $pH = pKa + \log [A^-]/[HA]$



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Buffer Solutions

- Buffer solution is an aqueous solution consisting of a mixture of a weak acid and its conjugate base or a weak base and its conjugate acid
- Keep pH at a constant value
 - Acidic buffer – $\text{pH} < 7$ (weak acid and its salt)
 - Alkaline buffer – $\text{pH} > 7$ (weak base and its salt)
- Bound water is not free to act as a solvent for salts and sugars, with density greater than that of free water with no vapor pressure



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Osmosis – Importance

- Osmosis defined – water drawn into a solution through semi permeable membrane
- Osmosis causes a change in relative volume of two liquids separated by semi-permeable membrane resulting in osmotic pressure
- Osmotic pressure is the pressure required to prevent the increase in volume
- Role in food processing and preservation – mango pickling



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Osmosis

- Isotonic Solution
- Hypotonic solution
- Hypertonic solution



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Surface Tension

- Boundary between a liquid and a gas/vapour is called surface
- Boundary between liquid-liquid or a solid-liquid junction is called interface
- Molecules at the surface or interface are not surrounded completely by other molecules of same type and same physical state
- Results in net attractive force for each molecule directed towards the interior of the phase in which molecule resides



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Surface Tension

- Inward attraction reduces the number of molecules at the surface/interface resulting in reduction of surface area
- Forces (hydrogen bonding and Van der Waal) causing reduction in surface area is referred to as surface tension
- Factors affecting surface tension – increase in temperature of a liquid phase decreases the surface tension
- Interfacial tension between edible oils and water is critical in the stability of many food emulsions