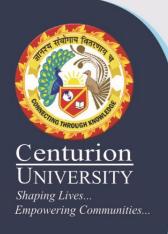
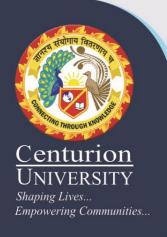


Preservation by Drying, Dehydration



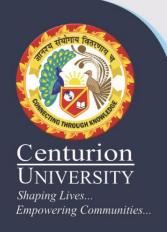
Dehydration

- Foods are dehydrated by removal of water resulting in decreased weight and bulk
- Dehydration reduces the water activity level
- Vegetables are diced before drying to increase surface area
- Blanching is necessary to inactivate enzymes which cause browning



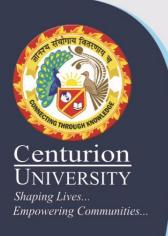
Methods of Dehydration

- Sun drying one of the ancient and traditional methods of drying
- Spray drying a fine spray of liquid is injected into blast of hot air in a chamber
 - suitable for dried milk and coffee powder
 - Water evaporates leaving the solid part of the product in powder form
- Fluidised bed drying warm air is blown upwards directly underneath the food



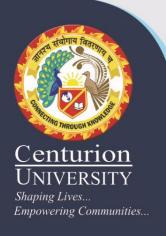
METHODS OF DEHYDRATION

- Tunnel drying hot air (concurrent system) is blown over the vegetables drying the food with little shrinkage leaving a relatively high moisture content while the counter-current system produces a product with low water
- Roller drying the food product (liquid or paste form) is uniformly spread over heated rollers that rotate slowly drying the product
 - Scraper removes the dried product baby foods
- Accelerated freeze drying food is first frozen and the temperature is increased under strong vaccum
 - Frozen water changes into water vapour
 - Little shrinkage with no change in flavour
 - Rehydrates well, but very fragile and crumbles easily



Factors in control of drying

- Improper control of few factors may cause "case hardening" due to rapid evaporation of moisture from surface
- Following factors should be considered:
 - Temperature used
 - Relative humidity of the air (higher at the beginning than later)
 - Velocity of the air
 - Duration of drying
- Quality of dried foods during storage is retained by storing in moisture proof containers with inert gas (nitrogen, CO₂)



Intermediate moisture foods

- IMF (jam, jellies, honey, raisins, dates, dried fruit) are moist enough to be eaten without rehydration and shelf stable without refrigeration or thermal processing
- Moisture content is reduced to low level (20-50%) to prevent spoilage organisms
- Principle involved in preservation is lowering of water activity by addition of glycerol, sucrose, salt and antimycotic agents such as sorbic and benzoic acid
- Process involves infusing solute (high concentration of dissolved solutes) into moist foods by cooking them in a low water activity solution and processed by partial drying



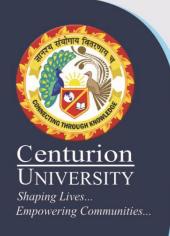
Methods of Concentration

- Solar evaporation evaporating water with solar energy, used for obtaining salt
- Open Kettles food is concentrated in open kettle that is heated by steam – jellies, jams, certain types of soups
 - High temperature and long concentration times damage most foods with thickening and burning of product to the kettle wall
 - Used for caramelized colour and flavour development with high sugar content



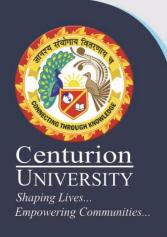
Methods of concentration

- Concentration by Flash Evaporation food material is brought in direct contact with flash evaporators
 - Steam superheated to 150°C is injected into food and then pumped into an evaporation tube where boiling occurs
 - Boiling mixture enters into a separator vessel and the concentrated food is drawn off at the bottom
 - Food lose volatile flavour constituent due to high temperature



Methods of concentration

- Concentration by thin film evaporation food is pumped into a vertical cylinder which has a rotating element that spreads the food into a thin layer on a cylinder wall
- Concentration by vacuum evaporation involves use of low temperature hence used for heat sensitive foods
 - Thin film evaporators are operated under vacuum
 - Several vacuum vessels attached in series are maintained at progressively higher degrees of vacuum and the product becomes highly concentrated



Methods of concentration

- Freeze concentration ice crystals formed during freezing are removed by centrifugal force resulting in a concentrated unfrozen food which passes through fine mesh screen
- Ultrafiltration and Reverse Osmosis pressure driven membrane separation
 - Large solute particles are selectively removed in ultrafiltration
 - Small solute particles are removed in reverse osmosis