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Preservation by Drying, Dehydration



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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**



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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



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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 vacuum**
 - **Frozen water changes into water vapour**
 - **Little shrinkage with no change in flavour**
 - **Rehydrates well, but very fragile and crumbles easily**



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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)**



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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



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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



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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



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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**



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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