UNIT I – TOPIC 5

CONCENTRATION OF FOODS

Concentration of Foods

1. Concentration process increases the solids content and reduces the weight and volume of a food.
2. Latent heat is transferred from the heating medium (steam) to the food to raise the temperature of its boiling point during evaporation. The vapour pressure rises and bubbles of vapour in the liquid are formed due to latent heat of vaporization supplied by the steam.
3. The vapour is then removed from the surface of the boiling liquid.
4. The more common concentrated foods include evaporated and sweetened condensed milks, fruits and vegetable juices and nectars, sugar syrups and flavoured syrups, jams and jellies, tomato paste etc.

Methods of Concentration

Solar evaporation

Solar evaporation is the simplest method of evaporating water with solar energy. This process was used in earlier times to obtain salt from sea water and still it is practiced. However, the process is very slow and is suitable only for concentrating salt solutions.

Open kettles

Only some foods can be satisfactorily concentrated in open kettle that is heated by steam e.g. in case of jellies and jams and for certain types of soups. However, high temperatures and long concentration times damage most foods. In addition, thickening and burning of product to the kettle wall gradually lowers the efficiency of heat transfer and slows the concentration process. This method is apt for caramelized colour and typical flavour development in foods high in sugar.

Concentration by flash evaporation

Concentration process is markedly speeded when sub sized food material is brought in direct contact with heating medium. This is done in flash evaporators. Clean steam superheated at about 150°C is injected into food and then is pumped into an evaporation tube where boiling occurs. The boiling mixture then enters a separator vessel and the concentrated food is drawn off at the bottom and the steam plus water vapour from the food is evacuated through a separate outlet. Foods lose volatile flavour constituent because of high temperature.

Concentration by thin film evaporation

In thin film evaporators, food is pumped into a vertical cylinder which has a rotating element that spreads the food into a thin layer on a cylinder wall. The cylinder wall of double jacket construction usually is heated by steam. Water is quickly evaporated from the thin food layer and the concentrated food is simultaneously wiped from the cylinder wall. The concentrated food and water vapour are continuously discharged to an external separator from which product is removed at the bottom and water vapour passes to a condenser. Product temperature may reach 85°C or higher but since residence time of the concentrating food in the heated cylinder may be less than a minute, heat damage is minimal.

Concentration by vacuum evaporation

This method is suitable for heat sensitive foods as this method involves low temperature. Evaporation under vacuum can be done by operating thin film evaporators under vacuum by connecting a vacuum pump or steam ejector to the condenser. Several vacuum vessels can be attached in series so that the food product moves from one vacuum chamber to the next and thereby becomes more and more concentrated at each step. The consecutive vessels are maintained at progressively higher degrees of vacuum and hot water vapour arising from first step is used to heat the second vessel and so on. In this way heat energy is efficiently used.

Freeze concentration

Initially formed ice crystals during freezing process are removed with the help of centrifugal force resulting in a concentrated unfrozen food which passes through a fine mesh screen. This process is repeated many times to reach final concentration of food.

Ultrafiltration and reverse osmosis

These are the two methods of concentrating foods employing pressure driven membrane separation process. In ultrafiltration large solute particles are selectively removed whereas in reverse osmosis smaller solutes are separated out.

Intermediate moisture foods (IMF)

Intermediate moisture foods are those in which the moisture content is reduced to a level low enough to prevent spoilage microorganisms from growing but moist enough for the food to have improved palatability characteristics. Intermediate moisture foods or semi-moist foods contain 20-50 per cent. In addition, they contain high concentration of dissolved solutes. These foods do not require refrigeration during storage and can be eaten without rehydration. Honey, jam, jelly, cakes, dates and osmo-dried food products are the examples of intermediate moisture foods.