

Sub Name:FOOD PROCESSING AND PRESERVATION

Sub Code: C-10

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Tray Dryer

In tray dryers, the food is spread out, generally quite thinly, on trays in which the drying takes place. Heating may be by an air current sweeping across the trays, by conduction from heated trays or heated shelves on which the trays lie, or by radiation from heated surfaces. Most tray dryers are heated by air, which also removes the moist vapours.

Tunnel Dryers

These may be regarded as developments of the tray dryer, in which the trays on trolleys move through a tunnel where the heat is applied and the vapours removed. In most cases, air is used in tunnel drying and the material can move through the dryer either parallel or counter current to the air flow. Sometimes the dryers are compartmented, and cross-flow may also be used.

Roller or Drum Dryers

In these the food is spread over the surface of a heated drum. The drum rotates, with the food being applied to the drum at one part of the cycle. The food remains on the drum surface for the greater part of the rotation, during which time the drying takes place, and is then scraped off. Drum drying may be regarded as conduction drying.

Fluidized Bed Dryers

In a fluidized bed dryer, the food material is maintained suspended against gravity in an upward-flowing air stream. There may also be a horizontal air flow helping to convey the food through the dryer. Heat is transferred from the air to the food material, mostly by convection.

Spray Dryers

In a spray dryer, liquid or fine solid material in a slurry is sprayed in the form of a fine droplet dispersion into a current of heated air. Air and solids may move in parallel or counterflow. Drying occurs very rapidly, so that this process is very useful for materials that are damaged by exposure to heat for any appreciable length of time. The dryer body is large so that the particles can settle, as they dry, without touching the walls on which they might otherwise stick. Commercial dryers can be very large of the order of 10 m diameter and 20 m high.

Pneumatic Dryers

In a pneumatic dryer, the solid food particles are conveyed rapidly in an air stream, the velocity and turbulence of the stream maintaining the particles in suspension. Heated air accomplishes the drying and often some form of classifying device is included in the equipment. In the classifier, the dried material is separated, the dry material passes out as product and the moist remainder is recirculated for further drying.

Rotary Dryers

The foodstuff is contained in a horizontal inclined cylinder through which it travels, being heated either by air flow through the cylinder, or by conduction of heat from the cylinder walls. In some cases, the cylinder rotates and in others the cylinder is stationary and a paddle or screw rotates within the cylinder conveying the material through.

Trough Dryers

The materials to be dried are contained in a trough-shaped conveyor belt, made from mesh, and air is blown through the bed of material. The movement of the conveyor continually turns over the material, exposing fresh surfaces to the hot air.

Bin Dryers

In bin dryers, the foodstuff is contained in a bin with a perforated bottom through which warm air is blown vertically upwards, passing through the material and so drying it.

Belt Dryers

The food is spread as a thin layer on a horizontal mesh or solid belt and air passes through or over the material. In most cases the belt is moving, though in some designs the belt is stationary and the material is transported by scrapers.

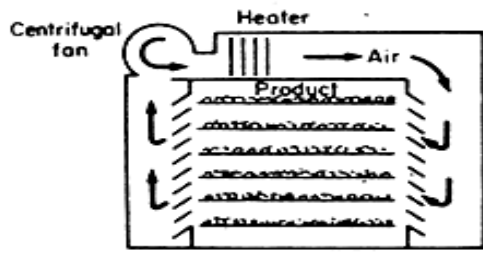
Vacuum Dryers

Batch vacuum dryers are substantially the same as tray dryers, except that they operate under a vacuum, and heat transfer is largely by conduction or by radiation. The trays are enclosed in a large cabinet, which is evacuated. The water vapour produced is generally condensed, so that the vacuum pumps have only to deal with non-condensable gases. Another type consists of an evacuated chamber containing a roller dryer.

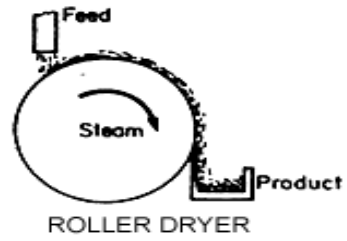
Freeze Dryers

The material is held on shelves or belts in a chamber that is under high vacuum. In most cases, the food is frozen before being loaded into the dryer. Heat is transferred to the food by conduction or radiation and the vapour is removed by vacuum pump and then condensed. In one process, given the name accelerated freeze drying, heat transfer is by conduction; sheets of expanded metal are inserted between the foodstuffs and heated plates to improve heat transfer to the uneven surfaces, and moisture removal. The pieces of food are shaped so as to present the largest possible flat surface to the expanded metal and the plates to obtain good heat transfer. A refrigerated condenser may be used to condense the water vapour.

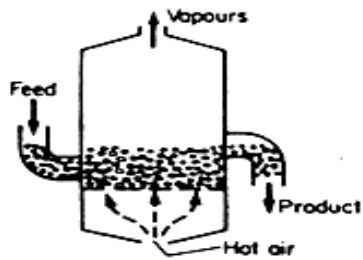
Various types of dryers are illustrated in **Fig. 7.8**:



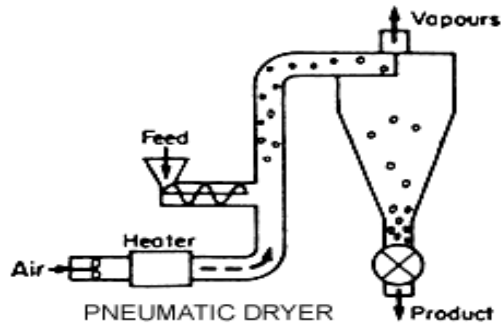
TRAY DRYER



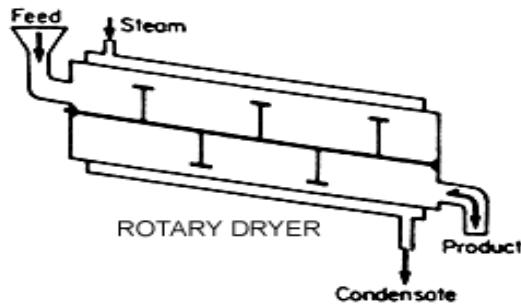
ROLLER DRYER



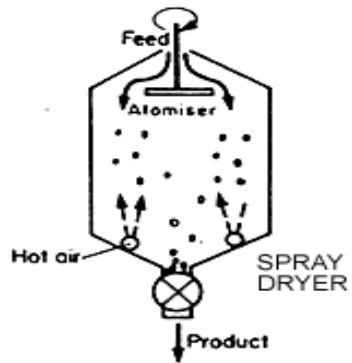
FLUIDISED BED DRYER



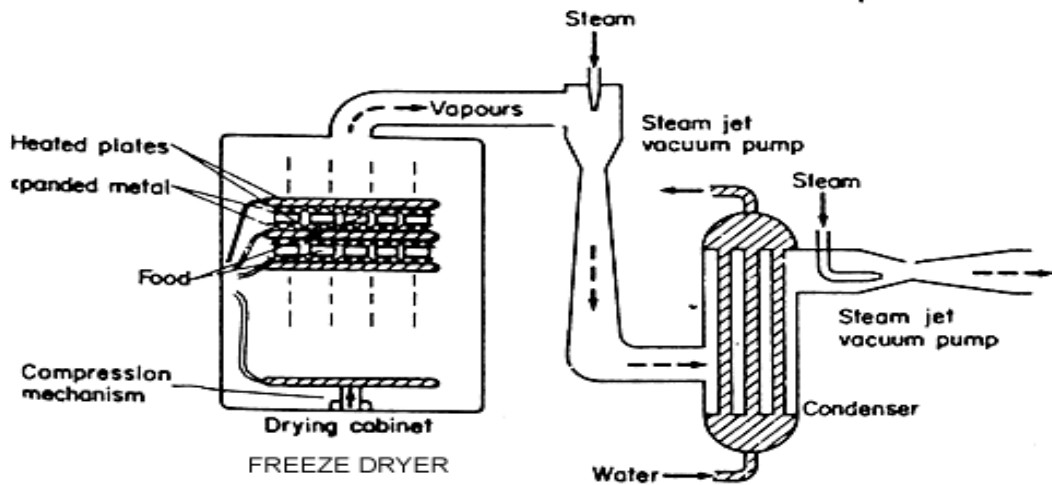
PNEUMATIC DRYER



ROTARY DRYER



SPRAY DRYER



FREEZE DRYER

Figure 7.8 Dryers

