**5.1.3. Drum (Tumble) Dryer**

It is an energy saving technique for high viscosity liquid foods or foods in puree form (baby food, mashed vegetables, and shredded potatoes). The mash is spread in a thin layer on the outside of the drum, the inner part of which is heated by steam. While completing the drum cycle, the dried product is scraped off with a knife.

Drums can be single or double. Diameter can be 0.5-6.0 meters, length 1-6 meters. The drum internal temperature can reach up to 200°C. The food to be dried is applied in 0.5-2.0 mm thickness. The residence time of the raw material in the drum can be from a few seconds to 20 seconds. Although it is an effective method, spray dryers replaced them due to the less thermal destruction[58].

**5.1.4. Spray Dryers**

It is used for drying liquids that can flow easily. Liquid food is first heated to increase viscosity. It is given by mixing with hot air (150-200°C) as small droplets (10-200 µm in diameter) from a nozzle or atomizer. The dried product and the hot air are separated from each other in the cyclone or filter. The process is fast, the temperature remains at 40-50°C during the drying temperature. The residence time is 1-20 seconds. Some of the oil must be separated beforehand so that very oily products can be dried. Products with high sugar content require a carrier such as maltodextrin[58].

**5.1.5. Fluid Bed Dryers**

It is the development of belt dryers. Hot air is given to the food moving on the belt from the bottom and fast. Drying occurs by convection. Fluid level; depends on the size distribution, density, shape, viscosity of the particles as well as the properties of the air used. The fluidized bed is equipped with a vibration mechanism. These dryers are suitable for small particle foods[58].

**5.1.6. Freeze Dryers**

Also called lyophilization. It is based on the principle that the ice turns into steam (sublimation) without passing into the water phase under high vacuum (<0.6 KPa). Frozen food is placed in the vacuum unit, vacuum is applied, and a controlled amount of heat is given to the food, allowing the drying to continue. The product quality is very high, but the drying time is long (10-40 hours), which increases the cost. Due to its expensiveness, its use in foods is very low. It is mostly used in mountaineering foods and in the pharmaceutical-enzyme industry[58,59].

**5.1.7. Other Drying Methods**

Explosive puffing: High temperature and high pressure are applied to the food at the same time. The overheated water is removed by abruptly removing the pressure. High heat impairs quality, blasting destroys tissue integrity, but rehydration quality is good[60-62].

Osmotic dehydration: Fruits are placed in a solution containing intense sugar. Sugar replaces the water in the tissue. It is not a drying method in the classical sense. It is generally used in candy type confectionery making[63].

Microwave drying-drying with radio frequencies: Waves with a frequency of 300-3000 MHz are used in microwave drying. The microwave causes the water molecules to rub against each other and generate heat. Fluidized bed and microwave application have been shown to be very effective. It is widely used in the production of products such as pasta-ravioli[64-66].

Microwave-assisted freeze drying: The latent heat of evaporation required in lyophilization is given with the help of microwave. Reducing the drying time (up to 1/3, 1/2) is its most important advantage. The equipment is expensive[67,68].

Centrifugal fluid bed dryer: Its principle is similar to fluid bed freezer. High velocity hot air is supplied to a rotating drum along with the food. The food gains a fluid feature in the drum[69,70].

**5.2. Drying Vegetables**

The raw material is washed, sorted, cut, rinsed and dried. At this stage, if necessary, boiling and cooling can be applied before drying. Then, the cooled product is cleaned by separating from foreign materials and non-specific materials. By passing through a metal detector, this product can be stored as a semi-finished product. On the other hand, this semi-finished product can be packed and stored as finished product after passing through the grinding and screening stages[15,55].

These products are kept in polyethylene bags, paper bags, cardboard boxes or tin cans in 2-layer packaging, inside and outside. Moisture should not be more than 3-4% in dried vegetables. Fumigation process is also applied to protect the dried product from pests during storage. The warehouse should be dry, cold and dark. In general, dried vegetables can be stored for a minimum of 1 year in warehouses with 50-60% relative humidity at 0-4°C[71,72].

**5.3. Drying Fruits**

The raw material is washed, sorted, and, when necessary, peeled, pitted or sliced. Then, it is transferred to the drying stage either by being subjected to the sulphurization process or dipped in alkali. The dried product is sorted, passed through a metal detector and packaged and sent to the warehouses[15].

Pre-treatments are applied to fruits as well as vegetables. The only difference is that in this process, plums and grapes are immersed in alkaline (dipping) and apples, peaches, grapes and apricots are sulphated. K2CO3 or NaOH solutions are used in the dip application. With this application, the natural wax layer is removed, drying is accelerated and the color is preserved. On the other hand, sulphation with SO2 prevents enzymatic and non-enzymatic changes[73-75].

Dried fruit is stored for a while in large crates or boxes and stabilized to the desired humidity level. Then it is sieved, sorted and packaged. The product should be protected from moisture, light, air, dust, microorganisms or insects, and placed in hermetically sealed packages as soon as the product comes out of the dryer. As with vegetables, the warehouse should be fumigated again. Dried fruits should preferably be stored at 0-4°C[71,72].