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PROSPECTS OF THE PROCESS OF DEHYDRATION OF FRUITS AND VEGETABLES

Qobilov H.X.
Docent, PhD, Bukhara engineering technological institute
Sabanbayeva M.Y.
Researcher, Bukhara engineering technological institute

Abstract. Al fruits and vegetables can be dried in various forms, including cuts, juice, paste, slurry, and even whole, using various dryers. Recent research on drying has focused on improving energy consumption efficiency, product recovery, and nutrient preservation. Technological advancements in drying methods involve development and optimization of novel drying techniques, including their combination to obtain quality products. As the demand for new and healthier ready-to-eat goods with lengthy shelf lives and greater rehydration capability expands, advancements in the drying of fruits and vegetables are crucial. The drying process has a tremendous impact on the product's quality and cost.
Key words: technological advances, vegetables, dehydration, drying, fruits

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Introduction. New drying procedures may provide advantages such as enhanced energy efficiency, higher product quality, lower costs, and decreased environmental impact. Dehydration of agricultural products is a critical process that must be carried out with caution. Fruit and vegetable storage through drying have a long history and is based on sun and solar drying processes. Drying used to be as simple as lying the product out on mats, rooftops, or drying floors in the, using solar radiation and convective air. Other options include drying the harvest beneath a cover, on treetops, or even on field shelves. Heat is transferred to the fruit or vegetable raw material through convection from the ambient air and radiation from the sun on its surface during sun drying. Since foods to be dried are exposed and climatic changes can occur, the method is highly unsanitary and volatile. Mechanized solar dryers such as tray, cabinet and tunnel dryers have been designed to overcome the challenges of damage, dust, pest infestation and unexpected rainfall encountered in open air drying. Application of mechanized drying to conserve agricultural produce has grown significantly, necessitating the development of fast drying methods and approach that decrease the amount of fuel dispelled in these operations. Due to the poor heat and temperature conductivity of fruits and vegetables, a spontaneous heating process occurs in warehouses, and as a result, a part of the stored product is lost. depends. The heat release property of fruits and vegetables depends on the rate of respiration, which is calculated based on the amount of carbon dioxide released. Because fruits and vegetables contain a lot of water, their heat capacity is high. Usually, when calculating the heat capacity of fruits and vegetables, the amount of water in it is taken into account. Knowing the heat capacity of fruits and vegetables and the amount of heat released from it, it is possible to calculate how much the temperature of the product in the warehouse has increased.

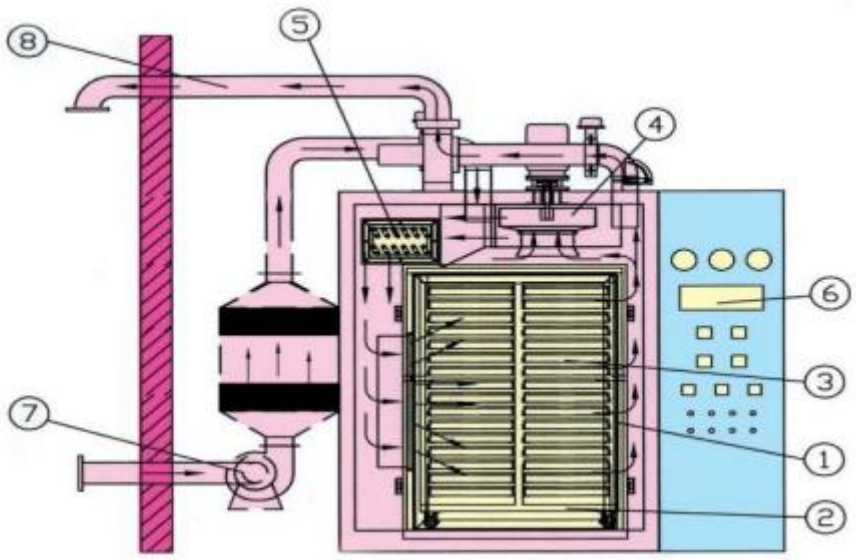


Figure 1. Drying process

Fruit or vegetable juice is blasted via an atomizing valve, resulting in small droplets that are equally spread throughout a vast drying chamber and allowed to fall into hot air flowing upwards. Changes in parameters such as particle diameter, air temperature, and air speed, among others, can be used to accomplish the required degree of drying, so that when the droplets touch the bottom of the drier, they have devolved into small powder particles. The technique may not be suitable for foods sensitive to mechanical damage, due to the strong shear action during atomization. This drying method reduces the possibility of soluble material migrating by lifting the food particles and transporting them outside using heated air blown from beneath the bed. Through openings in the bottom, heated air is blown into the drying chamber. A linear velocity can be achieved by using a sufficient volumetric flow rate of air to lift the wet fruit or vegetable and keep it suspended in the air that is drying it. The method is widely used to dry wet granular and particle food products that can be fluidized in beds of inert solids, such as slurries, pastes, and suspensions. The down sides of this method are particle size restrictions and poor thermal efficiency.

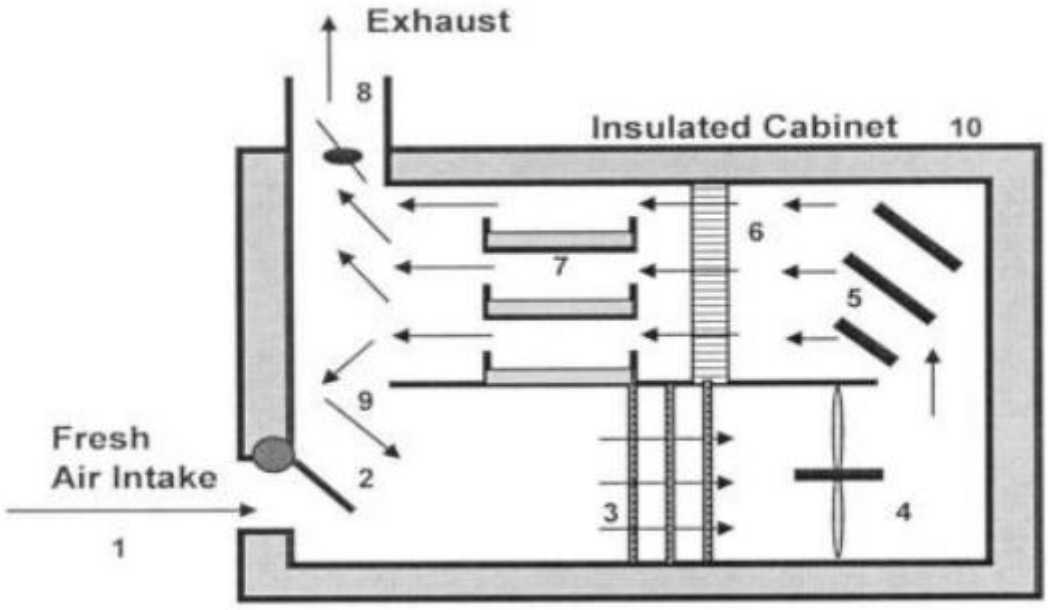


Figure 2. The components of a cabinet dryer

Freezing the food, sublimating the ice, and extracting bound water molecules are all steps in the process. During freezing and low temperatures, the lack of liquid water causes the production of a higher-quality end product and completely stops most microbe-mediated reactions. During the ripening period, fruit respiration accelerates and reaches its peak when ripe enough for consumption. Then the breath decreases, which indicates that the fruit is ripe. The rate of breathing slows down as the temperature drops. If the products are frozen, but not all of the water in them is frozen , they will continue to breathe. During product storage, temperature rise due to metabolic heat leads to self-heating. In most cases, the temperature rises by 1-2 ^{0}C during spontaneous heating . Even a slight increase in temperature has a negative effect on the quality of the product. The ventilation surface of the warehouse is of great importance in reducing the temperature of fruits and vegetables. Wilting is mainly characteristic of apples, pears and grapes. Usually raw, overripe fruits wither quickly. The main task of storing fruits and vegetables is to preserve their physical and chemical composition, color, taste, nutritional value and other properties. The main difficulty in cooling storage of fruits and vegetables is related to the large amount of free water in these products. In conditions of high temperature, it activates the processes of respiration, ripening and aging of cells and tissues, enhances evaporation and the development of pathogenic microflora. For this reason, conditions must be created to reduce the life activity of products and macro-organisms stored in storage. Harvest - in the first days after harvesting, the respiration of the wet product increases. Then the rate of respiration slows down, especially when fruits and vegetables are quickly cooled. Save in the process the air humidity when it decreases evaporation, breath get and pathogen of microorganism's development increases. breath acceleration in warehouses the air composition is also affected shows. Mechanically damaged, frozen and diseased fruits also tend to wither. Fruit blackening disease appears on the skin of apples, grapes and pears. The food is first frozen (at - 20°C), after which a controlled quantity of heat is supplied under vacuum to induce sublimation, in which ice is converted straight to vapor and subsequently condenses as ice on a refrigeration coil, which is generally kept at -55°C. One of the most significant characteristics of freeze-dried fruits is their rehydration capacity. In this case, an increase in air temperature and moisture of the product is observed. Therefore, the main task in storing the product is to take all measures to prevent it

from overheating and sweating. Artificial cooling of warehouses, active ventilation and storage of products in containers are important in this regard. The immense expense and quantity of energy used throughout the freezing, drying, and condensing processes are disadvantages of freeze-drying products. Because of the long freeze-drying period, the product can collapse, resulting in a rough product with minimal rehydration ability and a loss of aroma. Exotic fruits and vegetables, soup ingredients, mushrooms, orange juice, mango pulp, and other industrial applications of the technique have all been effective. Though using a microwave was able to optimize the freeze drying of onions. Developed an integrated ultrasound freeze drying device to dry bell pepper. The use of ultra sound technology was found to minimize rate of drying by 11.5%. Food on the moving belt dries in a couple of minutes, as opposed to hot air tray or tunnel dryers, which take several hours, or freeze dryers, which take even longer. Convection, conduction, and radiation are the three forms of heat transfer pathways used in this drying technique. All of these heat transfer modes worked together to produce an energy-efficient drying process. Many fruits (apples, pears) have a waxy layer on their surface. Due to this, it becomes difficult for microorganisms to feed, and their number on the surface of unripe fruits is small. After breaking off, the waxy layer is damaged and the number of microorganisms increases. Depending on the type of fruit, the number of microorganisms on the surface is different. Microorganisms on the surface of the pear are the most common in apricots and peaches, and are rare in apples. The number of microorganisms also depends on the degree of ripening of fruits. Yeast bacteria are abundant in ripe fruits, and fungal bacteria are rare. There are more microorganisms in vegetables than in the surface of fruits. For example, several million microorganisms can be found on the face of a hot pepper. Food to be treated must be liquid or semi-liquid. The substance is usually an infrared translucent plastic material floating on the heated circulating water area, and it is applied to the surface of a conveyer belt. When infrared energy passes through the water surface, the refractive principle of the water surface provides a window. When moist food and transparent plastic come into touch, an infrared window is formed, allowing infrared energy to be transferred directly to the material. Damage of fruit and vegetable products by microorganisms depends on various factors. Among them, biological properties of the product, agricultural production and microbiological factors are the main ones. Poisoning of products by microorganisms depends on their size and anatomical structure. Usually, large and very small fruits are quickly damaged by microorganisms.

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