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DRYING AND DEHYDRATION: AN EMERGING POSTHARVEST PRESERVATION METHOD OF FRUITS

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Abstract

Drying of fruits is one the earliest and effective method of food preservation which play significant role in fruit supply chain. The dried and dehydrated fruit products are good source of energy as well as concentrated source of vitamin and minerals. Higher shelf life, easy handling, lower volume, smooth transportation and cost effective storage are few advantages of dried/ dehydrated fruit product. Lowering of moisture content which ultimately lowers down microbial spoilage is core principle of drying and dehydration. While opting drying and dehydration one must know the factor which affects its efficiency, these include factors such as type of product, cost of dehydration, quality of final product and source of energy. Drying and dehydration technologies can be one of the possible approach to meet the nutritional security as more than 20% of the world perishable crops are dried to increase the shelf life and product availability.

***Key words*:** Fruits; drying and dehydration; nutrition value; shelf life.

Introduction

Fruits and vegetables are most important products in agricultural sector. Fruits are important sources of essential nutrients such as vitamins, minerals and fibre. Since the moisture content of fresh fruits is more than 80%, they are categorized as highly perishable commodities. Drying and dehydration are one of the oldest yet most common methods used to improve the shelf life of fruits and vegetables. The fitness of drying method depends on many factors such as the type of product, thickness of product availability of dryer. Above all, the critical parameters are Energy consumption and quality of dried products.

Drying can be defined as the removal of water by conventional source like sunlight, wind under natural condition in order to protect qualities of fresh fruits such as colour, flavor, nutrients, appearance and uniformity during drying process. Dehydration is the removal of moisture under controlled conditions such as temp. RH etc. to a specific/desirable extent in order to protect qualities of fresh fruits such as colour, flavour, nutrients, rehydration, appearance and uniformity during drying process.

Objective of drying and dehydration : The main objective is to preserve food along with increasing the shelf life than that of the normal fruits. Dried fruits are easier to handle, transport and storage. They are of low volume and highly nutritious, economic value is increased after drying and dehydration. It is also diversify the supply of fruits with different flavour and texture hence gives the consumer more option to choose the fruit product.

Drying methods and their Advantages and Disadvantages : There have been many advances in the drying and dehydration technology in the last few years which helps in decreasing the consumption of energy along with production of high quality product compare to the conventional methods

which ensure the food safety. The methods of drying can be categorized into three, 1. Traditional or conventional methods. 2. Commercial methods. 3. Latest developed methods.

Traditional methods

1. Sun drying

The conventional drying was started in the 18th century, sun drying in agriculture in the in the developing area is not an option but a essential as most of the rural area does not have any link with the grid connected electricity. In sun drying source of energy is direct sun hence it is very cheap and simple among all the drying methods Some of the drawbacks are contamination of the product by insects, birds and other animals and dust thus sanitary quality is not up to the mark as well as product quality can be negatively affected by the microbial effect. A minimum temperature required is 86 °F and humidity of 60% or below is ideal for sun drying. In the open sun drying the fruits are left exposed under the direct sun. Fruits are placed on trays made of screens and wooden dowels for many days depending upon the fruit types and the temperature.

Direct solar dryers

Solar drying is different from the sun drying since it uses equipments for absorbing radiation. Some part of the incoming solar radiation are being trapped and some part being reflected back to the atmosphere, some part of the trapped radiation are absorbed by the crop materials resulting the temperature of the crop increases which helps in drying of the product. This structure is simple, and can be manufactured by the farmer by using materials available in the local market and it is suitable for crops such as cassava, banana, and mango slices.

Commercial methods

Osmotic drying : Osmotic dehydration a partial removal the moisture before actual drying. This operation is done by immersing the product in the hypertonic solution such as sugar and salt solution resulting water, vitamin, minerals, organic acids outflow from the food tissue and inflow of solutes into food tissue from the solution drying. In the Recent years it has received more attention as a method of pre-treatment prior to drying because of having some advantages such as reducing the damage in flavour, colour, inhibiting the browning, and decreasing the energy cost.

Freeze drying : It is a dehydration process which is usually used to preserve a perishable food or make the food material more suitable for transportation. Freeze drying of biological material is one of the most suitable methods of moisture removal as freeze drying is done in very low temperature all the deterioration and microbiological activity are prevented and thus provides a better quality and high value dried product along with good sensory quality and high levels of nutrient retention. Freeze-drying works by freezing the material followed by reducing the pressure which leads to sublimate the frozen water present in the product directly from the solid phase to the gas phase without going through the liquid phase also known as lyophilisation.

Vacuum drying : It a novel methods of drying which is exclusively used for drying of heat sensitive commodities. In vacuum drying removal of moisture from food materials takes place under then low pressure situation. As in the vacuum there is no air there will be no partial pressure, so the absolute pressure is called as water vapour pressure. Pressure ambitious flow is the means of transport in moisture movement in vacuum drying. The heat transfer is done by conduction method A thin layer of food is placed on a hot plate which supplies latent heat as a result evaporation of water from the food materials takes place. Some of the advantage of vacuum drying are it requires less energy, faster than many of the other method, it causes less damage to the products.

Spray drying : The Spray Drying is a well-recognized industrial drying technology used widely for drying and powdering the heat sensitive materials from liquid foods into solid or powder form**.** In spray drying the removal of moisture from slurry or liquid by breaking it into small droplets is takes place which is done in the presence of hot air with a aim to obtain a solid, dry powder. Compare to most of the other drying processes, spray drying takes less time for drying of the droplets. The drying time of depends upon many factors such as, pump rate, flow rate, heat and aspiration rate**.** Sticky products are in general difficult to dry with the spray-drying method, for avoiding the stickiness, carrier agent is being used which are of high molecular weights aids Carrier agent used in spray drying are Maltodextrin 10 DE, Arabic gum, cashew tree gum, waxy starch, maltodextrin 20 DE.

Microwave drying : It is a good approach for drying the food materials with overcoming some of the drawbacks of traditional drying. Microwaves are generated inside an oven by stepping up the alternating current from domestic power lines. Microwaves go through the inner core of the food causing water to get heated within food which leads to transfer of moisture from the food material. Microwave drying allows fast remove of moisture which results in rapid drying and the drying uniform and consume less energy compared to the conventional drying**.** However microwave drying has got some of the drawbacks which include product damage caused by extreme heating.

Latest method

Ultrasound : Among recent emerging technologies ultrasonic dehydration is one of the most promising dehydration techniques because the effects of ultrasound are more significant at low temperature which ensures the reduction of the chance of food degradation. It can be used for maintaining pre and post-harvest quality and improving the nutritional value of vegetables and fruits. The advantages of ultrasound over the heat treatment include; minimization of flavour loss, greater homogeneity and significant energy savings. However, many researches have revealed that the use of US affects the food tissue, including the cellular breakdown and formation of micro channels, which leads to breaking up of the microstructure.

Infrared drying : Infrared (IR) has been successfully applied in drying of fruit products. IR has been shown to cut the covalent bonds and release antioxidant compounds such as flavonoids, carotene, tannin, ascorbate, flavoprotein, and polyphenols in repeating polymers. It has many advantages over conventional drying, many studies revealed that infrared radiation is faster than convectional drying . The irradiated surface evaporates more water and the drying time can be shortened by up to half. Unluckily, IR does not penetrate very much into food materials instead it is used only for surface heating. Vibration is useful to allow the material to be uniformly irradiated by IR.

Low pressure superheated steam drying : Superheated steam drying has been successfully applied in many of the foods and agricultural products, it is of low energy consumption, high drying rate wiyh high quality of the final product besides it is one of the eco-friendly methods and avoids fire and explosion hazards**.** But it has some drawbacks while applying in heat sensitive food materials so to overcome this major problem a low pressure superheated steam drying concept has been developed to dry the heat sensitive products which has been effectively used in many fruits and vegetables such as banana mangosteen rind.

Conclusion

Drying is one of the most important operations for improving the shelf life while maintaining its nutritional and physical quality. It has been one of the most important operations in the food industry sector for many years and still continuing to provide food security and increasing

industrialization of foods. Many new technologies came up in the recent years to reduce the energy such as osmotic dehydration, vacuum drying, freeze drying etc which offering a great scope in the drying technology for the production of quality products. As the standard of living rising day by day the demand for dried products are increasing so developing a cost effective, eco-friendly, quality food producer dryer and energy efficient drying technology can bring a breakthrough in the drying technology.

Future thrust

Though various method have been developed in drying technology there is a still further studies needed for development of cost effective and energy efficient methods of drying. More research is needed to identify the proper process parameters for improving the shelf life and nutritional value. However, drying models that take all the variables into consideration are still non-existing, which makes it a potential area of research.

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