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STUDY OF DIFFERENT TYPES OF VEGETABLE DRYING METHODS IN DRYING BOX

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Abstract - Drying is a mass transfer process consisting of the removal of water or another solvent by evaporation from a solid, semi-solid or liquid. A source of heat and an agent to remove the vapor produced by the process are often involved. With the help of this review, it is possible to determine various vegetable drying methods that could easily be adopted for preservation of vegetables. The objective of this paper is to understand the different types of vegetable drying methods in drying box.

Keywords – ***Drying,Vegetable drying***

1. INTRODUCTION

Food drying is one of the primogenital methods of preserving food for later use. It can either be an Alternative to canning or freezing, or compliment these methods. Drying of foods is simple, safe and easy to learn. In India, drying is the most commonly used method to dry the agricultural material like grains, fruits and vegetables. In villages while drying, the crop is spread in a thin layer on the ground and exposed directly to solar radiation and other ambient conditions. The rate of drying depends on various parameters such as solar radiation, ambient temperature, wind velocity, relative humidity, and initial moisture content, type of crops, crop absorptive and mass of product per unit exposed area. This form of drying has many drawbacks such as degradation by windblown, debris, rain and insect infestation, human and animal interference that will result in contamination of the product.

Basically the drying process involves the migration of water from the interior of the product to be dried on to the surface for its evaporation and therefore it is a heat and mass transfer phenomenon. The convective heat transfer coefficient is an important parameter which determines the heat and mass transfer. The convective heat transfer coefficient varies from crop to crop and the mode of drying. The basic essence of drying is to reduce the moisture content of the product to a level that Prevents deterioration within a certain period of time. Drying is a dual process of - heat transfer to the product from the heating source. And mass transfer of moisture from the interior of the product to its surface and from the surface to the surrounding air.

2. LITERATURE REVIEW

AyoolaOlalusi [1] examined that the drying characteristics of onion slices were at air temperatures of 50˚C, 60˚C and 70˚C and sample thicknesses of 2 mm. During the drying experiments, air velocity was held stable at 0.9 m/s. The effects of air temperature on the drying characteristics and quality parameters such as vitamins C and D, drying time decreased considerably with increased temperature. The time required to reduce the moisture content to any given value was dependent on the drying conditions, being the longest at an air temperature of 50˚C, 0.9 m/s and the shortest at an air temperature of 70˚C and air velocity of 0.9 m/s. The loss of vitamin C, which is a thermo-sensitive compound, was the least at an air temperature of 50˚C.

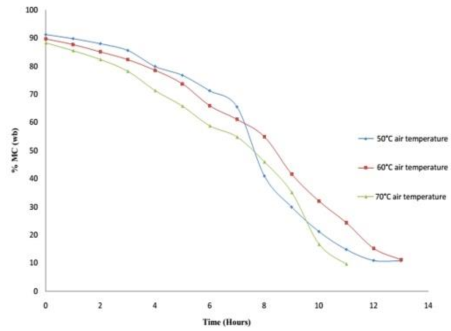

Fig 1. Drying curves for mechanical dried red onion slices.

As reported it can be concluded that the drying time decreased considerably with increased temperature [Fig.1]. The time required to reduce the moisture content to any given value was dependent on the drying conditions, being the highest at an air temperature of 50˚C, 0.9 m/s and the lowest at an air temperature of 70˚C and air velocity of 0.9 m/s[Fig.1]. For each of the plots of the drying curves from the mechanical drying tests, there was an absence of or just a very brief appearance of a constant rate period because onions are hygroscopic and hygroscopic foods tending to quickly enter the falling rate period[Fig1]. An increase in drying air temperature had a negative effect on quality for both vitamin C and vitamin D which is a thermo-sensitive compound; this was likely due to the elevated processing temperature and period of exposure. Dried red and white onion at an air temperature of 50˚C had the highest vitamin C retention after drying.[1]

Cristina [2] studiedthe temperature had an important effect on hot air-drying and freeze-drying kinetics. For both methods, drying times to dehydrate garlic slices were similar at comparable temperatures. The maximum allicin retention was obtained for freeze-drying whole cloves at 20˚C. However, higher freeze-drying temperatures may cause collapse and allicin loss in whole cloves. For slices, allicin retention was similar for both hot air and freeze-drying at low temperatures. Allicin content decreased as temperature increased in both processes, but the influence of temperature on the loss of allicin was more pronounced for hot air-drying. Freeze-dried powders were more hygroscopic than hot air-dried ones. However, the drying method did not have an influence on the values of their glass transition temperature.

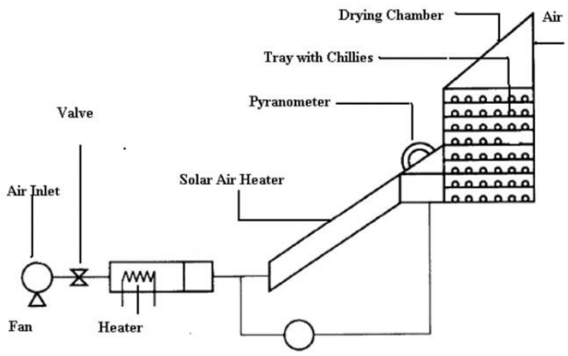

Fig. 2 Forced convection solar dryer with electric air heater. **T**he above setup consisting of solar dryer and a electric air heater helped determine the important effect on hot air drying and freeze drying kinetics[Fig2].

Biplab Paul [3] analyzed that solar drying of chilli is technically feasible and economically viable. Blanching of chilli prior to drying improves the quality of final product to reach the safe moisture content for storage. Also drying temperature retains its colour& texture which is acceptable in the market. An indirect type of solar dryer with forced air circulation not only enhances the production of final product but also produce superior quality chilli acceptable in the international market. Normally farmers not capable of investments for drying chilli which increases losses. Researcher must strive to develop new generation solar dryer which are effective and economically viable.

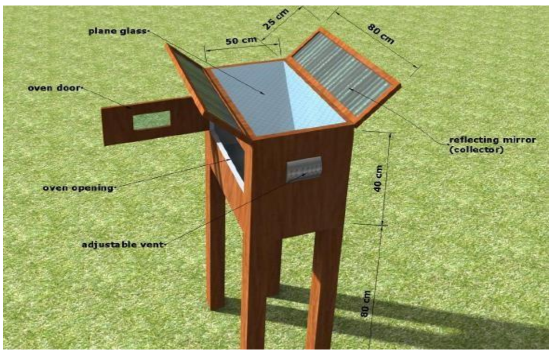

Fig. 3. The solar cabinet dryer with mirror reflector

H. U. Emelue [4] presents design of two domestic solar dryers and tested in Abraka, Delta State of Nigeria. the solar cabinet dryers were constructed to convert solar energy into heat energy for domestic purposes[Fig.3].The one with mirror reflectors gave higher temperature, efficiency of drying and power output than the one without the mirror reflectors[Fig.3]. Both could reduce the water content of products like cocoa seedlings, groundnut and corn to preserve them for future planting. He has shown that these dryers could conveniently cook an egg without much labour.It is easy to construct and maintain, and its construction materials are readily available in the local market. This prototype dryers when mass produced, could act as an alternative dryer to the conventional means of drying and sometimes cooking for rural farmers in Nigeria and tropical countries with similar circumstances.

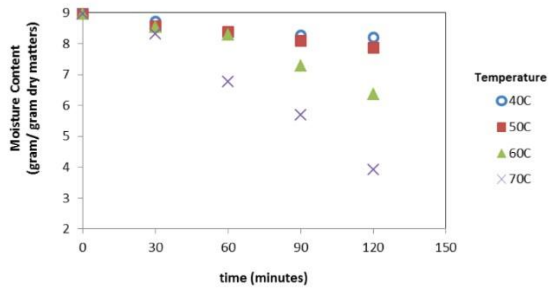

Fig 4. Moisture content removal under various drying time and temperatures.

M. Djaeni [5] studied the effect of convective drying of onion using tray dryer under various drying time and temperatures. The onion dried at 40°C, 50°C, 60°C and 70°C were observed at 2 hours respectively. The decreasing moisture content of onion at the current drying time, was observed under various drying temperatures as presented in [Fig.4]. Based on this research, the moisture removal was strongly effected by temperature. For example, at the same time during the drying, the moisture content of onion at 70°C was lower than that of 60°C or below. It implied that higher temperature reduced drying time.

Vijaya G.S. Raghavan [7] explored the application of microwaves in the drying of fruits and vegetables. he benefit of using microwave lies in its short processing time which is most advantageous for product quality when compared with other drying techniques. The quality of microwave dried commodities is often between air-dried and freezedried products. The rapidity of the process yields better colour and retention of aroma. Quality is further improved whenvacuum is used since the thermal and oxidative stress are reduced.

AminuSaleh Mohammed [8] condensed and Vacuum drying at 70 °C, 1000 mBar was found to be effective in preserving the comprehensive work ON Design and construction of a Vegetable Drier of reducing the cost of drying and also for practical demonstration of some of the theoretical knowledge acquired. It was discovered that the drier is efficient since the heat leakage was found to be very low. He made some calculationthe performance of the drier can be said to be satisfactory. Instead of drying for 24 or weeks traditionally, this drier will be able to dry vegetable for 9-36 hours without smoke, moisture inside and desirable market quantities. It also has the advantage of maintaining the original colour of the vegetable, it is hygienic and no dust. However, since this project is a prototype, it could be developed into bigger efficient vegetable drier. There can be diverse ways in which the project can be improved upon depending on where and the quantity of the vegetable to be dried.

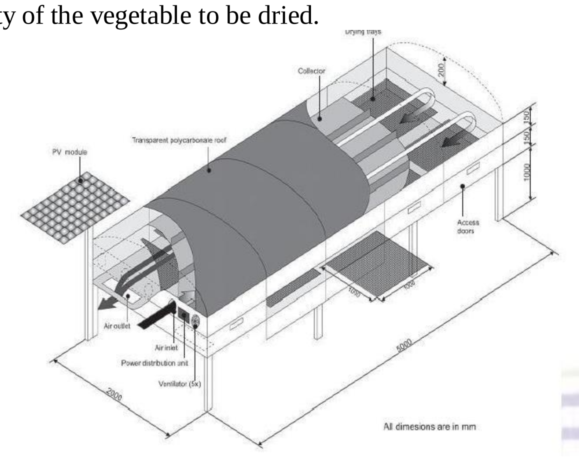

Fig. 5. Description of double pass solar dryer.

UmeshToshniwal [9] analyses that the solar dryer is beneficial than the sun drying techniques [Fig.5]. Solar dryers do have shortcomings. They are of little use during cloudy weather. During fair weather they can work too well. Although solar dryers involve an initial expense, they produce better looking, better tasting, and more nutritious foods, enhancing both their food value -and their marketability. They also are faster, safer, and more efficient than traditional sun drying techniques.

Kiremire BT [10] analysed the results shows significant losses in minerals as a result of drying, the amount of nutrients retained could be valuable especially in communities that have limited alternative sources of these micronutrients.

Kheng Yuen SIM [11] compare the vacuum drying and oven drying and he analysed that the Vacuum drying at 70 °C, 1000 mBar was found to be effective in preserving the radical scavenging activity and major nutritional contents of *maitake*mycelia as

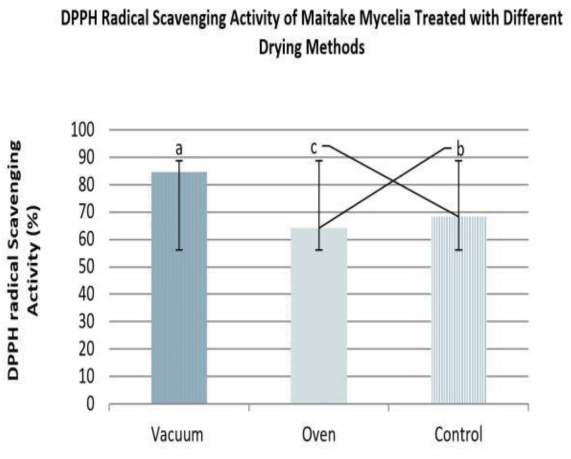

Fig. 6. Compared the result of drying

Compared to direct oven drying. This study concluded that vacuum drying can be considered as one of the low cost post-harvest approach in improving *maitake*quality.

3. CONCLUSION

It has been observed that drying of vegetables technically feasible and economically viable. There are many different methods of drying. Lots of research show that the drying improve the quality and life of the products. Also as time of drying increases moisture contain in product is decreases drying temp change its color but its texture is acceptable in market. Dryer with forced air circulation not only enhances the production of final product but also produce superior quality of product acceptable in the international market.

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