

# International Journal of Innovative Research in Science, Engineering and Technology

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## Comparison of Dehydration Kinetics of Tomato Slices using Different Method

Priti Jain<sup>1</sup>, Nidhi Khanna<sup>1</sup>, M. K. Pathak<sup>2</sup>, A.K.Gupta<sup>1</sup>

Department of Post Harvest Process and Food Engineering, College of Agricultural Engineering, JNKVV, Jabalpur  
MP, India<sup>1</sup>

Department of Forestry, JNKVV, Jabalpur, MP, India<sup>2</sup>

**ABSTRACT:** In the present study the tomato slices of 6 mm thickness were dried using sun drying, solar cabinet drying and hot air tray drying method. The initial moisture content of the tomato slices was 2677.77 % (db). The slices were subjected to drying till the final moisture content of slices reached less than 5 %. It was observed that for same amount of moisture removal hot air tray drying took lesser time as compared to sun and solar drying.

**KEYWORDS:** Tomato slices, Drying time, Moisture content

### I. INTRODUCTION

The drying is a process commonly used to preserve the agricultural produce and to prolong their shelf-life. Many developing; including India, countries still face enormous challenges of postharvest losses of agro commodities due to inadequate processing and storage facilities.

Fresh tomatoes are perishable in nature and require immediate processing or preservation. Tomatoes produced in the peak seasons are either consumed fresh, sold at relatively cheap prices, or are allowed to go waste (Abano and Sam-Amoah 2011). During peak period, a considerable amount of the produce is wasted due to lack of proper post harvest management. To reduce the extent of PHT losses, the tomatoes may be dehydrated to produce the tomato powder which can be reconstituted to prepare various value added products. The basic objective of drying of food products is to reduce the moisture content to a certain predetermined level so that microbial spoilage is avoided. Longer shelf life and significant reduction in the volume of the products are major reasons for the popularity of dried food material.

Thermal damage incurred by a product during drying is directly proportional to the temperature and drying time involved (Vadivambal and Jayson 2007). Even though hot-air drying is the most common method to preserve foods, many researchers believe that hot-air drying leads to degradation of products flavor, colour, nutrients and case hardening, due to their long drying times and high temperatures employed for the purpose (Alibas et. al, 2005), (Contreras et. al, 2008). The objective of present research was to investigate the influence of different drying methods on the drying kinetics of tomato slices.

### II. MATERIALS AND METHODS

#### Materials

Fresh tomatoes of good quality from the same cultivar were procured from the local Market of Jabalpur (M.P.). Selection of tomatoes was based on visual assessment for uniformity of colour and geometry. The tomato samples were washed and stored in a refrigerator at 4°C temperature in order to slow down the physiological and chemical changes (Maskan, 2001), (Karaaslan and Tuncer 2008). Prior to drying, the individual tomatoes were cut into slices of thickness 6 mm using a slicer.

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## Drying method

### Sun Drying

Tomato slices were placed on stainless steel trays and put under the Sun for drying. Stainless steel trays were placed on wooden blocks for better air movement all around the tomato slices. The impingement of the sun on the metal increases the drying temperature. The trays were covered with plastic net to protect the tomato from invasion of contaminants.

### Solar cabinet Drying

Solar cabinet dryer was used for the drying of tomato slices. A foil surface inside the dehydrator helps to increase the temperature. Ventilation during drying reduces the drying time. Shorter drying times reduce the risks of food spoilage or mold growth.

### Hot Air Tray drying

The hot air tray dryer consisted of three basic sections viz. an air blowing section, air heating section and a drying chamber. The drying compartment was composed of a holding stand for placement of trays and was placed perpendicularly to the airflow. Heated air was forced inside the drying with the help of an axial blower. The air velocity was measured with the help of an anemometer. A set of electrical resistances was installed to produce heated air. Thermometer was used to measure dry bulb temperature of the air flowing through drying trays.

Once the operating conditions had been established, the tomato slices were placed in a single layer over the tray and were inserted into the dryer cabinet. The loaded trays were removed from the dryer and weighed at a regularly intervals of 2 hour for the determination of weight loss during the drying period. Experiment was carried out till no further reduction in the weight of sample was observed with the increment in drying time.

## III. RESULTS AND DISCUSSION

### Drying characteristics of tomato slices

The tomato slices were dried by using three methods viz., open sun drying, green house type solar drying and hot air tray drying. The initial moisture content of tomato slices was found to be 2677.77 % (db). The drying behavior of tomato slices under different drying methods is presented in Fig. 1, 2 and 3, as a plot of moisture content versus drying time. Sun and solar drying of tomato slices were started at 10:00 AM and terminated at 6:00 PM. During the sun drying of tomato slices temperature varied from 42°C to 47 °C, and the maximum temperature recorded was 46 °C while the maximum drying temperature of 55 °C was recorded under green house type solar drying. Under hot air tray drying the temperature was kept at 60 °C throughout for the drying period.

The loaded trays were weighted at the beginning of the experiment and subsequently after every 2 hrs till the end of the drying period. The trays were covered with reduce the chance of moisture exchange between the tomato slices and environment. The trays were placed under sun next morning until the final moisture content was reached. Weighing of the loaded tray took 30 sec for each sample while removing the tray from the tray dryer, solar cabinet dryer as well as open sun. The weight loss was converted in corresponding moisture loss for calculating the moisture (db). The samples were dried up to the final moisture content level of 1.9 to 3.2% (db). The moisture content of samples at different drying time was compared under selected drying methods.

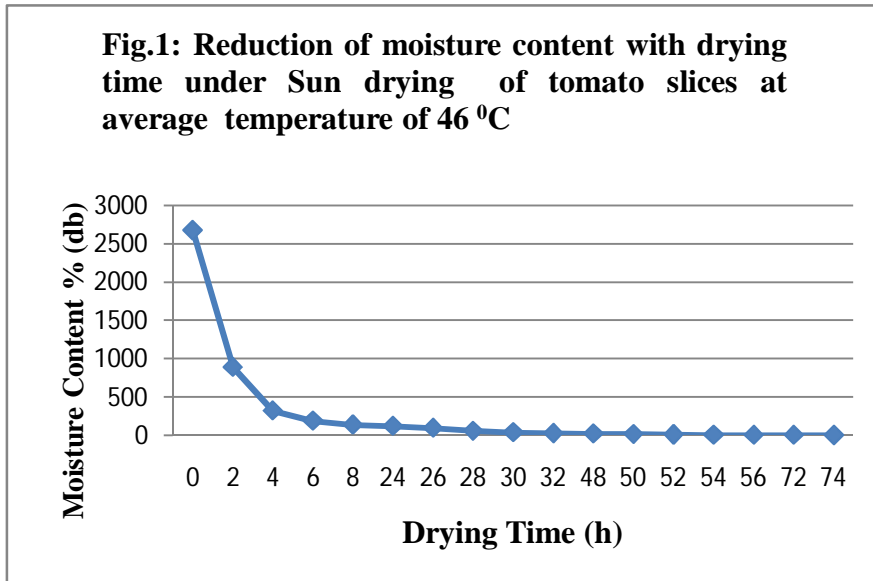
Fig 1 shows that at the initial stage of drying i.e. (0 to 8 h), moisture content of tomato slices decreased rapidly. During 0 to 8 h of drying moisture content from 2677.77 to 138.66 % (db), which further reduced to 6.83 % (db) during drying interval of 8 to 54 h. The moisture content of tomato slices decrease slowly from 6.83 % (db) to final moisture content of 3.3 % (db) during 54 to 74 h of drying time. After 74 h of drying no changes in moisture content was recorded.

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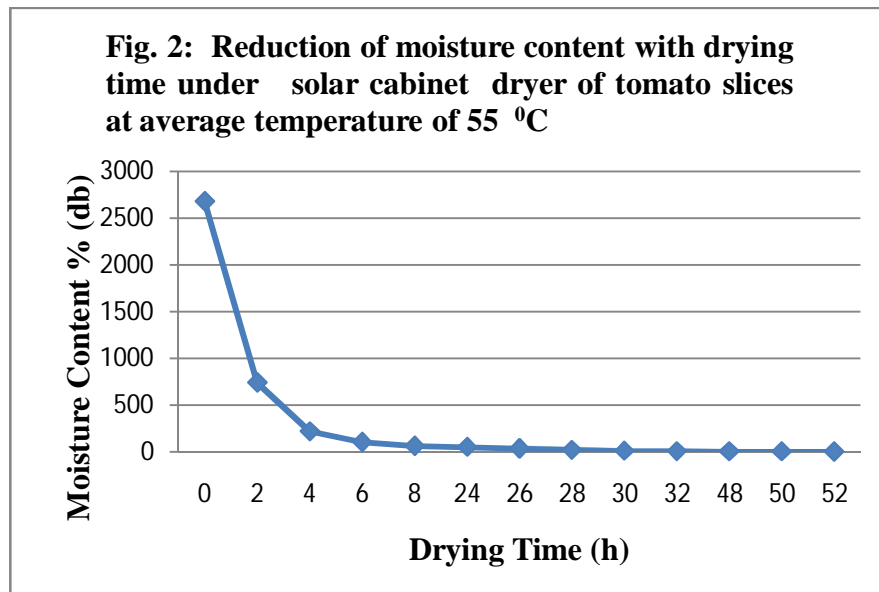
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The drying curve (Fig 2) indicates that at the initial stage of drying i.e. (0 to 8 h), moisture content of tomato slices decreased rapidly. During 0 to 8 h of drying, the moisture content reduced from 2677.77 to 62.6 % (db), which further reduced to 6.7 % (db) during drying interval of 8 to 32 h. The moisture content of tomato slices decreased slowly from 6.72 % (db) to final moisture content of 2.45 % (db) during 32 to 52 h of drying time. Moisture content of tomato slices was constant after 52 h of drying.



It can be observed from Fig.1 & Fig. 2 that the rate of drying was higher solar cabinet drying (Plate 1) as compared to sun drying. After 8 h of drying the moisture content reduced to 138.66 % (db) under sun drying while it reduced to 62.6 % (db) under solar cabinet drying. These trends may be due to the higher average drying temperature generated by solar cabinet compared with sun drying.

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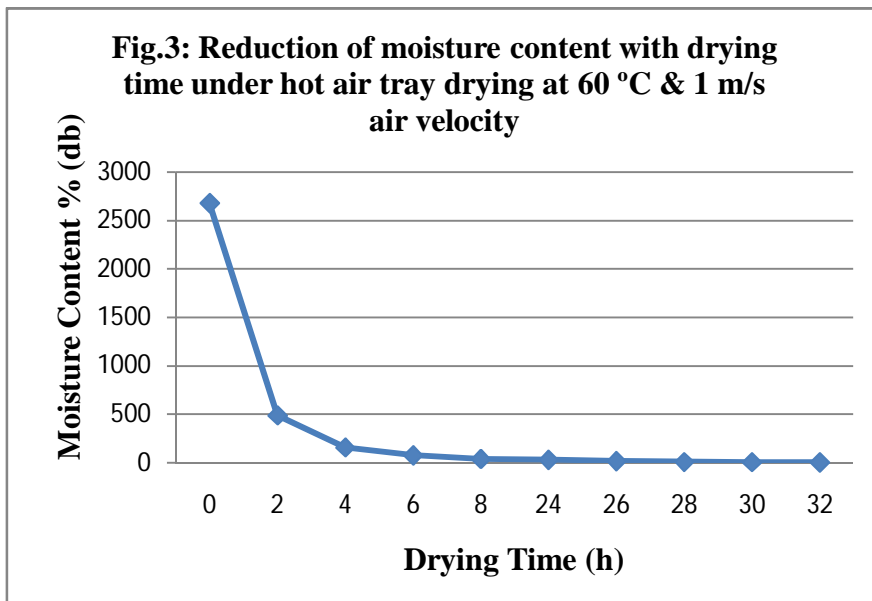
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**Plate 1:** Solar cabinet drying of tomato slices

Fig. 3 presents that at the initial stage of drying i.e. (0 to 8 h) moisture content of tomato slices decreased rapidly. During 0 to 8 h of drying, moisture content reduced from 2677.77 to 36.61 % (db), which further reduced to 6.6 % (db) during drying interval of 8 to 28 h. The reduction in moisture content of tomato slices from 6.6 % (db) to final moisture content of 1.93 % (db) was slowly during 28 to 32 h of drying time. The hot air tray dried tomato slices was shown in plate 2.



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Moisture removal increased rapidly as tomato slices warmed up, and then slowed down considerably. Moisture content decreased rapidly in hot air tray drying than sun and solar drying due to higher temperature of air. As hot air temperature increased, moisture removal increased and ultimately resulted in the reduction in drying time.



**Plate 2:** Hot air tray dried tomato slices

## IV. CONCLUSIONS

In the present paper, the results obtained by drying tests allowed a comparison between different drying curves. The average drying rate increased with increase in temperature and decreased with increase in time. Total drying time considerably reduced with the increase in drying air temperature. The time taken for Sun drying (74 h) and solar drying (52 h) were maximum in comparison to hot air tray drying (32 h) to attain 1.9% to 3.2 % moisture content (% wb) of dried tomato slices.

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