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Some Studies on Drying Characteristics of Tomato Slices

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ABSTRACT

The drying characteristics of tomato slices were studied by using polyhouse dryer, solar cabinet dryer and open sun drying. Dried tomato powder characteristics were studied. The ripened tomato of local variety were taken and cut into slices of 8 mm thick. The pretreatment was given by dipping the tomato slices into 10% salt solution and 5% KMS. The pretreated samples were placed in polyhouse dryer, solar cabisnet dryer and open sun drying for drying of tomato slices. The dried slices ere fed manually to Willey mill for making powder. Tomato powder was analyzed to lycopene content, reducing sugars, ascorbic acid, TSS, pH and total carbohydrates. The time taken for polyhouse drying is 65 h whereas solar cabinet and open sun drying was 90 h and 110 h respectively. Comparing different methods of drying, solar cabinet dried sample contain high amount of vitamin C, TSS, reducing sugars and carbohydrates as compared to other methods. The tomato powder in solar cabinet dryer may be considered as a better quality product for human consumption.

Key words : Open sun drying, Polyhouse, Solar cabinet Dryer, Tomato slices,Tomato powder.

Tomato (Lycopersicum esculentum) is one of the most popular and widely grown vegetable throughout the world and is known for excellent nutritive, medicinal and food values. Various foods prepared from tomatoes are: tomato preserves such as whole peeled tomatoes, dried tomatoes such as tomato flakes and tomato powder and tomato based foods such as tomato soup, tomato sauce and ketchup.

To increase the shelf life of tomatoes, different preservation techniques are being employed that comprise of manipulation of storage temperature and relative humidity, addition of chemical preservatives, protection against air/germ pollution through waxing, dehydration and processing into other products. Therefore, it is essential to preserve the tomatoes by using any of the food preservation techniques and to be made available in an acceptable form throughout the year at relatively minimum cost.

Drying is a common technique for preservation of food and other products including fruits and vegetables. The main advantage of drying food products is the reduction of moisture content to a safe level that allows extending the shelf life of dried products. Therefore, the drying processes offer an alternative way of using tomato for consumption. Dried tomato in the form of slice or powder helps to develop new food materials for ready to eat products. Keeping this in view, a study was undertaken to investigate the capability of polyhouse dryer, solar cabinet dryer and open sun drying for drying tomato so as to get a good quality of the final product and to study its quality characteristics.

Medugu, D.W. (2010) fabricated solar chimney and cabinet dryer and used to study the drying characteristics of tomatoes, pepper and bitter leaves. The results revealed that tomatoes, pepper and bitter leaves can be dried within 129, 105 and 84 h respectively in solar chimney dryer given an average 51% of the time spent for the natural sun drying. With solar cabinet dryer, the same quantities of tomatoes, pepper and bitter leaves can be dried within 138, 129 and 90 h respectively with an average 79% of the time spent for natural sun drying.

Raj Kumar (2007) investigated the use of a lab model solar cabinet and vacuum assisted solar dryers were developed to study the drying kinetics of tomato slices (4, 6 and 8 mm thickness) and the results were compared individually with open sun drying. The tomato slices of 4, 6 and 8 mm thickness could be dried from 94.0 to 11.5% wet basis

moisture content, respectively in 300, 420 and 570 min using solar cabinet, in 360, 480 and 600 min using vacuum assisted solar dryer and it took 435, 615 and 735 min under open sun drying method.

Juliet (1992) used the concept of polyhouse type solar dryer for drying pigeon pea. She used forced ventilation for drying the produce and developed a simulation model to predict the drying bahaviour of product in the solar dryer under different conditions. Her model suggested that even under unfavorable conditions of low temperature, high relative humidity and low radiations, the drying took place in the solar dryer. She observed that a greenhouse type solar dryer could provide a viable alternative to traditional open sun drying.

MATERIAL AND METHODS

The experiment was conducted at College of Agricultural Engineering, Bapatla.

Preparation of sample

The ripened tomatoes of local variety were taken. The tomatoes were cut into slices of 8 mm thick. Treated with hot water to inactivate the enzymes. Pretreatment was given by dipping the tomato slices into 10% salt solution and 5% potassium meta bisulphate.

Drying of tomato slices

Pretreated tomato slices were dried in polyhouse dryer, solar cabinet dryer and open sun drying till the constant moisture content were recorded. The physical and chemical characteristics of dried sample were studied.

Drying characteristics of tomato slices
Polyhouse

The drying characteristics of tomatoes in polyhouse were studied. A polyhouse of 5m x 10 m plinth area was installed in College of Agricultural Engineering, Bapatla. The polyhouse was covered with UV treated polyethylene cover. The polyhouse was also provided with the natural draft ventilators on the top. In the front side of the polyhouse, a door of 1.2 m x 1.2 m was provided to access into the polyhouse.

Firstly, about 3 kg of pretreated tomato slices were taken. The tomato slices are placed uniformly over the trays inside the polyhouse dryer from 8.00 AM to 5.00 PM. The slices were dried until its moisture content lowered down for safe storage. During the experiment the air temperature and relative humidity inside and outside were recorded with glass bulb thermometer and hygrometer. Drying was continued until there was no large variation in their weights.

Solar Cabinet Dryer

A solar cabinet dryer (Make: SEED, Model: SDM-8) of an enclosure with glass sheet as cover. Solar radiation entering the enclosure was absorbed in the product itself and the surrounding internal surface of enclosure. Suitable opening were provided for the forced circulation of air. Fan is run with the help of solar photovoltaic cell. Temperatures ranging from 40 – 80^0 C were usually attained inside the solar dryer.

The tomato slices made from 3 kg tomatoes were taken into stainless steel wire mesh trays of size 100x100 mm each. All the trays containing tomato slices were placed inside the solar drier and the drier was exposed to sun from 8.00 AM to 5.00 PM. Reduction in weight due to moisture losses was recorded continuously at every five-hour interval during drying. The drying was continued until there was no large variation in their weights.

Open sun drying

The leveled ground of around 5 x 5 m was chosen about 3 kg of pretreated tomato slices were taken into a rectangular thermo-coal plate and slices are spread uniformly. Then the samples are placed in open for sun drying from 8.00 AM to 5.00 PM. During drying the slices were frequently stirred manually. Reduction in weight due to moisture loss was recorded at every five-hour interval during drying. The drying was continued until there was no large variation in their weights.

Willey Mill

Willey mill was used for grinding the dried tomato slices. The dried slices were fed manually to Willey mill, for making powder. The powder was used for analyzing the lycopene content, reducing sugars, ascorbic acid, total soluble solids, pH and total carbohydrates.

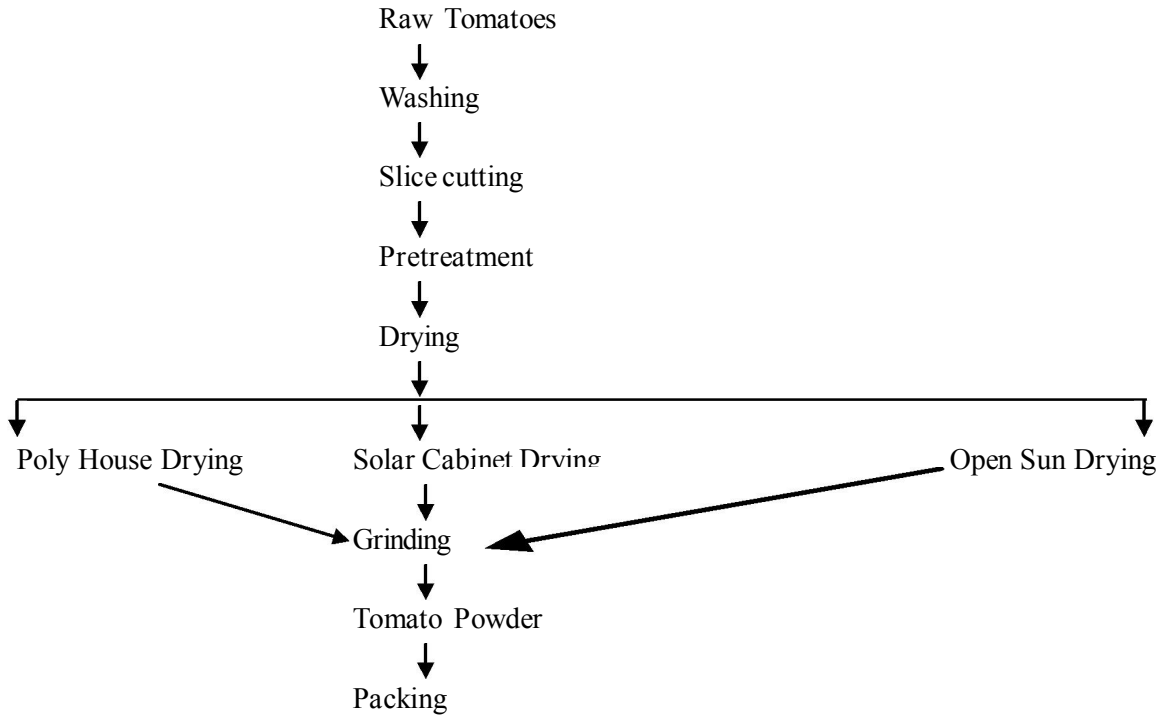

Fig. 1 Flow chart for production of tomato powder.

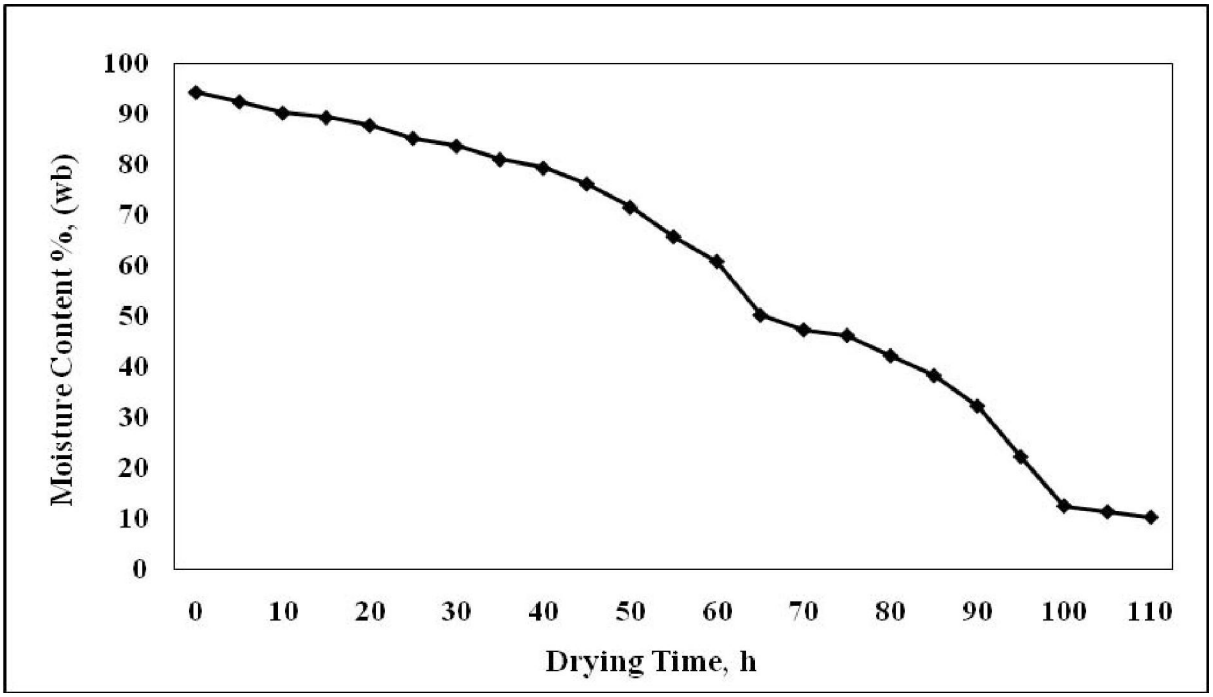

Fig. 2 Variation of moisture content against drying time in open sun drying

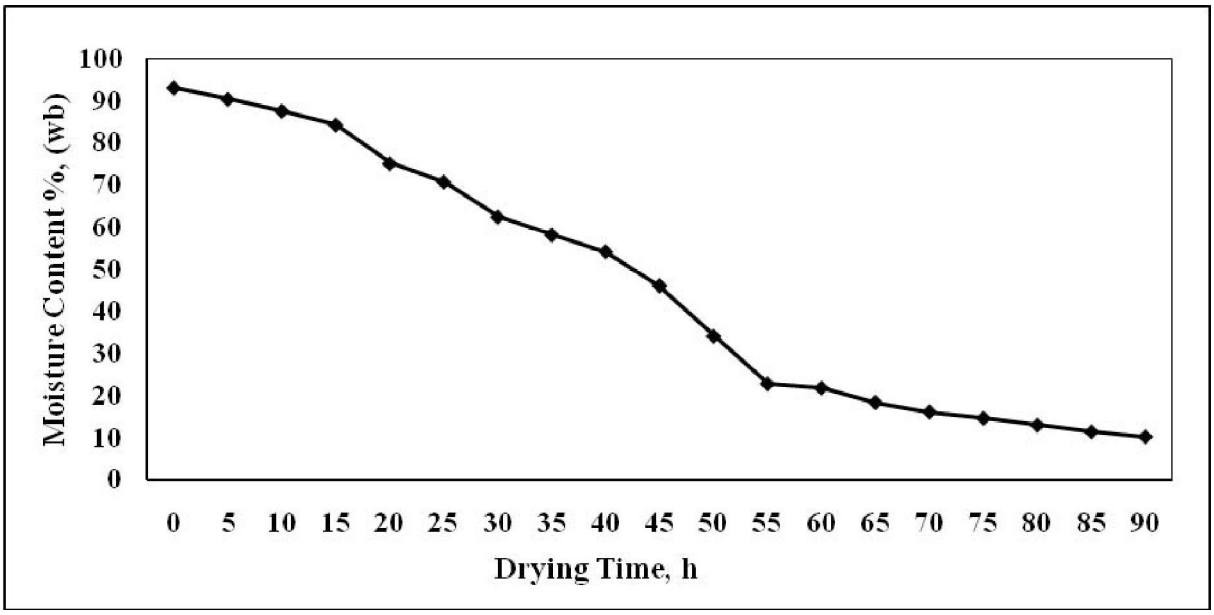

Fig. 3 Variation of moisture content against drying time in solar drying

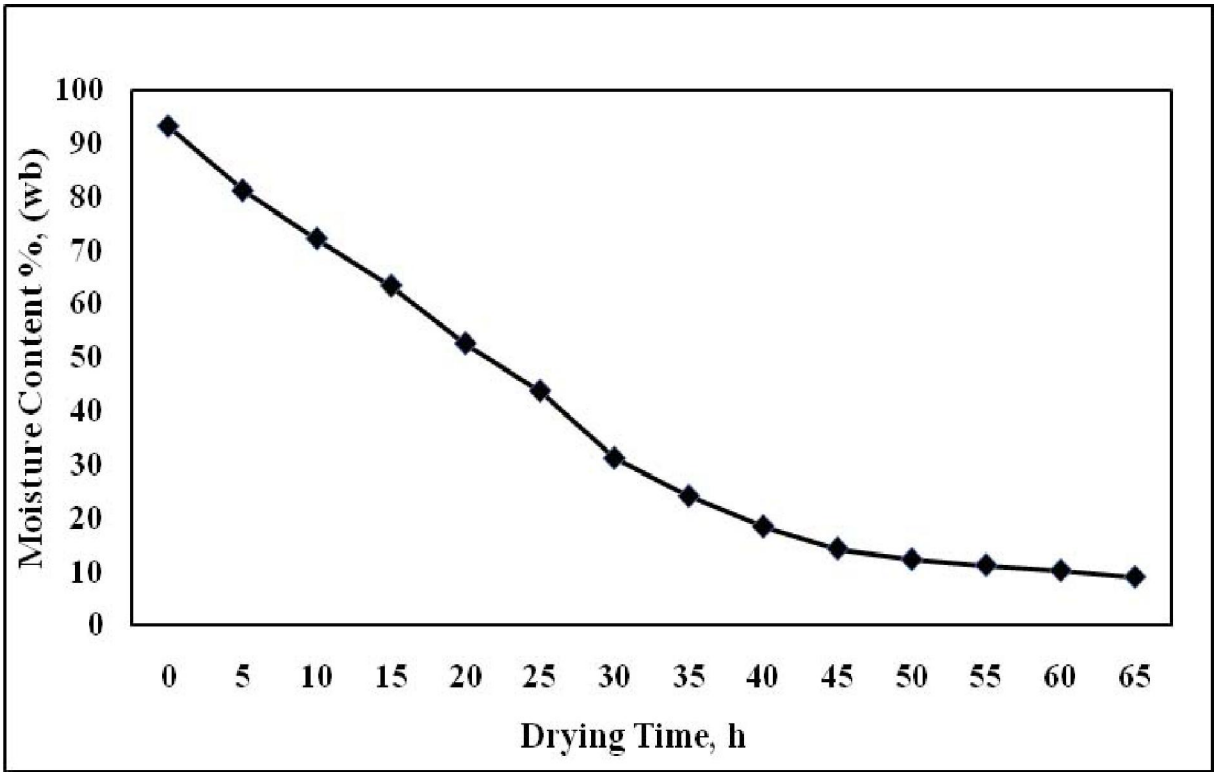

Fig. 4 Variation of moisture content against drying time in polyhouse dryer

Table 1. Proximate analysis of tomato powder.

	Polyhouse drying	Solar Cabinet drying	Open sun drying
Vitamin-C, %	25	32	29
Reducing Sugars,%	24	26	25
Total Carbohydrates, %	59	60	59
Total soluble solids, %	50	57	52
Lycopene content, %	66.12	79.09	75.15
pH	3.75	3.85	3.9

Production of Tomato powder

The various steps involved in the production of tomato powder are given in form of flow chart as shown in Fig. 1.

RESULTS AND DISCUSSION

Open Sun Drying

The sample was kept in open sun drying 8.00 AM on the sunny day and continued up to 5:00 PM. The partly dried slices wrapped in polyethylene cover and kept it at room temperature during night. On the next day, the partly dried slices as again exposed to open sun and it is dried to a final moisture content of 10.2% (wb).

Fig. 2 shows the variation of moisture content with respect to drying time and moisture content of samples decreases from 94.19% to 10.20% in total drying period of 110 h. From the figure, it is clear that the decrease in moisture content faster up to first 65 h (50.16%) of drying periods and later it was found slow and it took 70 h time to loose moisture content from 50.16% to 10.20%.

Solar Drying

The sample containing 3 kg of pretreated tomatoes slices at 93.18% (wb) moisture content was taken in to 100x100 mm mesh trays and placed inside the solar cabinet dryer and the dryer was exposed to sun on the bright sunny day and drying is started from 8.00 AM and continued till 5.00 PM.

The variation of moisture content with respect to drying time was shown in Fig 3. The moisture content of samples decreased from 93.18% (wb) to 10.15% (wb) in a total drying period of 90 h. From the Fig. 3, it is clear that the moisture content of slices of decrease with increased drying time.

As compared to open sun drying which took 110 h of drying time, the solar drying method saved about 20 h of drying time besides giving a best quality final product.

Polyhouse Drying

The sample containing 3 kg of pretreated tomatoes slices at 93.18% (wb) moisture content was taken in to 50x50 cm trays and placed inside the Polyhouse and drying is started from 8.00 AM and continued till 5.00 PM.

The variation of moisture content with respect to drying time was shown in Fig. 4. The moisture content of samples decreased from 93.18% (wb) to 10.15% (wb) in a total drying period of 90 h. From the Fig. 4, it is clear that the moisture content of slices of decrease with increased drying time.

As compared to open sun drying which took 110 h of drying time, the solar drying method saved about 45 h of drying time besides giving a best quality final product.

Proximate Analysis

The fresh tomato contains 20.6 -- 23.17 mg/100 g, 18%, 53.30%, 4.50% of vitamin C, total reducing sugars, lycopene and carbohydrates respectively. The results of proximate analysis of dried tomato slices in three different drying methods are given in Table 1.

The solar cabinet dried samples contained high amount of vitamin C, total carbohydrates, reducing sugars, TSS, lycopene respectively. The polyhouse dried slices almost showed the results very close as fresh tomato except about 6% reduction in TSS. The pH value was low in polyhouse as compared to solar cabinet and open sun drying.

It was concluded that, from the results of drying experiments and proximate analysis tests the tomato powder produced in solar cabinet drier may be considered as better quality product for human being consumption.

LITERATURE CITED

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