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Effects of SO_2 Application on Drying Time and Some Quality Characteristics of Dried Fruits on the "Hacıhaliloglu " Apricot(*Prunus armeniaca L.*) Variety

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Abstract

In this study, effects of drying apricot of a variety "hacihaliloglu" by applying SO2 on the quality of dried fruit has been analysed by comparing it to the method of drying it directly without sulphuring. According to the findings, it has been determined that there are substantial differences between these two drying methods in terms of total weight, dehydration as percentage and length of drying time. Weight loss in first three days of drying was important in both methods while it was unimportant for the following days. Differences between two methods in terms of some physical specifications like Water Soluble Solid Contents at the beginning of the drying, and, dried fruit ratio, stone weight, seed weight, and stone ratio at the end of the drying were determined to be unimportant.

Key words: Apricot, drying methods, sulphuring

INTRODUCTION

Apricot is an important fruit both for nutrition and for agriculture sector because of its fruit specifications and the nutriment elements it contains. It is consumed as fresh and dried, and besides, it is used as an input for the production of foodstuff like fruit juice, marmalade, fruit sauce, ice cream, pastry etc.[1,2,3]. Turkey, with production of 350.000 tonnes of fresh apricot, is one of the biggest producers of apricot in the world. Apricot produced in Turkey constitutes 20,15% of total apricot production in the world[4]. 55-60% of apricot production in Turkey is produced in Malatya. In Malatya Region, "Hacihaliloglu" variety of apricot constitutes 90% of dried apricot[1,5].

In Malatya region, different methods are used for drying apricots. Most of the apricots are dried under the sun light after being sulphurated when they are fresh. This method increases the durability of fruits; lengthens the storing time; and makes fruits look more brilliant and more attractive. But, this drying method is not preferred so much in terms of both human nutrition and taste because of the sulphur content of fruits[6,7].

Another drying method is to dry fruits directly under the sun without applying sulphur. This method has recently been used most commonly due to the facts that fruits are produced more organically; taste and flavour of the fruits are much beter; it can be applied much more easily and production costs are much lower in this method[1]. However, this method has also some disadvantages like having darker fruit color; having dried fruits to be spoiled much more easily; having fruits to turn sour easily; having fruits to become infested by bugs easily; having fruits which have higher enzymatic and microbial activity; and having fruits which have higher level of loss in vitamin C content[6,8]. Recently, some studies on drying the apricots in heated environments by using solar energy or mechanical heaters have been carried out in order to shorten the drying time, to lessen the loss in colors and quality, to prevent the pollution of the products[9,10,11].

Since almost all apricots in Malatya region are being dried directly under the sun in an open environment, the time needed for drying the fruits wholly is about 10 to 15 days. During such a long period of time natural color and quality of the product is being damaged and there can be some dirts on the products[1,2].

In this study, it is aimed to compare the two most commonly used drying methods of apricots which are drying directly under the sun, and drying under the sun with sulphuring, with respect to their effects on drying speed and time, on daily and total dehydration, on fruit efficiency and on some other dried fruit quality specifications.

MATERIAL AND METHODS

Material

This Study was carried out in district of Darende within the Malatya Province and, apricot of a kind named "Hacihaliloglu" which is most commonly grown in this region was used as a material. Sufficient numbers of samples from fresh apricots used in the study were obtained from different trees aiming to make their dimensions and ripenesses homogenous. Results were evaluated according to the completely randomized dizayn.

Methods

Sulphure Application:Sulphuring was applied twice in a sulphuring room with an area of 3x3 square meters by burning SO2 on bedsteads and in an amount of 2 kg sulphure per ton and by making apricots wait there for 8 hours for each sulphuring. Samples taken out of sulphuring

room after sulphuring started to dry on a cotton linen spred out on the smooth ground with other samples which would be dried without sulphuring[1,2,13,14,15,16].

Weight Loss and Other Measurings: During the experiment, temperature and relative humidity of the environment in which samples were left was measured once in every three hours, six times a day, and, these measures was repeated and recorded for eight days until samples was reached to the ideal drying level at which apricots have lose 55-60% of their total weight[17] (drying level which lets seeds of apricots can easily be

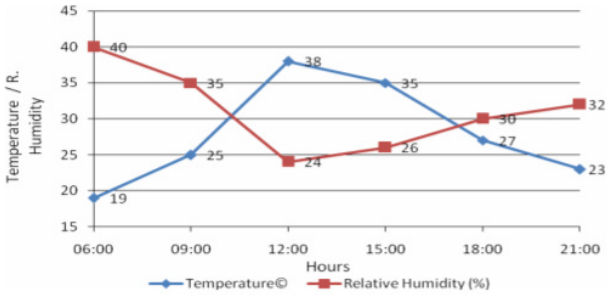

Figure 1. Changes in temparature and relative humidity during drying period

taken out of fruits). Daily changes are given in Fig.1. This period is the most appropriate time to take the seeds out of fruits. About 8% of the fruit weight which had already fallen by 55% was constituted by seeds. When the water content of the fruits which were left for drying after seeds were taken out is about 15-20%, this means that drying is completed[1,2,13,14,15,16]. Weight measuring of fruits which were drying for eight days were taken by means of scale sensitive to the 0.05 g and measures of total soluble solid(TSS) content were taken by means of hand refractometer[17].

As it can be seen from the table, samples, dried by the first method of drying with sulphuring(A1), were left for drying in an amount of 1000 g and their weight

RESULTS AND DISCUSSION

Fruits which were sulphured and weight of which were measured at the beginning were spred out on the floor and left for drying. Samples, starting on the first day, were weighted regularly at 06.00 pm. every day. Measures of daily and total dehydration at the end of 8th day are given on the Table 1' as below.

decreased to 401.20 g after 8 day drying period. While the weight loss was 158 g at the end of first day, it was only 36.37 g At the end of the last day of drying period. Dehydration as percentage was 15% of total weight at the end of first day while it was 59% in total at the end of last day. On the other hand, weight of the samples dried by the method of direct drying under the sun without sulphuring as a control(A2) decreased down to the level of 505.20 g at the end of 8th day. Weight loss was 126.20 g at the end of first day while it was only 28.50 g at the end of 8th day. Daily dehydration was 12.62% fort he first day while it was 49.48% in total. Comparative graphic set up for all these figures is given in Table 2."

As seen on the Table1 and Figure 2, there are substantial differences between two drying methods both in terms of total weight loss and dehydration as percentage at the and of 8th day and, these differences are important with 1% importance statistically for each specification.

According to the data we can easily say that samples dried with sulphuring were dried more quickly. When we look at the data, it can be said that this speed is about 10% and is around 3 days within the total drying time. As we compare these data with the results of other studies, these results are in conformity with the results of other studies and experiences of producers of the region. Just as Bostan and friends found out in their study that in 7 days drying time for Hacihaliloglu kind of apricots left on a cotton linen, total weight decreased to 45% and that difference between dehydration as percentage was important[17].

Table 1. Changes in dehydration and weight loss in fruits dried with different methods

	Sulphured (A1)		Nonsulphured (A2)	
Time (day)	Weight loss (g)	Dehydration (%)	Weight loss (g)	Dehydration (%)
1	158.00*	15.80	126.20 *	12.62
2	109.00**	26.71	91.13**	21.73
3	121.70**	38.88	91.06 **	30.84
4	64.80	45.36	48.02	35.64
5	53.30	50.69	57.31	41.37
6	45.80	55.26	53.11	46.68
7	36.40	59.00	28.50	49.48

LSD=(**): % 1 (*): % 5

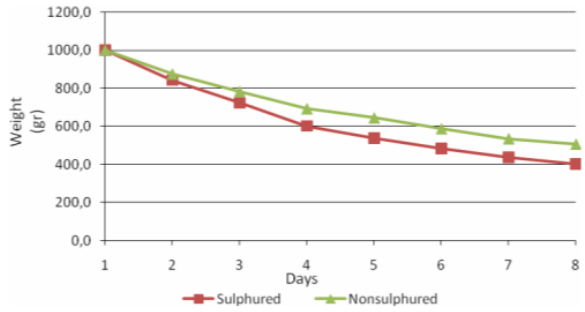

Figure 2. Weight losses in different methods during the drying period(g)

It can be argued that this difference between the drying speed of these two methods is originating from penetration of SO2 during the sulphuring period and from the softening effect caused by the application of very high heat on the tissues of fresh fruits. Because, high temparature and SO2 gas within the room during the sulphuring which lasts for eight hours and repeated for two times caused softening on the tissues and surfaces of fruits[2,5,12,15,17]. Similarly, in drying study of Durmus and friends[15]. made by means of solar collector, it was found out that sulphured samples were drying in a shorter period of time under the same temparature. Mengec et al.[8] have also found similar results by mechanical drying circumstances in laboratory environment and, these results are interpreted as a result of drying kinetics and very high diffusion parameters of fruits dried with sulphuring[2,8].

When we analyse the dehydration levels in both methods, we realise that dehydration on the first day of both methods are statistically important and, dehydration on the other days are unimportant. High level of water content within the fruits on the first 3 days can be a reason of this situation. As the water content of the samples started to decrease, so did the daily differences between the weight loss and dehydration levels of the samples and, differences after the 3rd day were unimportant. Bostan et al.[17] are supporting the finding that about 70% of total weight loss and dehydration was occured on the first 3 days.

Some other physical specifications of fruits have also been analized and compared after drying for both methods. Since weight of kernel affects the efficiency of dried fruit directly and seed weight rate affects the efficiency and quality of fruits to be used as snack or as foods, these two factors were analized within the framework of physical quality specifications. Average measurements obtained are given in Table 2' as below.

Table 2. Effects of different drying methods on some dried fruit specifications

Drying methods	Kernel weight rate (%)	Seed weight rate (%)	Dried fruit ratio(%)	Kernel ratio(%)	TSS (%)
Sulphured	29.87	10,14	70.14	33.94	26.23
Nonsulphured	25. 23	9.71	74.67	38.49	23.18

CONCLUSION

There are some differences between physical fruit specifications of two methods in Table 2, however, these differences are found to be unimportant statistically. Samples taken out of sulphuring room are scaled for their weight and their total soluble solid are measured in order to analyses the weight losses and changes in their total soluble solid content occured during sulphuring. It was observed that there is about 1% weight loss in fruits after fumigation and there is 2.94% increased in their total soluble solid content due to this weight loss. These changes are found to be unimportant statistically. By taking both above mentioned results and experiences of producers into account, we can conclude that there is an advantage of about 3 days earlier drying for the method of drying with sulphuring in total drying time of 12 to 15 days. When we take some factors into account such as climate of the region, work-load, pollution in products, losses in physical quality of products, time and labor, drying method arises as an important issue[2,8,17]. Taking the human health, quality of products, time and labor losses into account, drying in apricot production in the region should be made by means of modern methods such as solar energy or mechanical drying[8,9,10,15,16].

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