Effect of blanching – hot air drying combination process on physicochemical properties of dried Persimmon slices (Diospyrus kaki L.)

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Abstract**—** *Drying is one of the most important processes in preserving foods that plays an important role in maintaining the quality and quantity of their active ingredients. The main purpose of food drying is increasing shelf life and decreasing moisture of the final product. The hot air is used in the most drying processes. These dryers due to the rapid food drying are effective to color, flavor and taste preservation. These dryers can be crystalline food and dry them more similar to their original shape. The effect of different drying temperatures (٤٥, ٥٥ and ٦٥°C) with different treatments (blanching in boil water, water solution salt, sugar solution, citric acid solution, cinnamon solution and control sample) on drying time and drying kinetics of persimmon were compared. Samples were dried until constant weight was maintained. Results were showed a significant effect of pre-treatment Blanching in boiling water, salt water and sugar solution. The minimum drying time in the oven at ٦٥°C for ٦h on blanching in boiling water pretreated and the maximum drying time at ٤٥°C was observed for the control samples.*

Keywords-*Drying; pre-treatment; temperatures; Persimmon; Diospyrus kaki L.*

I. INTRODUCTION

Removing water from food and agricultural products constitutes a significant portion of the processing activity for persons working in the food and agricultural processing industries. Two major moisture removal methods are drying (or dehydration) to produce a solid product and evaporation to produce a more concentrated liquid. The words drying and dehydration are often used interchangeably, especially when referring to food products; however, only the word drying is commonly used when referring to processing of non-food products. Applications range from on-farm drying of grain, fruits, and vegetables to large scale commercial drying of fruits, vegetables, snack food products, milk products, coffee, and other products [٨,١٣].

The history of dry products in Iran goes back to very long period ago, and the most of the traditional methods (solar drying) is used [١٤].

Diospyros kaki is the most widely cultivated species of the Diospyros genus. Although its first published botanical description was not until ١٧٨٠, [٩, ٣] the kaki is also among the oldest plants in cultivation, known for its use in China for more than ٢٠٠٠ years. The persimmon (kaki) is a sweet, slightly tangy fruit with a soft to occasionally fibrous texture. This species, native to China, is deciduous, with broad, stiff leaves. Cultivation of the fruit extended first to other parts of East Asia, and was later introduced to California and southern Europe in the ١٩th century, to Brazil in the ١٨٩٠s, [١١] and numerous cultivars have been selected.

Apart from tannins, triterpenoid compounds such as α-amyrin, uvaol, ursolic acid, ١٩α-hydroxy ursolic acid and ١٩ α,٢٤-dihydroxy ursolic acid can be isolated from the leaves of D. kaki.[٥].

The purpose of this study was to investigate the effect of pretreatments and temperatures on drying of persimmon fruit (Diospyros kaki).

II. MATERIAL & METHOD

Sugar, cinnamon, salt and citric acid Powder were purchased from Merck Co. and one of the stores in the Mashhad.

A. Sample preparation

Persimmon fruit was purchased from local market in Sabzevar and was slice into pieces with thickness ٥mm. In order to measure the moisture, three samples as control samples were dried at ١٠٥°C for ٢٤ h to achieve constant weight [١٠ and ١]. The three pieces were inserted in a pretreatment solution (boil water, salt water, sugar solution, citric acid solution and cinnamon solution). Each of the samples after pretreatment was placed into three oven

temperatures (٤٥, ٥٥ and ٦٥°C). Digital scale with an accuracy of ±٠.٠١g was used to measure the weight changes of samples [١٢]. Every ٢٠ minutes, the sample was removed from the oven, then cooled in desiccator and then weighed and were returned into the oven immediately. This was done to achieve a constant weight.

B. *Statistical analysis*

Experiments were performed in three replicates and means were compared by Duncan test at ٥% level. Diagrams were plotted using Microsoft Excel software.

III. RESULTS AND DISCUSSION

Regression equations of moisture content for pretreatment of Persimmon slices are shown in Table ١. The results showed that with increasing temperature from ٤٥°C to ٦٥°C increased the rate of drying. Also, the effect of blanching pretreatment was also increased significantly with increasing drying temperature from ٤٥°C to ٦٥°C. Comparing the mean results of dried persimmon slices pre-treatment shown in Table ٢. The results also showed that blanching, salt and sugar soluble pre-treatments were more effective than the control samples, significantly and other treatments were not significantly different. Drying rate for the blanching pre-treatment showed the greatest increase; and then salt and sugar solution pretreated showed the greatest increase in the rate of drying.

Also the water temperature, considering the effect on the tissue can be effective on drying rate and water absorption [٢, ٧, and ٤].

TABLE I. REGRESSION EQUATIONS OF MOISTURE CONTENT FOR PRETREATED PERSIMMON SLICES

pretreatment	*Regression equations*	*R ٢*
Control	Y=٠.١٢٤x-٠.٨٧٥	٠.٩٥٤
Salt solution	Y=٠.١٣١x-٠.٧٨٤	٠.٩٤٤
Sugar solution	Y=٠.١٣٣x-٠.٨١٩	٠.٩٤١
Citric acid solution	Y=٠.١٢٤x-٠.٨٢١	٠.٩٤٨
Cinnamon solution	Y=٠.١٢٧x-٠.٨٧٠	٠.٩٥٦
Boil water blanching	Y=٠.١٢٧x-٠.٦٨٥	٠.٩١٧

Drying at ٦٥°C for control samples, boil water, cinnamon, salt, sugar and citric acid solutions is shown in figure ١. In this figure, the rate of moisture loss by the samples was plotted every ٢٠ minutes. Proximity curves on cinnamon and citric acid pretreatment is the most noticeable, but less in other forms adaptability between the two curves. This shows that there is a significant effect of pretreatment.

Kotwaliwale stated that the effect of pretreatment on fungal is significant. He also stated that the tissue stiffness of samples were immersed in potassium meta-bi-sulphite, are different from Blanche samples with hot water and steam, significantly [٦].

TABLE II. TABLE TYPE STYLES

Pre-treatment / *Temp.*	*Salt sol.*	*Cinnamon sol.*	*Sugar sol.*	*Citric acid sol.*	*Boil water blanching*
٤٥	٥٠.٩٩٩	٥٣.٨٩٨	٥٢.٠٩٤	٣٢.٧٢٨	٤٦.٥٥٣
٥٥	٥٥.٩٤٢	٤٧.٦٦٣	٥٠.٢	٥٥.٩٨٧	٤٨.٧٣٧
٦٥	٣٦.٦١٥	٣٩.٦٦٠	٣٢.٤٠	٣٧.٠٩١	٥٥.٠٤٩
Significancea	*	n.s	*	n.s	*

a. *, ns represents a significant and non-significant respectively (p<٠.٠٥)

IV. CONCLUSIONS

Effects of pretreatment in combination with hot air drying methods were evaluated on the progress of the drying process. The results of this survey showed that with increasing temperature from ٤٥°C to ٦٥°C, the drying rate in all samples increases. The blanching effect and salt and sugar solution were more effective than the control samples.

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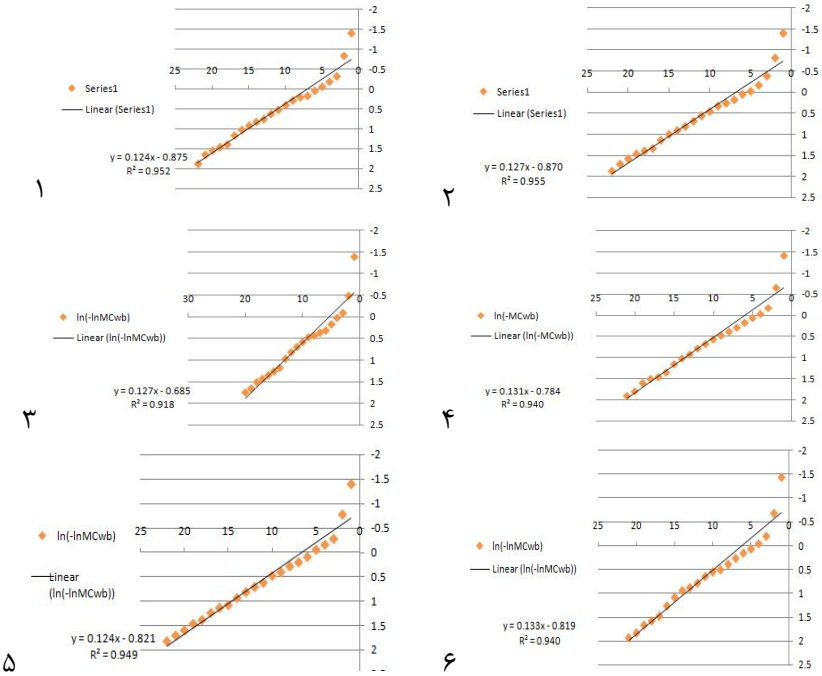

Figure ١. Drying at ٦٥°C for (١) Control, (٢) Cinnamon solution, (٣) Boil water blanching, (٤) Salt solution, (٥) Citric acid solution and (٦) Sugar solution