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Effects of Dried on Some Properties of Strawberry Tree Fruits

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In the fruits of two different genotypes (57A1 and 57A22) of Turkish strawberry trees (*Arbutus unedo* L.) dried at 70 and 80 °C in a computer connected parallel air flow type drier, fruit weight, fruit color and vitamin C were determined. In this study, it was determined that drying increased losses of fruit weight and Vitamin C, and soluble solid content and also colour variations in dried fruits occurred. In both genotypes, the drying at 70°C temperature was better than 80°C in terms of fruit weight, vitamin C, soluble solids and colour.

Key Words: Strawberry tree fruits, Drying, Vitamin C, Fruit weight, Colour.

INTRODUCTION

Strawberry tree, *Arbutus unedo* L., belonging to the family Ericaceae, is evergreen shrub or small tree usually smaller than 4 m[1,2]. *Arbutus unedo* is native in regions bordering the Mediterranean Sea especially in Southern European countries, but today it is also cultivated in the Near East and Transcaucasia[1,3]. It has edible, round, fleshy, red coloured fruits at full maturity and matured in autumn. Its fruits are eaten as both fresh and the product processed into jam, fruit jelly, wine, marmalades, spirits and liqueurs[3,4]. Its spirit is a popular and traditional alcholic beverage along with other distilled spirits from various Greek and foreign region[5]. Strawberry tree fruits are rich sources of Vitamin C (150-280 mg/100 g)[2]. *A. unedo* is used in herbal medicine due to having antiseptic, diuretic and antimicrobial properties[6-8]. A tea from the leaves is used as diuretic in Turkey[9]. Besides, it can be incorporated into yogurts either in pieces or as flavours and be utilized as berry in confectionery[4]. Its dried fruits can be

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also used to make tea, flavours and colourful *etc*. in industry. Dried strawberry tree fruits can be added to various food preparations[10,11]. They are sweeter because water of them has been removed. Chemical compounds of *Arbutus unedo* L. fruits[4,6,12] and its spirit[5] were determined in some studies. However, there is no investigation about drying applications for later use and physico-chemical changes occurred during drying up to now. The content of soluble solid, vitamin C in fruits and fruit colour influence markedly their sensory and visual quality. Thus, it seemed important to determine variation of these characteristics during drying process.

Strawberry tree fruits cannot be stored by cold storage method for along time because of its structure and also, storage conditions are not completely known. For later use, preserving of these fruits is needed. One of the oldest methods of preserving food is drying. Water removal from fruit by drying reduces the moisture content to a level, which allows safe storage over an extended period of time. Besides, drying or dehydration makes easier food product handling because of the volumetric shrinkage and weight losses[13]. Drying process involves heat and mass transfer, which may cause changes in product quality. Desirable and undesirable chemical and biochemical reactions may occur leading to changes in colour, texture or other properties of the fruit product. The method used for drying affects properties such as colour, texture and density[14]. In this study, we aimed to determine changes in soluble solid and vitamin C content and fruit colour in fruits dried by air flow type dryer at various temperatures of the two strawberry tree genotypes (57 Ayancik 01 and 57 Ayancik 22) with North Turkey origin.

EXPERIMENTAL

Ripe fruit samples belonging to two different genotypes of strawberry tree (*Arbutus unedo* L) (57A1 and 57A22) were collected at maturation period from Sinop Province in Black Sea Region in Turkey in end of November in 2004. The fruits samples come fully matured fruits were harvested piece by piece. The fruits were cleaned in an air screen to remove all foreign material such as dust, dirt, pieces of branches and leaves. Fruit weight, vitamin C and soluble solid content and fruit color were determined at both fresh and dry fruit samples. Fruit weight of fruit samples were randomly taken from each genotype freshly harvested and weighted by scale with 0.01 g sensitive. Vitamin C content was determined to according to AOAC[15]. Soluble solids by using a hand refractometer and fruit colour by a reflectance colorimeter were measured. Fruit colour was evaluated by measuring Hunter *L* (brightness, 100 = white, 0 = black), a (+, red; -, green), and b (+, yellow; -, blue) parameters of dehydrated strawberry tree by means of a reflectance colorimeter (CR 300, Chromomeeter, minolta, Japan). A white tile (No: 21733001) was used to standardize the instrument. From the instrumental Hunter *L, a, b* values, and color difference (ΔE) was calculated according to equation of $\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}$. Freshly harvested strawberry tree fruits were dried in a computer connected parallel flow type dryer at 70 and 80°C temperature. Data were numerically coded, entered into a database (SPSS for Windows) and analyzed. One-way analysis of variance (ANOVA) was used to test the hypotesis that several means are equal. Once we have determined that difference exists among the means, pair wise multiple comparisons were made using Duncan's Multiple Range Test. When the number of group was two, independent samples t-test was used to test hypothesis around mean.

RESULTS AND DISCUSSION

Weights of dried fruits significantly ($p < 0.01$) decreased compare to fresh fruits. However, there was no difference between 70 and 80°C in terms of fruit weight (Fig. 1 and 2). The average weight of fresh fruit was 8.34 g while dried fruits (57A1) were 2.80 and 2.68 g at 70 and 80°C temperatures (Fig. 3). Also, the similar result was also observed for 57A22. Weight loss due to drying was *ca.* 67 % in 57A1 and 63% in 57A22.

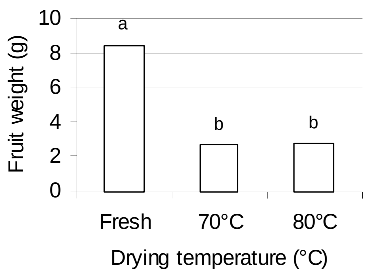

Fig. 1. Fruit weight of arbutus 57A1 dried at different temperatures

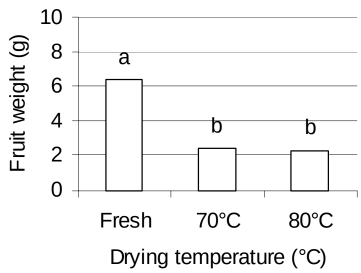

Fig. 2. Fruit weight of arbutus 57A22 dried at different temperatures

Vitamin C content of dried fruits significiantly ($p < 0.01$) decreased compare to fresh fruits in both genotypes. However, there was no difference between 70 and 80°C in terms of vitamin C content (Figs. 3 and 4). While the vitamin C content of fresh fruit was 215.0 ppm, thats of the fruits of dried at 70 and 80°C temperatures were 61.6 and 40.3 ppm, respectively, in 57A1. In 57A22, the vitamin C content in fresh fruit was 280 ppm and dried fruits at 70 and 80°C temperatures had 90 ppm and 50 ppm vitamin C content, respectively. Vitamin C loss in dried fruits were *ca.* 76 % in 57A1 and 74% in 57A22. Lis and Lis[16] suggested that losses of vitamin C increased with the increasing drying temperature in plums. Okoh[17] reported that considerable losses of vitamin C in sun dried some Nigerian vegetables were shown from between 252 and 980 mg/100 to between trace and 27 mg/100g.

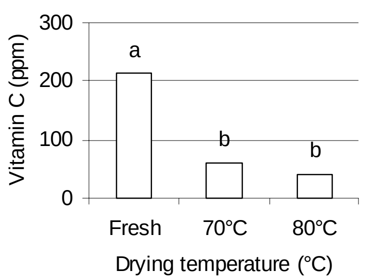

Fig. 3. Vitamin C content of arbutus 57A1 dried at different temperatures

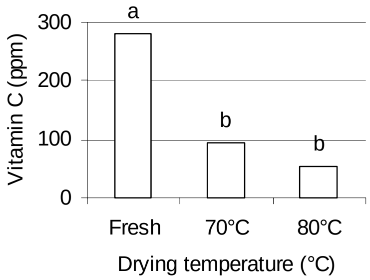

Fig. 4. Vitamin C content of arbutus 57A22 dried at different temperatures

Soluble solids of dried fruits significantly ($p < 0.01$) increased compare to fresh fruits in contrast to fruit weight and vitamin C in both genotypes. There was a significant difference between drying temperature of 57A1 and 57A22 (Figs. 5 and 6). The soluble solid of fresh fruit was 25.7 % while the soluble solids of dried fruit were 63.4 and 47.0 % at dried at 70 and 80°C temperatures, respectively, in 57A1. It was suprizing that soluble solid content at 70°C was higher than 80°C. This may be due to the higher temperature forming a film on the outside layer of fruits at the begining of the drying and protecting water removal throughout drying.

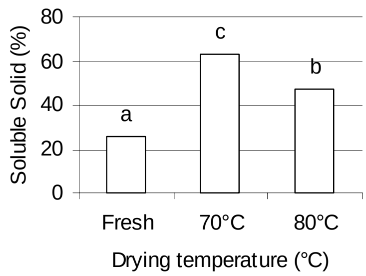

Fig. 5. Soluble solid of arbutus 57A1 dried at different temperatures

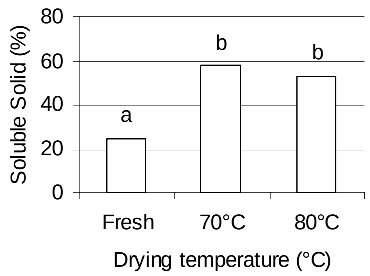

Fig. 6. Soluble solid of arbutus 57A22 dried at different temperatures

Colour plays an important role in appearance, processing and acceptability of food product. It is perceived as part of the total appearance[18]. The first quality judgment made by consumers on a food at the point of sale is based upon its appearance[19]. The effects of drying on the colour of strawberry tree are given in Figs. 9-14. The Hunter *L* value was influenced by the drying temperature ($p < 0.01$). Samples of 57A1 dried at 70 and 80°C showed lower *L* value than fresh samples. Samples of 57A22 dried at 70°C had the lowest *L* value (Figs. 7 and 8). The decrease in *L* value is correlated with the increase in browning of foods[20-22]. Koyuncu *et al.*[23] reported that the rosehip dried at 30°C showed an extensive browning.

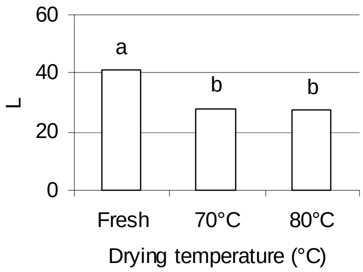

Fig. 7. Changes in Hunter *L* of arbutus 57A1 dried at different temperatures

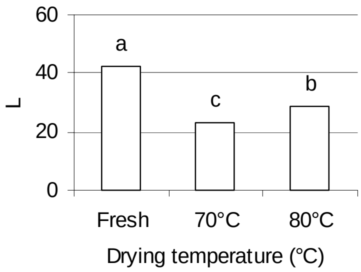

Fig. 8. Changes in Hunter *L* of arbutus 57A22 dried at different temperatures

The redness (*a*) and yellowness (*b*) values in the dried fruits in both genotypes decreased ($p < 0.01$) in comparison to fresh samples (Figs. 9-12). However, there was no significant difference between 70 and 80°C. Compare with the fresh strawberry tree, there were about 45% decline in Hunter *a* and *b* values in 57A1 while this decline was about 55-60 % in 57A22. Koyuncu *et al.*[23] stated that redness (a) and yellowness (b) values decreased in dried rosehip fruits in comparison to fresh samples. The colour difference (ΔE) at 80°C was more than at 70°C ($p < 0.01$) in 57A1 while there was no difference between dried fruits at different temperatures in 57A22.

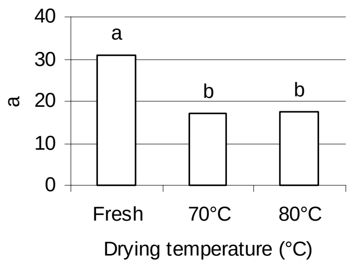

Fig. 9. Changes in Hunter *a* of arbutus 57A1 dried at different temperatures

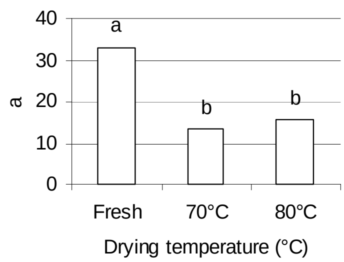

Fig. 10. Changes in Hunter *a* of arbutus 57A22 dried at different temperatures

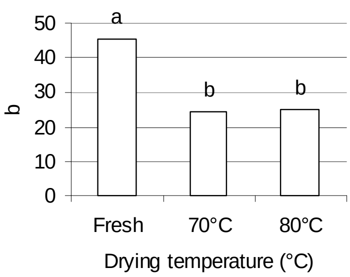

Fig. 11. Changes in Hunter *b* of arbutus 57A1 dried at different temperatures

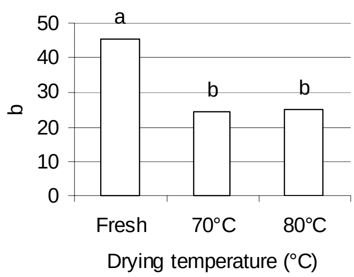

Fig. 12. Changes in Hunter *b* of arbutus 57A22 dried at different temperatures

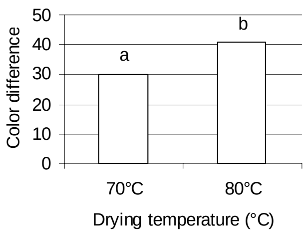

Fig. 13. Changes in colour difference (ΔE) of arbutus 57A1 dried at different temperatures

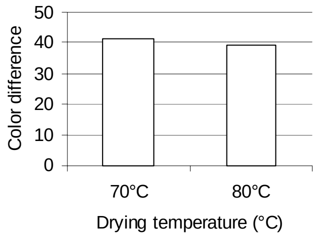

Fig. 14. Changes in colour difference (ΔE) of arbutus 57A22 dried at different temperatures

In this study, it was concluded that drying process increased the losses of fruit weight and vitamin C, and soluble solid content and also color variations in dried fruits were occurred. In 57A1, the drying at 70°C was more effective of 80°C in terms of soluble solids and color difference. Consequently, it can be suggested that strawberry tree fruit should be dried at 70°C for better quality and energy saving.

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