

Research Article

The Effects of Different Dipping Solutions and Storage Conditions on the Colour Properties of Raisin

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Abstract: In this study, we survey about the effect of pretreatment on the sultana (Raisin) color. We use from three kinds of solutions, 0, 5 and 10% of potassium carbonate salt and 5 % of Pakistan oil for pre treating. Dried grapes are stored at three levels of temperature (4°, 18° and 32°C) with three relative humidity. Relative humidity gets from saturated solution of potassium carbonate salt, potassium acetate and sodium chloride salt. We assess the color of samples in (2, 5 and 8 months) by Hunterlab. Color analysis indicates that the factors are studied (chemical pretreatment, temperature, keeping time) affect on color of raisins indexes. During keeping time the lowest index *L* pertains to those samples which are kept at 4°C and by increasing keeping temperature index *L* decreases and index *a/b* increases. *A/b* index will decrease when the concentration of potassium carbonate in emulsion increase and therefore color will be brighter.

Keywords: Chemical pretreatment, color, storage conditions, raisin

INTRODUCTION

Color is one of the important qualitative aspects of processing and non-processing foods and plays an important role in acceptance of that product. In addition it may show the chemical changes that happen during production and keeping period. Most of researchers defined product color as important change in dried grapes quality that changes during drying and keeping period for some chemical and biochemical actions (Esmaili *et al.*, 2007). Product color will affect a lot factors that some of them are attendance before drying and housing situation and lightening (Simal *et al.*, 1996). Among other foodstuffs, color changes in raisin is easier and this fact is for brownish action whether with enzyme or without it, warehousing and product distribution (Martins *et al.*, 2001; Canellas *et al.*, 1993). Brownish actions that are without enzymes can be defined as a hierarchy of phenomena that start with the reaction of acid amino (peptide amino) or protein group with glycoside hydroxyl of sugar and finish by formation of nitrogen polymers or melanoidins. In normal form consumers prefer grapes or raisins with brighter colors so avoidance of their brownish that lead to darkness and bad favor in raisin has significant importance (Buglione and Lozano, 2002). In order to decrease the ratio of fruit darkness during drying and warehousing periods, control of sulfur dioxide has wide

application in food industry and acts as an anti-oxidation and save the color and favor of dried fruits (Roos and Himberg, 1994). Also preparing with alkali emulsion leads to producing with bright color. Alkali environment prevents raisin color from darkening by controlling oxidase polyphenol and decreasing drying time (Esmaili *et al.*, 2007).

Esmaili *et al.* (2007) studied the effect of different preparing methods on raisin color and reported that prepared samples with alkali emulsion have brighter color rather than prepared samples with hot water and pretreatment with chemical solutions affect evaluating factors dramatically (Esmaili *et al.*, 2007). Also Simal *et al.* (1996) introduced keeping temperature as the main factor on raisin color changes and reported that increase in keeping temperature severe the brownish reaction. Canellas *et al.* (1993) studies the effect of keeping temperature on samples color. Tarr and Clingeffer (2005) who studied about keeping and packing situation on color of dried fruit reported that keeping temperature and amount of oxygen in keeping environment have a great effect on color. They also mentioned that high temperature and keeping time have a negative impact on the color of dried fruits (Tarr and Clingeffer, 2005). Modifying conventional methods to optimize preparing and keeping situation have an important priority. Unfortunately there isn't enough information about relation of biophysical features of

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dried grapes with preparing methods up to now, the effect of basic factors such as amount of alkali in emulsion and keeping situation on qualitative indexes don't take into consideration. In this study, the effects of alkali emulsion on preparing grapes and the effect of temperature and relative humidity in keeping environment on the color during keeping period are studied.

MATERIALS AND METHODS

This study was conducted in Urmia 2 years ago. Seedless grape prepared from Urmia gardens. This study was conducted in Urmia. Grapes primary humidity is about 74-75 % based on the weight of grapes and mean Brix of grapes was 25°. A table refract meter (Erma-Optical, Works, LTD, JAPAN) is used to measure Brix of grapes. A sensitive balance (Ohaus, AS200, USA, ±0.0001g) is used to weight samples and chemical material. A Hunter-Lab colorimeter (Hunter Lab DP-9000 color, Virginia, USA) is used to evaluate colors of samples in environment temperature. Color was expressed in Hunter Lab units *L* (lightness) and chromaticity parameters *b* (yellow-blue) and *a* (red-green). An incubator with a refrigerator is used to keep samples in temperature 18°C and also a refrigerator is used to keep samples in 4°C. In order to dry samples that are in a tray and covered by argent grid a mortar with compulsory air flow (Heraeus, W. Germany) is used. Harvested samples have been kept at 4°C temperature. After measuring humidity and Berix, the safe seeds are separated from their cluster. Then 4.5 Kg of them have been divided into 9 equal groups that each of them was 500 g and each one pretreated separately.

Table 1: The relative humidity that has been created by saturated salts in temperature of storage

| Chemical treatment | Temperature (°C) | | |
|---------------------|------------------|-------|-------|
| | 4 | 18 | 32 |
| Potassium acetate | 29.51 | 25.41 | 22.18 |
| Potassium carbonate | 46 | 44.85 | 43.84 |
| Sodium chloride | 80.77 | 77.62 | 74.87 |

To pretreatment, grapes are saturated during 30 seconds into three solutions (5% Pakistan oil that is without potassium carbonate, 5% potassium carbonate salt and 5% Pakistan oil and 10% potassium carbonate salt and 5% Pakistan oil). This study was done at 40°C temperature. Then each group is spread in separate trays and dried at 50±0.2°C. After drying process and keeping 48 h in environment temperature, dried samples are poured in polyethylene bags that are shallow and open and then are placed on a glass trivet in the glass container including saturated salt (saturated solution of sodium chloride salts, potassium carbonate, potassium acetate that are prepared at 80°C) with standard humidity (Table 1) and after that container's door was closed tightly. Also containers are kept at three temperatures 4°, 8° and 32° for 2, 5 and 8 months. These samples were analyzed after passing this time. The results obtained were analyzed statistically using SAS software and figures were plotted in Microsoft Excel 2003.

RESULTS AND DISCUSSION

In order to survey the effect of pretreatment and storage conditions in dried grapes texture, some of the prepared samples are evaluated by using texture device (Table 2).

Table 2: Experimental design for investigated parameters including alkaline pretreatment, temperature, and relative humidity on raisin textural properties

| NO. | Temperature | K2CO3% | Relative humidity | NO. | Temperature | K2CO3% | Relative humidity |
|-----|-------------|--------|-------------------|-----|-------------|--------|-------------------|
| 1 | 4 | 0 | 80.77 | 24 | 4 | 10 | 46 |
| 2 | 32 | 0 | 22.18 | 25 | 32 | 10 | 74.87 |
| 3 | 32 | 0 | 74.87 | 26 | 4 | 5 | 46 |
| 4 | 32 | 0 | 22.18 | 27 | 32 | 5 | 22.18 |
| 5 | 4 | 0 | 29.87 | 28 | 18 | 5 | 77.62 |
| 6 | 32 | 10 | 74.87 | 29 | 4 | 5 | 29.51 |
| 7 | 4 | 10 | 80.77 | 30 | 18 | 5 | 44.85 |
| 8 | 32 | 10 | 74.87 | 31 | 32 | 0 | 74.87 |
| 9 | 32 | 10 | 22.18 | 32 | 18 | 0 | 25.41 |
| 10 | 4 | 10 | 29.51 | 33 | 4 | 0 | 88.41 |
| 11 | 32 | 0 | 80.77 | 34 | 4 | 0 | 80.77 |
| 12 | 32 | 0 | 22.18 | 35 | 18 | 0 | 44.85 |
| 13 | 4 | 0 | 29.51 | 36 | 32 | 5 | 22.18 |
| 14 | 32 | 0 | 74.87 | 37 | 32 | 5 | 43.84 |
| 15 | 32 | 0 | 74.87 | 38 | 4 | 5 | 29.51 |
| 16 | 4 | 10 | 29.51 | 39 | 18 | 5 | 77.62 |
| 17 | 32 | 10 | 22.18 | 40 | 4 | 5 | 46 |
| 18 | 32 | 10 | 74.87 | 41 | 18 | 5 | 44.85 |
| 19 | 32 | 10 | 29.51 | 42 | 18 | 5 | 44.85 |
| 20 | 4 | 10 | 80.77 | 43 | 18 | 5 | 44.85 |
| 21 | 32 | 10 | 22.18 | 44 | 18 | 5 | 44.85 |
| 22 | 18 | 10 | 25.41 | 45 | 18 | 5 | 44.85 |
| 23 | 4 | 10 | 80.77 | - | - | - | - |

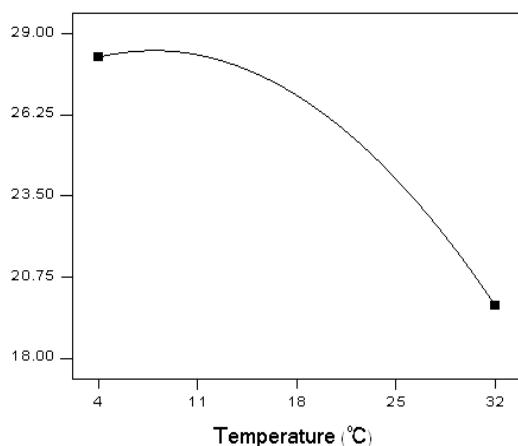


Fig. 1: The relationship between storage temperature and "L"

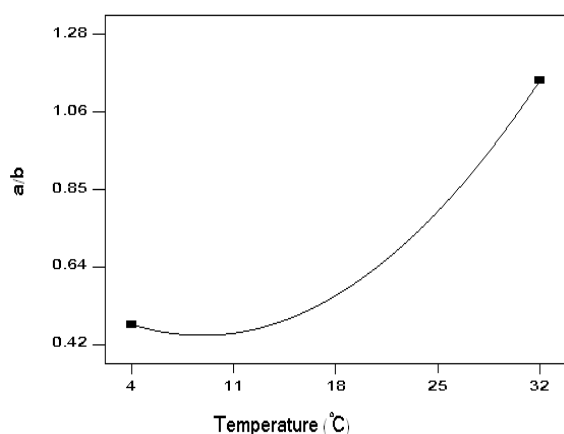


Fig. 2: The relationship between storage temperature and "a/b"

Color is a main qualitative feature in dried fruits and changes during and keeping time for some chemical and biochemical reactions. In general two kinds of browning reactions lead to color change, enzyme kind and non-enzyme kind. Some effective features on occurrences of browning reactions are temperature, sugar concentration and its nature. As temperature increases, the rate of browning reaction and the amount of pigment carbon and as a result the severity of color increase (Gee, 1980). The judgment index to determine the best color for grapes is the highest number (L) and the lowest number of ratio (a/b) (Esmaili *et al.*, 2007).

The color of pretreatment samples in the specific time is analyzed. After statistical evaluation, different data were evaluated.

The amount of a , b , L for all samples in the specific times are determined. Results show that keeping temperature in 0.05 has negative impact on L value. As you can see in Fig. 1, as the environment temperature

increases, the amount of L will decrease. Decrease of L in raisin samples through temperature domain (4, 11°C) is not meaningful while by increasing of keeping temperature, L changes get more. From temperature higher than 20°C decrease in amount of L will be more and kept samples at 32°C have the lowest amount of L rather than other samples.

Keeping temperature in a/b changes have meaningful impact. As you can see in Fig. 2, the amount of a/b ratio at 4°C have the lowest changes and this amount have low changes between 4-11 temperature domain but its increase is considerable when keeping temperature increases.

In kept samples at temperature higher than 18°C, the increase trend of a/b is ascendant and this amount at 32°C is maximum.

Color changes depend on occurrences of color changing reactions. In foodstuff keeping, color changes result from enzyme browning reaction, non-enzyme browning reaction and the browning resulted from acid ascorbic oxidation and color changing is related to these reactions. According to given explanations it is determined that kept samples at 4-11°C have the lowest color change in compare to other samples, so they have higher quality.

The research that conducted by Canellas *et al.* (1993) about raisin color in different situation shows that stored samples at 20-25°C have the lowest amount of L rather than other samples and so have darker colors and kept samples at 4 and 11°C have the most amount of L , so they have more suitable color (Canellas *et al.*, 1993). Simal *et al.* (1996) reported that amounts of L , a and b in stored samples at 27°C and 35°C decrease dramatically. And they refer to keeping temperature as an important parameter on the color (Simal *et al.*, 1996). After sensory evaluation of samples, Bride *et al.* reported that samples kept at 20°C have higher acceptance and as temperature increases, their color gets darker and their acceptance decreases. The results of this research are in accordance with Simal *et al.* (1996) and Canellas *et al.* (1993). Keeping temperature is an important factor in relation to increase in changing rate, because as temperature increases in dried production, the browning rate increases and the color of raisin gets undesirable.

To survey the effect of pretreatment on raisin color at different temperatures, their color is evaluated and amounts of a , b and L are gained. After statistical analyzing it is observed that a/b ratios decrease when the concentration of potassium carbonate increases and the color of our samples will be brighter. Figure 3 shows that a/b ratio decreases when the concentration of alkali in emulsion increases, though this decrease is meaningful, when it is between 7.5-10% in potassium carbonate concentration, we can obtain constant a/b ratio.

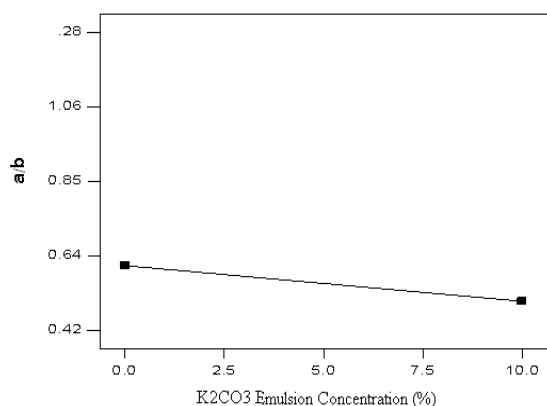


Fig. 3: The relationship between K₂CO₃ Emulsion Concentration on (a/b)

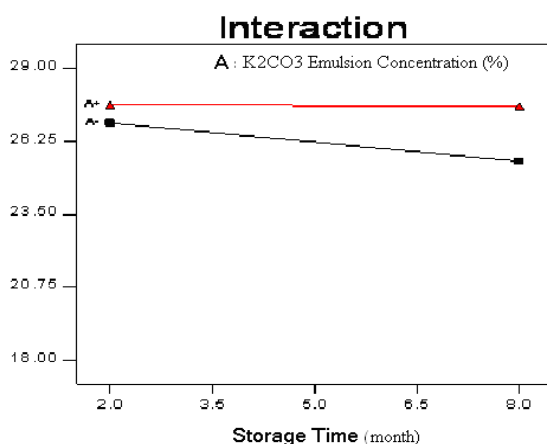


Fig. 4: Interaction of K₂CO₃ Emulsion Concentration and storage time on "L" A+ =10% K₂CO₃, A- = 0% K₂CO₃

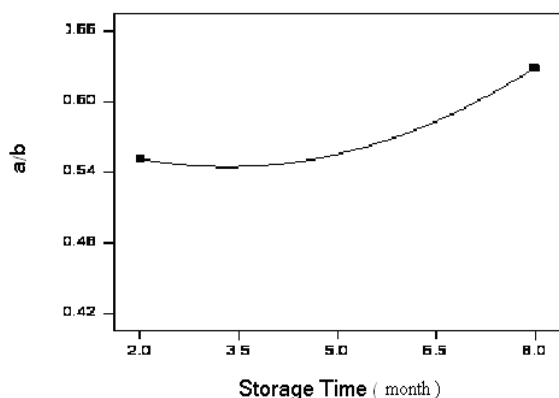


Fig. 5: The relationship between storage time on " a/b"

Mahmutoglo *et al.* (1996) a studied the effect of different material on pretreatment and also on raisin color. They reported that during warehousing period the amount of *a/b* in grapes which pretreated by emulsion

including potassium carbonate is lower than other methods and the color of non-treatment raisin has lower amount of *L* and they are darker. Finally they reported that pretreatment has meaningful impact on raisin color and the amount of *a/b* changes by pretreatment method (Mahmutoglo *et al.*, 1996). Simal *et al.* (1996) after evaluating the color of samples, reported that primary pretreatment and type of consuming material has considerable effect on three parameters of *a*, *b* and *L*. Esmaili *et al.* (2007) reported that the color of those raisins that pretreated by potassium carbonate emulsion and Pakistan oil after ethyl oleate has more *L* and the ratio of *a/b* is lower. The results of all these researchers agree that to get bright color, grapes pretreatment is necessary. Not only pretreatment increases drying rate, but also effect on color and main parameters. Alkali materials prevent poly phenyl reaction and finally the raisin color gets bright. When the concentration of potassium carbonate is zero, samples color is bright and this point is for oily solution. Oily solution decreases drying time and finally improves the product's color (Esmaili *et al.*, 2007; Simal *et al.*, 1996; Mahmutoglo *et al.*, 1996; Alizadeh *et al.*, 2010).

Figure 4 shows the interaction of alkali emulsion and storage time on the amount of *L* in different situations. As you can consider in Fig. 4, the amounts of *L* in pretreated samples by solutions without potassium carbonate decrease after 8 months but the amounts of *L* in samples pretreated with emulsion including 10% potassium carbonate and 5% Pakistan oil, the amounts of *L* don't change after 8 months. According to the figure and above definitions we should prepare primary samples with emulsion including potassium carbonate salt till the color of products gets brighter and constant up to the end. Because of polyphene compounds in the shell, it seems that the high concentration of potassium carbonate controls these compounds and decreases the browning reaction. In Fig. 4, you can see that prepared samples with emulsion including 10% potassium carbonate salt and finally their color are brighter.

In Fig. 5, the effect of keeping time on the ratio of *a/b* is shown. As you can see in this figure, the decrease of *a/b* is ignorable during the first four months and it changes by passing time and after 8 months, it has the highest amount.

Researchers conducted by Canellas *et al.* (1993) shows that samples have more color changes during the three first months and after this times color change increase. Mahmutoglo *et al.* (1996) reported that kept raisins color gets darker by passing time and decrease of *L* is considerable. Simal *et al.* (1996) reported that keeping time has meaningful impact on the amounts of *a*, *b* and *L*.

According to the results of this research and other scientific resources, it is defined that produced raisin

should be consumed during short time after production and it shouldn't be kept for long time. Raisins can be stored for 5 months in specific situations and after this time they get darker and undesirable.

CONCLUSION

Results of this study show that preparing and keeping situations affect the color of raisin samples. Color evaluations show that keeping temperature affects the color. As the temperature increases, the amounts of *L* decrease and *a/b* ratio increases. Finally the color of samples gets darker and the samples color has lower changes at the temperature between 4-11°C.

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