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EFFECT OF DRYING ON GRAPE RAISIN QUALITY PARAMETERS

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ABSTRACT

In present study the effect of the pretreatment and its effect on the different quality parameters were studied. The effect of different chemical combinations and without treated grapes were subjected to pretreatment before drying i.e. dipping grapes in to 0.5% NaOH solution at 90^{o}C for 2-3 sec repeated for two to three times and then dipped in to Ethyl oleate 1.0% + Potassium metabisulfite 1.0% pretreatment used in drying of grapes improve the physical and chemical properties of raisins and also reduce the time required for drying. Dipping treatment reduced the drying time i.e. for treated grapes it was 21 hrs. and for without treatment it was -30 hrs. In case of color and texture profile the results obtained by tray dryer with pretreatment was less hard than the without treatment.

Keywords: Texture, NaOH, Ethyl oleate, Potassium metabisulfite, Color

I. INTRODUCTION

Grape (*Vitis vinifera*) is grown from temperate to warm regions; however, hot and dry climate is ideal. Indian grapes come in varied characteristics namely colored, white, seeded, unseeded, large and small berries. Indian grapes are successfully grown at and above 250 mean sea levels. Major grape growing states are Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, and the north western region covering Punjab, Haryana, western Utter Pradesh, Rajasthan and Madhya Pradesh. Maharashtra ranks first in terms of production accounting for more than 75% of total production and highest productivity in the country. Grape is one of the important fruit covering an area of 60.2 thousand hectares occupying 1.30% of the total area. During 2013-14, the production and productivity of grapes in India increased to 25, 85,000 MT and 21.8 MT/ha respectively with marginal increase in area of production to 1, 18,700 ha The total grape export from India during the year 2013-14 season was 192617 MT worth Rs. 166.65 millions Among the several cultivars grown in India. Thompson seedless is the most popular variety due to its high consumer acceptability for raisins and more than half of the world raisins are being produced using this variety. Thompson Seedless and its clones are the major white seedless grapes grown on approximate 70% area. (NHB, 2014 data and FAO, 2014).

Pre-treatment is a necessary step in raisin production in order to ensure the increased rate of water removal during the drying process. A faster water removal rate decreases the rate of browning and helps to produce more desirable

raisins. Food products generally undergo some pre-treatment before drying with intention of some changes either physical or chemical changes – which help enhance mass transport and hence the drying rate as well as quality of the dried products. Pre-treating helps keep light-colored fruits from darkening during drying and storage and it speeds the drying of fruits with tough skins.

Drying removes the moisture from the grapes so bacteria, yeast and mold cannot grow and spoil the grapes. Drying also slows down the action of enzymes (naturally occurring substances which cause foods to ripen), but does not inactivate them. Because drying removes moisture, the grapes becomes smaller and lighter in weight. Grapes can be dried in the sun, in an oven or in a food dehydrator by using the right combination of warm temperatures, low humidity and air current. Drying is one of the oldest methods of preserving food, Slows down but doesn't completely inactivate enzymes. Drying also helps in the preservation of the grapes thereby increasing its shelf life.

II. MATERIALS AND METHODS

2.1 Raw Materials

The Thomson seedless and sonaka grape verities were procured from local market of Kolhapur. After the removal of unripe and spoiled one, the seedlings were washed thoroughly with water and stored at refrigeration temperature (4 ± 1^0C) until further use.

Chemicals

Sodium hydroxide, Sodium metabisulfite and Ethyl oleate were used of laboratory grade.

Packaging Material

LLDPE/Nylon (130 µ)

2.2 Methods

Pretreatments

A. Control without pretreatment
B. Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0%

Chemical composition of grape fruits

2.2.1 Determination of moisture

Moisture content was determined by using hot air oven drying method. 5 gm of sample was taken in pre-weighed empty petri plate and dried in hot air oven at 105^{0}C till constant weight were obtained (6 -7 hrs.). Plates were cooled in desiccator. The moisture content was calculated by using formula as reported by Ranganna, 1986.

$$\% \text{ Moisture} = \frac{\text{Loss in weight of sample after drying}}{\text{Weight of sample taken}} \times 100$$

2.2.2 Determination of crude fat

Fat content was determined by extracting 0.5 g of crushed sample using petroleum ether (60-80^{o} fraction) as solvent (AOAC, 1990) using semiautomatic SOCS PLUS SCS 4 equipment.

$$\% \text{ Crude fat} = \frac{\text{Weight of ether soluble material}}{\text{Weight of sample taken}} \text{ X } 100$$

2.2.3 Determination of crude protein

Crude protein content was determined by Microkjheldhal method (N×6.25) as per procedure of (A.O.A.C 1990).

$$\% \text{ N} = \frac{(\text{Sample} - \text{balnk}) \times \text{N of HCL} \times 0.014}{\text{Aliquote taken} \times \text{Wt. of sample(gm)taken}} \text{X } 100$$

$$\% \text{ Crude protein} = \% \text{ N X } 6.25$$

2.2.4 Determination of crude fiber

Crude fiber content of the sample was determined by the method of A.O.A.C. (1990). Crude fiber expressed as % crude fiber.

$$\% \text{ Crude fiber} = \frac{(W1 - w2)}{W} \text{X } 100$$

W1= weight in gm of Gooch crucible and contents before ashing

W2 = weight in gm of Gooch crucible containing ash

W = weight in gm of dried material taken for the test

2.2.5 Determination of ash

Ash content was determined by the method of A.O.A.C. (1990). Take 5 g of sample in silica crucible was ignited on low flame till smokeless and incinerated in muffle furnace at 550^{0}C for 5 hours. It was then cooled in desiccator and weighed.

$$\% \text{ Ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

2.2.6 Determination of total carbohydrates

Total carbohydrates content was calculated by difference method using following formula (Ranganna, 1986).

% Total Carbohydrate = 100 – (% moisture + % crude fat +% crude protein % + ash).

2.2.7 Determination of total soluble solids

The content of total soluble solids (T.S.S.) of fruit was determined with the help of hand refractometer (ERMA) corrected at 20^{o}C. A care was taken that the prism of refractometer was washed with distilled water and wiped dry before every reading (A.O.A.C.1990).

2.2.8 Determination of total Sugar

Total sugar was estimated as described by Ranganna (1986). 50 ml of the pulp was taken in a 250 ml volumetric flask. 5 g of citric acid and 50 ml of water was added and boiled gently for 10 min to complete inversion of sucrose. The solution was cooled and transferred to a 250 ml volumetric flask and neutralized with 1 N NaOH using phenolphthalein as indicator. Volume was then made 100 ml. An aliquot of this was then titrated against 10 ml of mixed (5 ml Fehling A + 5 ml Fehling B) Fehling's solution using methylene blue as an indicator.

2.2.9 Determination of acidity

The acidity of sample was calculated by standard A.O.A.C. method (1990). Acidity was expressed in per cent acidity as citric acid.

$$\% \text{ Acidity as citric acid} = \frac{\text{Titer x Normality of NaOH x Volume made up x 64 x 100}}{\text{Vol. taken for estimation} \times \text{Wt/ vol. of sample taken} \times 1000}$$

Measurement of color

Color measurements of the samples were carried out by using Color Flex EZ Spectrophotometer (Hunter Lab). The instrument was standardized every time during all the trials with a black tile and a white tile.

Measurement of texture

Texture analysis of fresh grape and raisin samples were carried out by using texture analyzer (Stable Microsystems Ltd., UK, Model TA-TX2i). Skin strength, elasticity and hardness were measured for grape and raisin samples

Sensory evaluation

The sensory evaluations of samples were carried out for the attributes like appearance, flavor, taste, texture, color and overall acceptability according to the method of Amerine *et. al*., (1965) on 9 point hedonic scale by a panel of ten semi-trained judges.

Statistical analysis

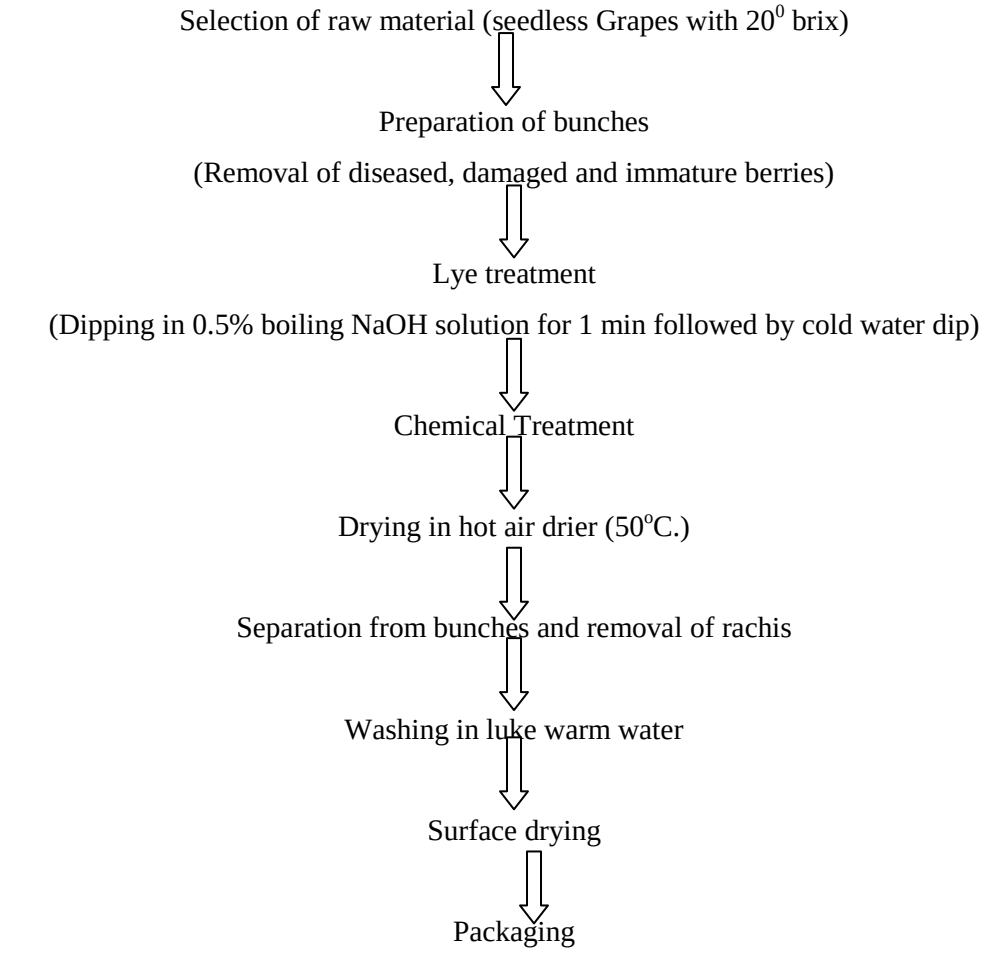
The results obtained were subjected to statistical analysis of variance (ANOVA) using complete randomized design. The critical difference at $P<0.05$ was estimated for significant difference.

Hot air drying

Hot air cabinet dryer was used for grape drying. The dryer was adjusted temperature ranges of 50^{o}C. The grapes sample was put on metal tray. The metal tray had wire mesh at the bottom to hold the samples. Constant temperature was held. Moisture loss was recorded by a digital balance at 60 min intervals during drying. The drying cycle was

repeated to reach the case of no change in grapes weight. The process for preparation of grape raisin preparation by using hot air drier is outlined in the given figure (Kassem *et al.*, 2011.)

Methodology for grape raisin preparation



(Australian cold dip method, Doreyappacowda, 1998)

III. RESULT AND DISSUSSION

Table 1 Physico-Chemical analysis of grapes varieties

Sr. no.	Parameters	Grape varieties	
		Thompson	Sonaka
1.	Moisture (%)	80.0	82
2.	Ash (%)	0.30	0.28
3.	Protein (%)	0.50	0.57

4.	Fat (%)	0.10	0.16
5.	Crude Fiber (%)	1.5	1.7
6.	Total soluble solids(°Brix)	17.5	18.5
7.	Total sugar (%)	10.54	12.71
8.	Titratable acidity (%)	0.15	0.12
9.	PH	6	6

*Values are average of three determinations.

Physico chemical analysis of different varieties of Grapes viz. Thompson seedless, Sonaka were carried out with average observations .The % moisture content found in both the varieties of grapes was 80% for Thompson seedless & 82% for sonaka, the % Ash content found in both the varieties of grapes was 0.30% for Thompson seedless & 0.28% for sonaka, the % Protein content found in both the varieties of grapes was 0.50% for Thompson seedless & 0.57% for sonaka while the % fat content found in both the varieties of grapes was 0.10% for Thompson seedless & 0.16% for sonaka whence the % Crude Fiber content found in both the varieties of grapes was 1.5% for Thompson seedless & 1.7% for sonaka, the % Total soluble solids content found in both the varieties of grapes was 17.5% for Thompson seedless & 18.5% for sonaka where as the %. The Total sugar for both the verities was 10.54% and 12.71 %, Titartable acidity content found in both the varieties of grapes was 0.15% for Thompson seedless &0.12% for sonaka and the pH content found in both the varieties of grapes was 6 for Thompson seedless & 6 for sonaka. But for grape raisin preparation the most suitable variety was Thomson seedless because of its size and shape so it was finalized. Obtained results are at par to the results obtained by Thakur *et.al.*, 2010.

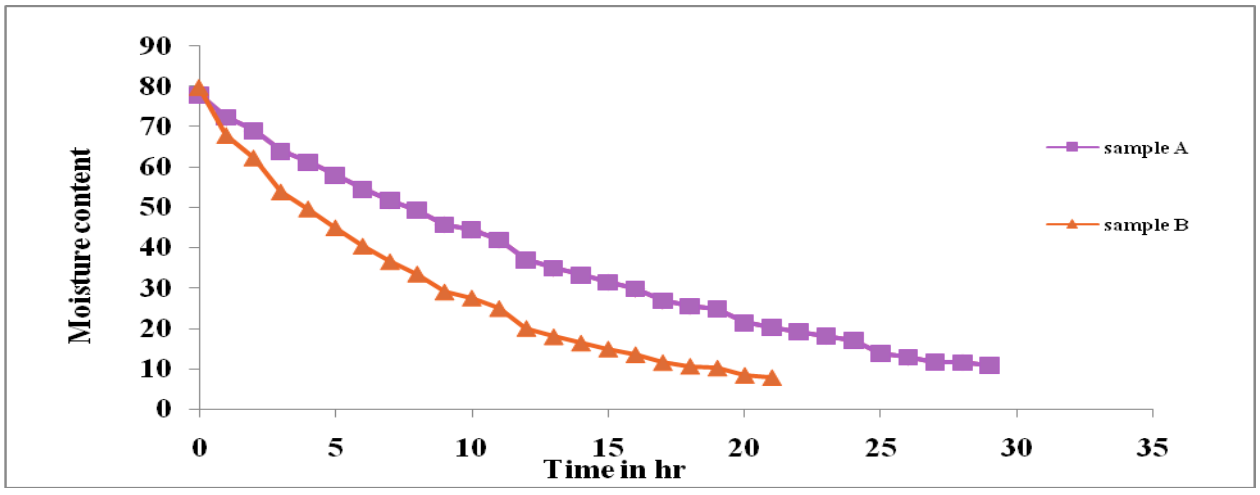


Figure 1 Drying curve of hot air dried grapes

A. **Control without pretreatment**
B. **Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0%**

The graph was plotted between moisture content Vs time required to reduce moisture from the grapes. The time was in hours and the moisture content was in percentage. From (**Figure 1)** the maximum time was required by control sample that was 21 hr and minimum time was required by the sample B that was 21 hr. Thus the combination of NaOH and ethyl oleate increased the drying rate than other pretreatment. Sodium hydroxide (90°C, for 2-5sec) caused cracking and perforation in the waxy cuticle and increased the drying rate by caustically creating fissures in the product's surfaces *(Winkeler,Cook, Kliewer&Lider, 1974).* Ethyl oleate removed the waxy layer on the grapes surface.

The nutrient composition of fresh grape was as moisture 15.23 ± 0.62 to 14.75 ± 0.53 % fat was 0.77 ± 0.05 to 0.72 ± 0.02 % protein was 2.88 ± 0.13 to 2.75 ± 0.21 %, ash content was 0.48 ± 0.06 to 0.58 ± 0.02 %, carbohydrate was 80.61 ± 1.32 to 81.17 ± 1.25 % and total sugar was 61.36 ± 1.21 to 61.67 ± 0.94 % as shown in Table 2 Thus the moisture of fresh grapes was 80-82% and that of raisins was 15.23 ± 0.62 to14.75 ± 0.53 % about 60 to 70% of moisture get reduced. There was slightly increment in ash and fat content of raisins as shown in Table 2 because of pretreatments that were used before the drying. The total sugar content of raisins was 60-70%. The area, water activity of raisins was also very less as compare to fresh grapes. Thus raisins were comfortable for transportation. The large amount of sugar present in raisins act as preservative. Hence the drying increased the shelf life of grapes. Thakur *et.al.,* 2010.

Table 2 Proximate analysis for Hot Air Drier raisins

Content (%)	**Sample A**	**Sample B**
Moisture	15.23 ± 0.62	14.75 ± 0.53
Fat	0.77 ± 0.05	0.72 ± 0.02
Protein	2.88 ± 0.13	2.75 ± 0.21
Ash	0.48 ± 0.06	0.58 ± 0.02
Carbohydrate (by difference)	80.61 ± 1.32	81.17 ± 1.25
Total Sugar	61.36 ± 1.21	61.67 ± 0.94
Total soluble solid (^{o}Brix)	22± 0.50	22± 0.20

Acidity (%)	0.50± 0.14	0.50± 0.22

Results are mean ± SD of 3 determinations

A. Control without pretreatment

B. Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0%

Table 3 Color analysis of tray dryer raisins

Sample	**L**	**a**	**b**
A	**22.62 ± 0.62**	**7.77 ± 0.08**	**10.16 ± 0.32**
B	**27.3 ± 0.73**	**7.74 ± 0.13**	**13.53 ± 0.16**

Results are mean ± SD of 3 determinations

A. Control without pretreatment

B. Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0%

Value of L, a, b with the positive value of a, b indicating red and yellow color and negative values indicating green and blue color, respectively, while 'L' indicates intensity of color i.e. lightness. The quality of raisins depends upon the color value. The positive values of b indicate the yellow color. So the sample which has greater value of b was of good quality. Potassium metabisulfite used to reduce the darkening due to both enzymic and nonenzymic browning during drying and storage. Hot air dried with pretreated raisin had higher color value than control sample. (CIE. 1978)

Texture profile of Hot air dryer raisins

A Control without pretreatment

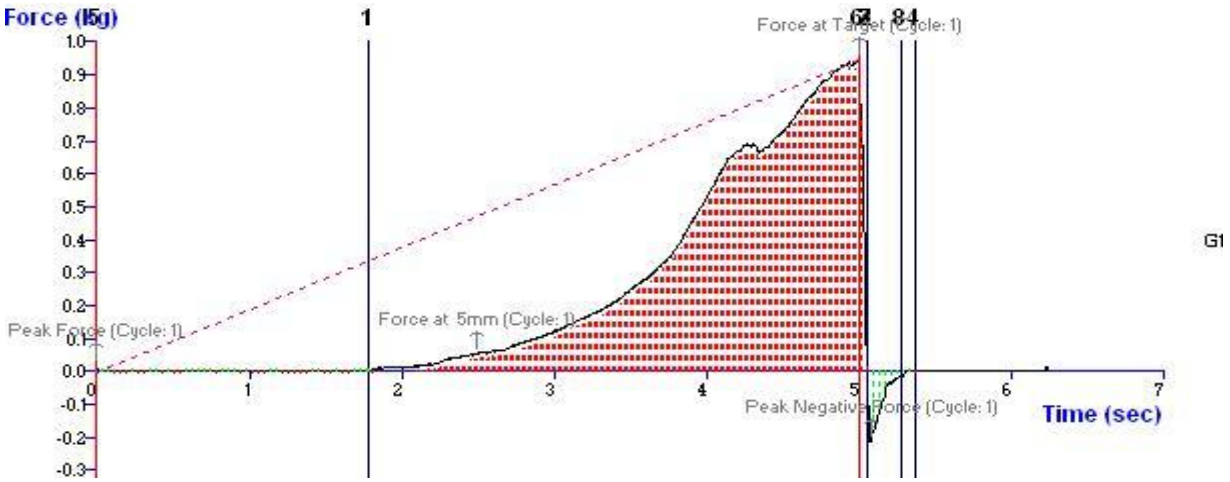


Figure 2 Grape raisin Samples A

B Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0%

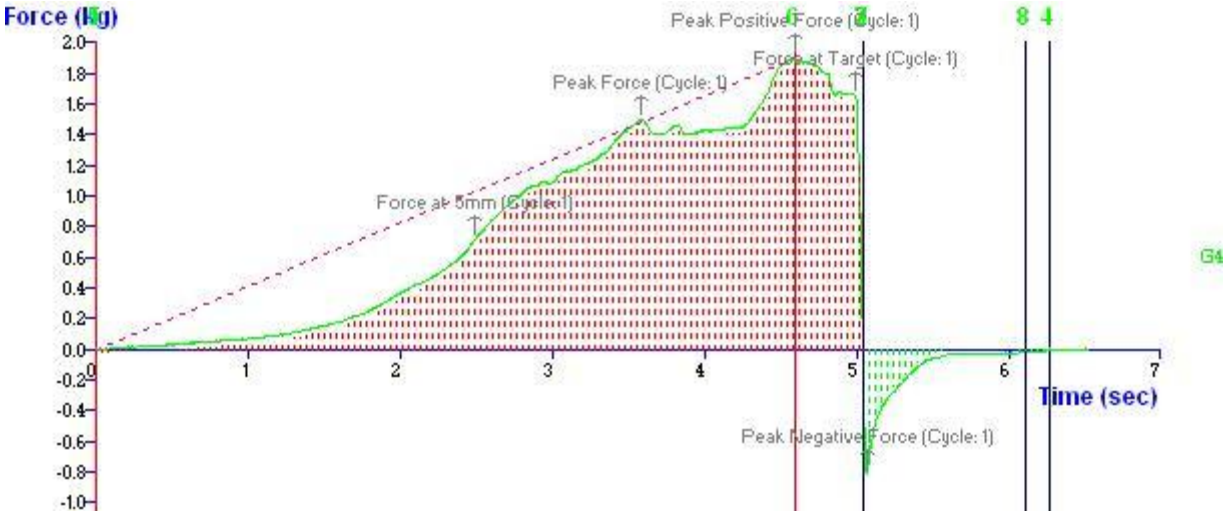


Figure 3 Grape raisin Samples B

The texture analysis of Hot air dried raisin samples were carried out. The probe used for texture analysis was 2 mm cylindrical probe. The depth of penetration was 0.5 mm and the force required was calculated in g/s. The sample which required less force had soft texture and samples which required more force had hard texture. Force was calculated from graph. The area covered by the probe multiply by the time gives hardness of the samples. From the texture profile grapes the force was calculated to know the hardness of raisins samples. In hot air drier samples with pretreated sample B raisin had good texture value.

IV. CONCLUSION

From above study it was concluded that pretreatment used in drying of grapes improve the physical and chemical properties of raisins and also reduce the time required for drying. Dipping grapes in to 0.5% NaOH solution at 90^{o}C for 2-3 sec repeated for two to three times and then dipped in to Lye solution 0.5% + Ethyl oleate 1.0% + Potassium metabisulfite 1.0% dipping gave better results i.e. 21 -30 hrs. In case of color and texture profile graphs the results obtained by tray dryer with pretreatment was good results.

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