



RESEARCH ARTICLE

Quality and sulfur residues of raisin made after sulfur fumigation at different time intervals

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ABSTRACT

The grape berries were exposed to the sulfur fumes for 0, 20, 30, and 40 minutes to make raisin and it was found that for the entire organoleptic characters raisin made after 30 minutes of sulfur fumigation showed the best results for all characters of quality. The 30 minutes fumigation for raisin making was highest for taste, color, flavor, and texture compared to control, 20 and 40 minutes fumigation. The weight remain percentage was highest for 30 and 40 minutes fumigated and lowest for the control berries of raisin. It was noticed that the sulfur residues increased with the increased in sulfur fumigation time. The 20, 30 and 40 minutes fumigated raisins came under permissible residues of SO₂ for all the treatments. These results suggest that 30 minutes fumigation gave better results and therefore could be recommended for raisin making for future.

Keywords: *Vitis vinifera*, Vitaceae, Raisin, Sulfur fumigation, SO₂ residues

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INTRODUCTION

Grapes originated in Asia, most botanists agree, is the home of *Vitis vinifera*, from which all the cultivated varieties of grapes were derived before the discovery of North America. The grapes belong to the family *Vitaceae*, widely distributed in the tropics and subtropics with range extending into the temperate regions (Cheema and Jindal, 2001). The grapes are very important fruit of Balochistan. It is grown on 15102 hectares and its annual production is 63187 tones. The grapes are grown in districts Quetta, Pishin, Killa Abdullah, and Mastung (Anonymous, 2010-11). Riva and Peri (1986) reported that grapes were dipped in ethoiloleaty and air dried under forced convection in a drying cabinet with air at 50 SN., 15% RH, are sun dried. In the sun drying daytime temperature ranged from 20 to 40 °C and humidity ranged from 40 to 75% and night temperature was about 22 °C and RH was 70 ± 5%. Experimental samples compared favorably with commercial samples of dried grapes with regard to composition and color, faster drying was due to ethoiloleate dipping pretreatment. According to Watts et al. (1989) for the sensory evaluation, the panelist used their senses of sight, smell, taste, touch and hearing to measure the sensory

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characteristics. There is no one instrument that can replace the human response of making the sensory evaluation components that are essential for the food study.

According to Larmond, E. (1977) the sensory characteristics are categorized as scale 1 to 9. The scale 1 stands for the dislike extremely or lowest while the scale 9 stands for the like extremely or highest characteristics. If the characteristic of sensory is near to scale 1 then it is not good and as it goes high and come to 9 or near to scale 9 then it will be good better and best. Lindsey et al. (1989) gave the explanation about the use of SO₂ for the postharvest of grapes to increase the shelf life of grapes. Thus the consumer will have the choice to buy the grapes throughout the year. The quality of grapes is great risk due to presence of rot and mold; which severely reduces the postharvest life and quality of grapes. If we do the proper handling and treatment then it increases the likelihood and consumers will receive high quality grapes. The estimated total SO₂ levels as can be consumed for dried fruit including raisin are 1200 ppm.

Mitchell (1992) mentioned that the grapes have problem of water loss, due to which stem drying occur and botrytis rotting is also a serious problem in grapes storage. If the SO₂ fumigation applied then these problems can be reduced. He has further mentioned that sodium meta bisulfite pads are used in grapes packages, which release the SO₂ and thus control the rotting of grapes. The objective of the present work was to evaluation the effect of sulfur fumigation on quality and sulfur residues of raisin made after sulfur fumigation for different time intervals.

MATERIALS AND METHODS

The fruit was placed in wooden trays (45 x 75 cm) for sulfuring. These trays were then placed in a wooden chamber for sulfur fumigation having size 0.60 x 1.20 x 1.20 meters (W x L x H). The trays were sulfured in this chamber for a fixed time. The chamber was covered with polyethylene sheet to make it airtight. Sulfur at the rate of 2 grams per kilogram of fresh fruit in an iron pan was burned on an electric heater. The grapes berries exposed to the sulfur fumes for 20, 30, and 40 minutes. Then the trays were brought in the room with open windows and roof fans and the grapes for the each treatment divided into 3 replications. The grapes fruit for the raisin was divided into 3 parts each with 3 kilograms of fruit. Then the fruit was put in wooden trays and spreaded for raisin making. Thus 12 trays were placed for this experiment, with 4 trays in each replication for 3 replications.

The sensory evaluation was done with the help of Food Technology Department of Agriculture Research Institute, Sariat, Quetta. The Food Technology Department had their panel for sensory evaluation work. The evaluation was done for the quality characters such as taste, color, flavor, and texture by using the method of Larmond (1977). The samples were analyzed for the sulfur residues by using the method of Skinner (1936). The experimental design was a completely randomized. Data were analyzed using PROC GLM of MSTATC for observation. Means values of parameters were separated according to least significant difference (LSD) test.

RESULTS AND DISCUSSION

The organoleptic characters of raisin were done for the taste, color, flavor, and texture (Table 1). For the characters of taste the 30 minutes sulfur fumigated berries showed the best value and there was no significant difference between other treatments. Similarly, the color of raisin was highest and the flavor and texture was the best for the 30 minutes sulfur fumigated

grape berries and lowest for the control. There was no significant difference for 20 and 40 minutes fumigated berries of raisin for the color, flavor and texture. Over all organoleptic characters of raisin fumigated for 30 minutes showed the best results for all the characters of quality. Therefore, these results suggest that the best treatment for raisin making is the 30 minutes sulfur fumigation for grapes berries. The same pattern of results was shown in the Figure 1 for taste, color, flavor and texture.

Table 1. Organoleptic evaluation of raisin made from grapes berries of Kishmish cultivars after sulfur fumigation.

Treatment Time (Minutes)	Taste	Color	Flavor	Texture
0	5.8 B	5.0 C	5.3 C	4.8 C
20	5.9 B	6.0 B	5.9 B	5.8 B
30	7.6 A	7.5 A	7.5 A	7.5 A
40	6.1 B	5.9 B	5.9 B	5.9 B
LSD (0.05)	0.4	0.4	0.4	0.5

Means within column with same letter are not different at $P \leq 0.05$.

Sensory evaluation (scale 1 to 9)
 1. Bad = Dull-Unpleasant taste-Hard (1-3)
 2. Fair = Attractive-Desirable taste-Soft (4-6)
 3. Good = Very Attractive-Pleasant taste-very Soft (7-9)

The weight loss and weight remain percentage of sulfur fumigated grape berries was recorded (Table 2), it was found that the weight loss percentage was highest for the control berries of raisin and there was no significant difference for the other treatments of fumigation for the berries of raisin. The weight remain percentage was highest for 30 and 40 minutes fumigated berries of raisin and lowest for the control berries of raisin. These results were supported by Mitchel (1992), who reported that grapes has large amount of water and loss water due to softening of fruit.

Table 2. Weight loss and weight remain of raisin made from grapes berries of Kishmish cultivars after sulfur fumigation.

Treatment Time (minutes)	Weight Loss (%)	Weight Remain (%)
0	73 A	27 C
20	72 B	28 A
30	72 B	28 A
40	72 B	28 A
LSD (0.05)	0.5	0.2

Means within column with same letter are not different at $P \leq 0.05$.

Table 3. Sulfur residues in raisin made from grapes berries of Kishmish cultivars after sulfur fumigation.

Treatment Time (minutes)	SO ₂ Residues (ppm)
0	0 D
20	685 C
30	735 B
40	983 A
LSD (0.05)	10.84

Means within column with same letter are not different at $P \leq 0.05$.


According to the results of Table 3, the sulfur residues were found highest in 40 minutes fumigated and lowest in 20 minutes fumigated berries. It was noticed that with the increase in fumigation time, the sulfur residues also showed an increase in the berries. The 20 30 and 40 minutes fumigated raisins came under permissible residues of SO₂ (Lindsey, 1989). These results suggest that 30 minutes fumigation gave better results and therefore could be recommended for raisin making for future.

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