Quality Change of Postharvest Okra at Different Storage Temperatures

Zhihua Cheng[1,2], Xiao Gong[1,*], Wei Jing[1], Zheng Peng[1], Jihua Li[1]
1.Key Laboratory of Tropical Crop Products Processing of Ministry of Agriculture, Agricultural Products Processing Research Institute, Chinese Academy of Tropical Agricultural Sciences, Zhanjiang, Guangdong, 524001, China;
2. College of Food Science and Technology, Huazhong Agricultural University, Wuhan, Hubei, 430000, China;
E-mail: 775182781@qq.com; jyc188657@126.com; appri_gq13@126.com; 1058747397@qq.com; gongxiaocau@126.com

Abstract: In order to analyze the influence of temperature on the storability and postharvest quality properties of okra, the postharvest okra was stored at 4 or 25°C and the changes of weight loss rate, firmness, and the contents of soluble protein, chlorophyll and vitamin C were determined. For 5 days, the weight loss of okra was about 0.94% and 13.74% stored at 4 and 25°C, respectively. The firmness of the fruit at 25°C declined by 36.04% after 5 days storage and decreased by 17.59% at 4°C. Soluble protein of okra at stored 4 and 25°C was 0.97 mg/g and 0.67 mg/g after 5 days, respectively. The chlorophyll content at 4°C was 7.76 mg/100 g after 5 days, compared with that at 25°C, decreased from the initial 16.32 to 4.54 mg/100 g. The vitamin C of okra fell by 35.60 mg/100 g after 5 days of storage at 4°C, which is significantly higher than that stored at 25°C, declining 17.97 mg/100 g by 5 days. Therefore, cold storage at 4°C play an important role in the maintenance of okra edible quality.
Key words: Okra; Storage temperature; Fruit quality; Nutritional maintenance

1 Introduction

Okra (*Abelmoschus esculentus* L.) is an annual vegetable crop, belongs to the family Malvaceae[1]. It is also called lady's finger, gumbo, guinogombo, guibeiro and bhindiin[2], which is widely cultivated in the tropics, sub-tropics areas, such as Africa, Asia, Southern Europe, and America[3]. The okra pods are green, tender, 4–5 ridged and about 6–8 cm in length[4]. Okra has a high nutritional value and contains rich bioactive components, including carbohydrate, protein, dietary fibre, calcium, magnesium, potassium, vitamins A and C[5,6], and okra pod also contain rich thick slimy polysaccharides, which are used to thicken soups and stews[7].

Okra is highly perishable because of its high moisture content and respiratory activities[8] , then the okra is highly susceptible to water loss, color fading and decay, resulting in loss of commercial value and become squashy and not easy to consume fresh[9] . The ridges of okra easily caused mechanical injuries and these pods become blacken on ridges and calyx disc after postharvesting, resulting in value deletion and unsaleability in quality conscious markets[10]. Therefore, there is urgent need to develop suitable method to reduce the post harvest losses in okra and maintain high quality from harvesting to the entire supply chain.

In this paper, the postharvest okra were stored at 4 or 25°C, to determine the effects of different temperature on the storability and postharvest quality attributes of okra. The quality changes in weight loss rate, firmness, content of soluble protein, chlorophyll and vitamin C were measured.

2 Materials and methods

2.1 Plant materials

The fresh okra pods were purchased from a supermarket (Zhangjiang, China) at commercial maturity in May 2018. Fruits were selected for uniformity of size, ripeness and absence of physical injuries or infection. Then, the fruit were divided randomly into three groups and stored at 4 and 25°C with 80% RH, respectively.

2.2 Weight loss rate

Five okra seed pods at each storage time were selected for weight loss rate determination. The Weight loss rate was determined according to the following formula[11]:

$$\text{The weight loss}=\frac{W_1-W_2}{W_1}\times 100\%$$

Where W_1 is original weight and W_2 is weight after storage.

2.3 Fruit firmness

Firmness of fruits was measured in GY-4 fruit hardness tester (Zhiqu Co.Ltd., Dongguan, China). The contents were expressed as N.

2.4 Soluble protein

Soluble protein was determined by using Coomassie brilliant blue G-250 rapid assay,[12] and expressed as mg/g.

2.5 Chlorophyll

The chlorophyll content of okra pods was estimated as described by Rangana[13] , expressed as mg/g.

2.6 Vitamin C

Vitamin C content was determined by titration with 2, 6-dichlorophenol indophenol[14], using different AA concentrations for the standard curve, and expressed as mg 100 g^{-1} of vitamin by fresh weight.

3. Results and discussion

3.1 Effect of different temperatures on weight loss rate of okra

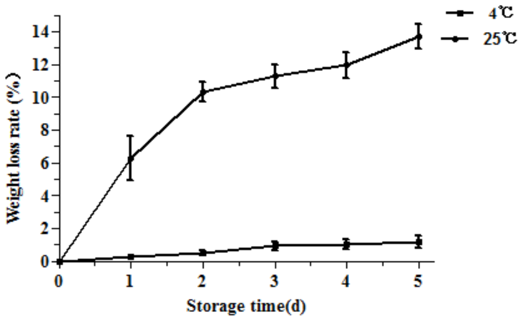

Figure 1. Effect of different temperatures on weight loss rate of okra

As shown in Figure 1, the weight loss rate of okra stored at 25°C raised sharply, increasing 13.74% at 5 days whereas the weight loss rate of okra at 4°C increased slowly by 0.94% at 5 days. It shows that low-temperature storage can effectively reduce the loss of water after harvest. The probable reason for higher weight loss rate may be due to higher incidence of injuries on the surface of okra during harvesting, resulting in excessive moisture loss.

3.2 Effect of different temperatures on firmness of okra

The firmness of okra declined gradually with the ripening of the fruit. As shown in Figure. 2, the firmness of fruit at 25°C declined rapidly, decreasing by 36.04% after 5 days of storage. However, the firmness of okra stored at 4°C decreased by 17.59% at 5 days. The decrease in firmness was significantly suppressed with the reduced storage temperature. Softening of okra is caused by breakdown of insoluble protopectin into soluble pectin or by cellular disintegration leading to increased membrane permeability[15]. In addition, the firmness of okra affected the amount of oxygen and delayed the softening time of the fruit, indicating that low temperature can effectively delay the oxidation decomposition of okra.

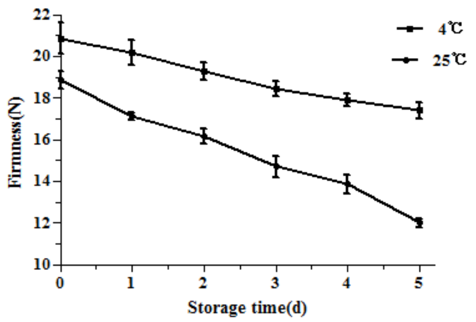

Figure 2. Effect of different temperatures on firmness of okra

3.3 Effect of different temperatures on soluble protein, chlorophyll and vitamin C content of okra

The soluble protein content of okra declined gradually for all treated during the whole storage. The soluble protein of okra was 0.97 mg/g after 5 days of storage at 4°C, compared to the okra stored at 25°C higher, declining 0.67 mg/g by 5 days. It clearly indicated that 4°C cold storage can effectively prevent the decline of soluble protein content and inhibit respiration and other physiological and biochemical reactions.

Table.1 showed that the chlorophyll content of okra decreased continuously during the whole storage. After 5 days of storage, the chlorophyll content of okra stored at 25°C decreased from the initial 16.32 to 4.54 mg/100 g, while the chlorophyll content of okra stored at 4°C was 7.76 mg/100 g. It indicated that low temperature treatment can maintain the chlorophyll content better. The probable reason may be due to enzymatic changes cause decomposition of chlorophyll.

The vitamin C content is also an important quality and nutrition index of okra. From Table 1, it can be seen the vitamin C content of okra stably decreased at 4°C, while declined rapidly at 30°C. The vitamin C of okra was 35.60 mg/100 g after 5 days of storage at 4°C, which is significantly higher than okra stored at 25°C, declining 17.97 mg/100 g by 5 days. It can be seen that 4°C cold storage can effectively prevent the degradation of vitamin C and maintain the nutrients of okra.

Table 1 Effect of different temperatures on soluble protein, chlorophyll, vitamin C contents of okra

Nutrition component	°C	Storage time /days					
		0	1	2	3	4	5
Soluble protein (mg/g)	4	1.67±0.12	1.46±0.09	1.28±0.08	1.15±0.10	1.09±0.06	0.97±0.08
	25	1.67±0.12	1.33±0.10	1.06±0.12	0.83±0.16	0.74±0.09	0.67±0.13
Chlorophyll (mg/100g)	4	16.32±0.26	15.06±0.22	13.92±0.28	11.25±0.31	9.34±0.27	7.76±0.32
	25	16.32±0.26	13.54±0.40	10.26±0.35	8.62±0.12	6.36±0.34	4.54±0.53
Vitamin C (mg/100g)	4	61.08±0.92	57.54±1.12	52.23±0.89	46.08±0.95	41.08±1.32	35.60±1.17
	25	61.08±0.92	50.24±1.24	42.63±1.10	35.54±0.84	26.54±0.67	17.97±1.21

4. Conclusions

Okra stored at 25°C for 5 days lost water and wilt, affecting commerciality, nutrition and consumption, so temperature is an important condition for preservation of okra. In this present study, the effect of different temperature (4 or 25°C) was investigated to extend the shelf life of okra. The weight loss rate of okra stored at 25°C was 13.74% at 5 days whereas stored at 4°C increased by 0.94%. The firmness of fruit at 25°C declined by 36.04% after 5 days of storage and decreased by 17.59% at 4°C. Soluble protein of okra stored at 4 and 25°C was 0.97 mg/g and 0.67 mg/g after 5 days of storage, respectively. The chlorophyll content of okra stored at 4°C was 7.76 mg/100 g after 5 days, compared with stored at 25°C decreased from the initial 16.32 to 4.54 mg/100 g.

The vitamin C of okra fell by 35.60 mg/100 g after 5 days of storage at 4°C, which is significantly higher than okra at stored 25°C, declining 17.97 mg/100 g by 5 days. In summary, low-temperature storage can maintain the quality of fruit and play a role in preservation.

5. Acknowledgment

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