

# Physicochemical Changes of Custard Apple at Different Storage Temperatures

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**Abstract.** In order to analyze the influence of different storage temperature on the storability and postharvest quality attributes of custard apple, the postharvest custard apple were stored at 4, 15 or 20-28°C (room temperature) by measuring the change of weight loss rate, firmness, content of total soluble solid (TSS) and titratable acid (TA). By 4, 7, 10 d with 22-28°C(room temperature), 15°C, 4°C, the weight loss of custard apple was about 1.97%, 2.21%, 1.04%, respectively. The firmness decreased gradually during the whole storage time with 22-28°C, 15°C, but the firmness of custard apple increased rapidly from 5.53 N to 9.11 N at 4°C, within 1 to 10 days of storage. TSS content increased gradually in the early stage of storage and then decreased. TA content decreased continuously during the whole storage time. Slight decline in pH of the all the products was observed during postharvest storage. The result showed that the shelf life of fruits were 4, 7, 10 d with 22-28°C(room temperature), 15°C, 4°C, respectively.

## 1. Introduction

*Annona Squamosa* L., also called sugar apple, sweetsop or custard apple, is listed as one of the world's five most famous tropical fruits. Custard apple is native to the tropical America, which is commercially cultivated in tropical and sub-tropical regions of Australia<sup>[1]</sup>. Custard apple is one of the important fruit crops of Andhra Pradesh. Nearly 75000 tons of this fruit is available from the state<sup>[2, 3]</sup>. Custard apple, popularly known as Sitaphal is grown in about 40000 ha in India mainly in the states of Andhra Pradesh, Assam, Tamilnadu and grows wild in Deccan plateau and some parts of central India<sup>[4]</sup>. Custard apple is considered as one of the delicious and nutritionally valuable fruit meant for table purpose<sup>[5]</sup>. Custard apple is heart shaped weighing about 150 g, with a very bumpy skin<sup>[6]</sup>, and its pulp is slightly, creamy yellow or white, sweet with a good flavor and low acidity<sup>[7]</sup>. Custard apple has a high nutritional value and contains rich bioactive components, including sugar, protein, vitamins, crude fiber, Fe, Ca, P and other mineral elements.

However, custard apple are climacteric fruits, generally characterized by high respiration and ethylene production, and are chilling sensitive<sup>[8]</sup>, then the custard apple is highly susceptible to spoilage,



soften very rapidly during ripening, and become squashy and not easy to consume fresh<sup>[9]</sup>. Being highly perishable, the fruits could not be sent to distant markets<sup>[10]</sup>. Therefore, there is urgent need to develop suitable method to minimize postharvest losses and generate more income<sup>[11]</sup>.

In this paper, the postharvest custard apple were stored at 4 or 15, 20-28°C (room temperature), to determine the effects of different storage temperature on the storability and postharvest quality attributes of custard apple. The quality changes in weight loss rate, firmness, content of total soluble solid (TSS) and titratable acid (TA) and pH were measured.

## 2. Materials and methods

### 2.1 Material and treatments

Custard apple fruits were procured in bulk from local market at 8 maturity stage. 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 three temperature sections (4, 15, 22-28°C) respectively.

### 2.2 Weight loss

Weight loss was measured according to the following formula:  $\text{Weight loss (\%)} = \frac{(\text{original weight} - \text{weight after storage})}{\text{original weight}} \times 100$ .

### 2.3 Firmness

Firmness of fruits was measured in GY-4 fruit hardness tester (Zhiqu Co.Ltd., Dongguan, China).

### 2.4 Total soluble solid (TSS)

TSS content of custard apple was determined by Abbe refractometer. (Atago Co. Ltd., Tokyo, Japan) at room temperature.

### 2.5 Titratable acidity (TA)

TA content fruits was titrated with 0.1 mol/L NaOH using phenolphthalein as indicator. Volume of NaOH was recorded and percent TA was calculated<sup>[12]</sup>.

### 2.6 pH

pH was determined by Multi-functional pH meter (Merrler toledo (Shanghai) Co., Ltd.)

## 3. Results and discussion

### 3.1 Weight loss

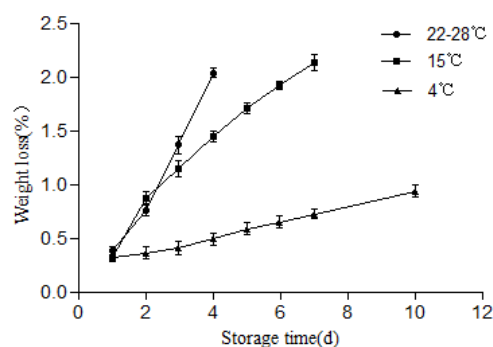


Figure 1. Effect of different storage temperature on weight loss of custard apple

Figure.1 showed that the weight loss of custard apple increased for all treated during the whole storage.

By day 4 with 22-28°C(room temperature), custard apple loss was about 1.97%, meanwhile, the fruit was soft with a serious odor and the peel has turned black. However, the custard apple by 7, 10 d with 15, 4°C loss were 2.21%, 1.04%, respectively. The study showed that low temperature treatment significantly inhibited the increase of weight loss and 4°C storage was best to extent the shelf life and inhibited weight loss of custard apple.

### 3.2 Firmness

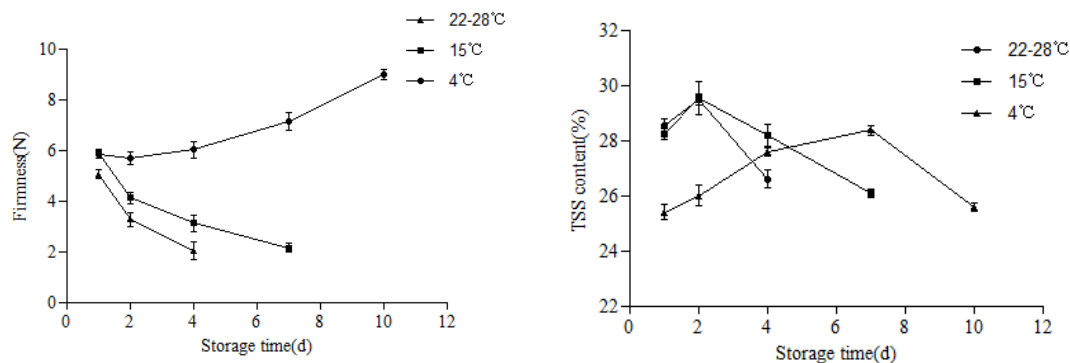


Figure 2. Effect of different storage temperature on firmness and TSS content of custard apple

Custard apple firmness is associated with tolerance to physical damage and decay, and plays a key role in consumer acceptability<sup>[13]</sup>. Most consumers subjectively estimate fruit softness based on its degree of deformation by applying a compression force with the fingers<sup>[14]</sup>. In our work, custard apple firmness decreased gradually during the whole storage time with 22-28, 15°C(Figure 2), but the firmness of custard apple increased rapidly from 5.53 N to 9.11 N at 4°C, within 1 to 10 days of storage. Increase in firmness may be correlated with pectin content, or the extent of chilling injury. The result showed that lower temperature have significantly extended the shelf-life of custard apple and maintain a higher firmness, and 4°C storage temperature was the best to control the decline of firmness.

### 3.3 TSS content

Total soluble solid (TSS) content is a key component that can be associated with custard apple sweetness and quality attributes. Figure 2 showed that TSS content increased gradually in the early stage of storage, which could be related to the loss of weight. However, TSS content declined significantly in the late stage of storage. Decline in TSS is may be due to settling down of some soluble colloidal solids, or other chemical reactions of sugar in presence of acid during storage.

### 3.4 pH and TA content

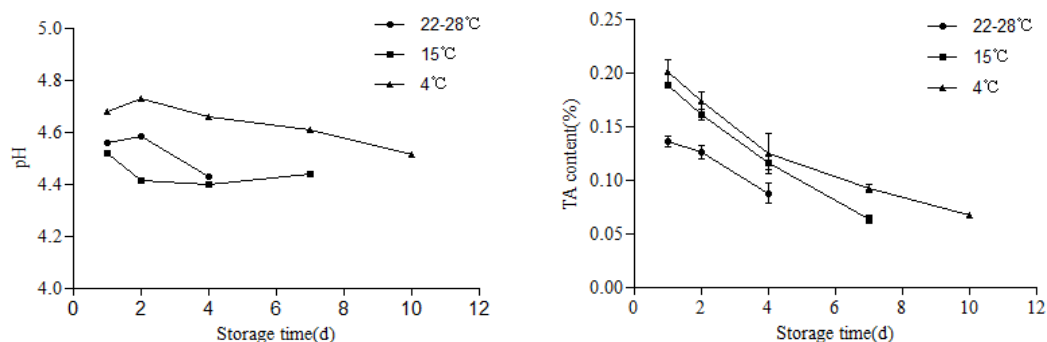


Figure 3. Effect of different storage temperature on TA content and pH of custard apple

As showed in the Figure 3, TA content decreased continuously during the whole storage time. The result showed that TA content with higher storage temperature was significantly decrease during storage, but at 4°C, the TA content of custard apple was decline slowly. Slight decline in pH of the all the products was observed during postharvest storage. As showed in Figure 3, the initial pH of custard apple were 4.55, 4.52, 4.67 with 22-28°C(room temperature), 15°C, 4°C, respectively. With the increase of storage time, the pH of custard apple separately were 4.42, 4.43, 4.51 with 22-28°C (room temperature), 15°C, 4°C. The reason was that ripening of custard apple fruits resulted in the increase in malic acid and citric acid<sup>[15]</sup>.

#### 4. Conclusion

In this present study, the effect of different storage temperature (4, 15, 22-28°C, ) was investigated to extend the shelf life of custard apple. By measuring some physical and chemical indicators, such as weight loss rate, firmness, content of total soluble solid (TSS) and titratable acid (TA), the custard apple fruit was soft with a serious odor, the peel has turned black and were inedible by 4 d of postharvest storage with 22-28°C(room temperature), however, the shelf life of fruits were 7,10 d with 15°C, 4°C. The result showed low storage temperature was more efficient to preserve the freshness and quality of samples during storage and 4°C storage temperature was best to extend shelf-life and maintain sensory and nutritive quality of custard apple.

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