Study on the Preservation Effect of Propolis on Sweet Cherry

Youting Yang¹, YanGong¹, Yifei Gao¹, Jingyu Huang¹, Man Xu¹, Bo Xiong¹ *
¹College of Horticulture, Sichuan Agricultural University, Sichuan, China
*Corresponding author’s E-mail address: xiongbo1221@sicau.edu.cn

Abstract: This experiment used ‘Hong Deng’ sweet cherry as material to study the effect of different concentrations (0.5%, 1.0%, 1.5%, 2.0%) of propolis extract on postharvest preservation of sweet cherry. The results showed that the propolis extract can effectively reduce the respiration rate of sweet cherry, reduce the weight loss rate, delay the decline of titratable acid, soluble solids and fruit hardness of sweet cherry, and slow the loss of fruit Vitamin C. The 2.0% concentration of propolis extract has the best preservation effect.

1. Introduction
Sweet cherries, also known as large cherries, have high moisture content, but they tend to suffer surface depression, cracking, mold growth, eventually rot and deteriorate during the sale, reducing the shelf life [1].

Propolis is gradually favored as a pollution-free antiseptic preservative. It contains a large amount of flavonoids and terpenoids [2], which can be used as a kind of food preservative. China is a big beekeeping country with rich and low priced propolis resources. It develops propolis preservatives, which has lower cost than similar products and has strong advantages in market competition. Therefore, it is feasible to use propolis as a preservative for sweet cherries [3].

At present, there are few reports on the application of propolis as an antiseptic preservative in the preservation of sweet cherries. Based on the characteristics of propolis, this experiment studied the preservation effect of ‘Hong Deng’ sweet cherry to determine the optimal concentration of propolis preservative, which provided a safer and more effective method for the storage and preservation of sweet cherry.

2. Materials and methods

2.1 Test materials
‘Hong Deng’ sweet cherry was provided by a local orchard in Ya’an Hanyuan County. Propolis were provided by Ya’an Beekeeping Base.

The test materials were harvested at the time of the ripening and were selected in uniform size, colour and absence of any damage. The fruits were pre-cooled immediately after harvesting and brought back to the laboratory for treatment on the same day. The selected sweet cherries were divided into 5 groups, 100 fruits in each group, repeated 3 times, the control group was treated with water, and the 1-4 treatment groups were treated with 0.5%, 1.0%, 1.5%, 2.0% propolis fresh liquid respectively. After being naturally dried, it is stored in a laboratory (indoor temperature 26℃). The indicators were measured every 48 hours after treatment.
2.2 Preparation of propolis preservation solution
Referring to the method of Tian\cite{4}, the original rubber is frozen and embrittled below 0 ℃, then pulverized into powder, added with 70% edible alcohol for 24 hours, and stirred every 5 to 6 hours during the extraction process. The mixture was allowed to stand at a lower temperature of 5 to 7℃ for about 2 hours, and filtered with a multi-layer gauze to remove beeswax and impurities. Then, the filtrate was diluted with distilled water to 0.5%, 1%, 1.5% and 2% preservatives respectively, and stored in a dark place at low temperature for use.

2.3 Indicators and methods
Weight loss rate (%) = (pre-storage fruit weight - fruit weight after storage) / pre-storage fruit weight × 100%. Decay rate (%) = number of sweet cherry rot and mold / number of extraction × 100%. Soluble solids were measured by a digital saccharide meter TD45. Titration acid content was calculated by acid-base titration with tartaric acid. Vc content was determined by 2,6-dichloroindophenol titration. Respiratory intensity was measured by the jar method\cite{5}. Fruit firmness was determined by GY-1 fruit hardness tester. Each treatment randomly took 10 fruits and finally averaged them.

Data analysis was performed using Microsoft Excel 2016 and DPS 9.50 statistical analysis software.

3. Results and analysis
3.1 Effects of different concentrations of propolis fresh-keeping solution on the weight loss rate of sweet cherry
It can be seen from Table 1 that the weight loss rate of each group of sweet cherries gradually increases with the prolongation of storage time. On the 9th day, the weight loss rate of the sweet cherries treated by propolis was significantly lower than that of the control (P<0.05). The fourth treatment had the lowest weight loss rate, and the difference was significant between the other treatment groups (P<0.05).

3.2 Effects of different concentrations of propolis fresh-keeping solution on the decay rate of sweet cherry
As can be seen from the table, the rot rate of the treated sweet cherry was slower than that of CK. On the 9th day, the rot rate of the treated sweet cherries was significantly lower than that of the control (P<0.01). By comparison, Treatment 4 performed optimally and was significantly lower than the other treatments (P<0.05).

Table 1: Fresh-keeping effect of sweet cherry on the 9th day of different concentrations of propolis preservation solution

| Treatment | Weight loss rate (%) | Rotting rate (%) | Soluble solids (%) | Titration acid content (%) | Vc content (mg/100g) | Respiratory intensity (mg/(g.h)) | Hardness (kg/cm²) |
|-----------|----------------------|------------------|--------------------|---------------------------|----------------------|----------------------------------|-------------------|
| CK        | 11.5 aA              | 68.0 aA          | 15.2 aA            | 0.76 aA                   | 2.84 aA              | 24.4 aA                          | 1.75 aA           |
| 1         | 10.5 bAB             | 56.0 aAB         | 16.0 bA            | 0.82 bA                   | 2.96 bAB             | 21.5 bB                          | 1.86 bAB          |
| 2         | 9.1 cB               | 65.0 aAB         | 15.5 bA            | 0.79 aA                   | 3.02 bAB             | 19.4 cB                          | 2.02 bB           |
| 3         | 9.5 cB               | 54.0 aAB         | 15.8 bA            | 0.83 bA                   | 3.75 cB              | 17.7 cB                          | 2.17 bB           |
| 4         | 8.5 dB               | 45.0 cB          | 16.2 bA            | 0.81 bA                   | 4.46 dC              | 16.0 cB                          | 2.22 bB           |

(Note: lowercase letters indicate P<0.05 significant levels, uppercase letters indicate P<0.01 extremely significant levels)

3.3 Effects of different concentrations of propolis preservative on the soluble solids of sweet cherry
It can be seen from the table that during the postharvest storage, the content of soluble solids in the fruit increased first and then decreased. Compared with CK, the soluble solids content of sweet cherry decreased slowly in each treatment. The soluble solid content of the four treated sweet cherries was
significantly higher than that of the control (P<0.05). Among them, the soluble solid content of the treatment 4 was the highest.

3.4 Effects of different concentrations of propolis fresh-keeping solution on the titratable acid content of sweet cherry
It can be seen from the table that during storage, the titratable acid content decreased with time. In the control group, the titratable acid content of the sweet cherry decreased the fastest, and the treatment with different concentrations of propolis preservation solution could slow its decline. When the titration acid content decreased, the titratable acid content of the four treated sweet cherries was significantly higher than that of the control (P<0.05), but there was no significant difference between the treatment groups.

3.5 Effect of different concentrations of propolis fresh-keeping solution on Vc content of sweet cherry
It can be seen from the table that the Vc content of sweet cherry decreased with time during storage. In general, the Vc content of sweet cherry in treatment 1 and control group decreased the fastest, and the rest of the treatment could slow the sweet cherry Vc to varying degrees. The content of Vc was significantly higher than that of the control (P<0.05), and the Vc content of the treated sweet cherry was the highest, which was significantly different from the control (P<0.01).

It can be seen from the table that the Vc content of sweet cherry decreases with time during storage. The Vc content of sweet cherry decreased the fastest in the control, and the other treatments could slow down the decrease of Vc content in sweet cherry. Treatment 4 had the highest Vc content, which was significantly higher than the control group.

3.6 Effects of different concentrations of propolis fresh-keeping solution on the respiratory intensity of sweet cherry
It can be seen from the table that the respiratory intensity of sweet cherry gradually decreases throughout the storage period, and the respiratory intensity of the control decreases most slowly. Different concentrations of propolis preservation solution can inhibit the respiration of sweet cherry and reduce respiratory consumption to varying degrees. At the 9th day of storage, the respiration intensity of the four treated sweet cherries was significantly lower than that of the control (P<0.01), and the effect of treatment 4 was the best.

3.7 Effect of different concentrations of propolis preservative on the hardness of sweet cherry
It can be seen from the table that the fruit firmness of sweet cherry decreased with the prolongation of storage time. Compared with the control, the firmness of the treated sweet cherry was significantly higher than that of the control (P <0.05), but the difference between the treatments was not significant.

4. Discussion and summary
The results indicated that the propolis preservation solution can maintain the stability of the hardness, soluble solids, Vc and titratable acid content of sweet cherry, significantly reduce the weight loss rate and decay rate of sweet cherry during storage, and inhibit the rise of respiratory intensity. In this experiment, the 2.0% propolis preservation solution had the best effect on sweet cherry. Because the preservation mechanism of propolis was complicated, the effect of propolis preservation with different concentrations on the quality of sweet cherry should be further studied.

Propolis is seldom used in sweet cherry. Based on the antibacterial and antiseptic mechanism of propolis, the preservation effect of sweet cherry was studied. Compared with the control, the effect of the treatment group was better, which fully shows that propolis has obvious fresh-keeping effect on sweet cherry.
References
[1] Zhong Yaoguang, Zhu Weiwei. Study on Postharvest Physiology and Preservation of Cherry Fruit [J]. Northern Horticulture [J], 2004(2): 67 ~ 68
[2] Ren Chuanying, Zhao Yonghuan, Zhu Chun et al. Application and safety analysis of propolis in food preservation [J]. Chinese food additives, 129 ~ 132, 161
[3] Luo Zhi-gang Yang Lian-sheng. Propolis and its application [J]. Guangzhou Food Industry Science and Technology 2002 183: 57-59. Luo Zhigang Yang Liansheng. Propolis and its application [J]. Guangzhou Food Industry Science and Technology 2002 183: 57-59.
[4] Tian Xuejun. Fresh-keeping effect of propolis on grapes [J]. Anhui Agricultural Sciences, 2008, 36(34): 15-20
[5] Xiong Qingxi. Experimental Course of Plant Physiology [M]. Sichuan: Sichuan Science and Technology Press, 2003, 68.