

EFFECT OF CITRIC ACID AND TREATMENTS ON PRESERVATION OF ASCORBIC ACID IN PROCESSING OF CHINESE JUJUBE JUICE

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Abstract

*Effects of citric acid and treatments on preservation of ascorbic acid in processing of Chinese jujube juice were investigated. In our research, we chose for testing *Ziziphus jujuba* Mill. 'Zanhuangdazao'. Before crushing the jujube fruits, we tried three trials including 1% salt solution treating the jujube fruit about 0.5 h, 5% sugar solution treating the jujube fruit less 1h and putting the jujube fruit in 60°C water about 5 minutes, and the preserving rate of ascorbic acid were 68.2%, 68.9% and 121.9% respectively. During the crushing, we put the 0.10% citric acid into the mix of water and jujube pulps, this method could raise the preserving rate of ascorbic acid to 79% compared to the contrast (29.9%). The study of pasteurization, boiling water sterilization and autoclaving indicated that pasteurization was the best sterilization mean with the preserving rate of ascorbic acid to 44.2%, boiling water sterilization was the second with the preserving rate of ascorbic acid to 44.1%, and the autoclaving was far worse than the others with the preserving rate of ascorbic acid only to 19.4%.*

Key words: chinese jujube juice, citric acid, ascorbic acid, preserving rate, high performance liquid chromatography.

INTRODUCTION

Chinese jujube (*Ziziphus jujuba* Mill.), a native plant of China, belongs to the genus *Ziziphus* (Rhamnaceae) and is a medicinal plant of China (Liu et al., 2009), is used as a significantly traditional Chinese medicine and invigorant (Li et al., 2009). It has crucial activities just as nourishing blood, fitting brain, activities of sedation, calm the nerves, antitumor effect, anti-aging and boost immunity (Sweetman, 2005; Gioia et al., 2008; Vidovic et al., 2008; Yu, 2008; Yang et al., 2008.) . The contents of cAMP, flavones, vitamins, dietary fiber, polysaccharide, triterpene acid are remarkable (Guil-Guerrero et al., 2004; San et al., 2010; Zhao et al., 2010) in the jujube fruits, particularly the ascorbic acid. Its average content reaches to 300-600 mg/100 g based on fresh weight, even some can reach to 800-900 mg/100 g. Especially the white maturing fruit involves considerable amounts of vitamins (Gao et al., 2011). The content of ascorbic acid is higher than that in the other fruits, which known as their highly ascorbic acid, such as kiwi fruit, orange, lemon, and so on. Nowadays, there are many kinds of jujube products, such as dried jujube, honeyed jujube,

jujube wine, jujube vinegar, jujube tea, jujube juice, etc.. Ascorbic acid is generally recognized as safe (GRAS) when used in accordance with Good Manufacturing Practices (21CFR182. 2000), is relatively inexpensive, and is widely recognized by consumers as a beneficial nutrient (vitamin C) (Kokkinidou et al., 2014). Vitamin C is a very important vitamin for human nutrition that is supplied by fruits and vegetables. Ascorbic acid is the main biologically active form of vitamin C. As a potent antioxidant, it has the capacity to eliminate several different free radicals (Scherera et al., 2012). However, many nutrients will be destroyed in the processing of products, especially ascorbic acid (Sheetal et al., 2013; Mapson et al., 1958; Maria et al., 2013). The ascorbic acid is so active and easily be broken by external condition just like heat, oxygen, light ray and pH. So, the content of ascorbic acid is low in the current jujube products. Therefore, it is very necessary to research a new method to protect ascorbic acid. In our research, we chose *Ziziphus jujuba* Mill. 'Zanhuangdazao' as the material and investigated the effect of citric acid and treatments on preservation of ascorbic acid.

MATERIALS AND METHODS

Ziziphus jujuba Mill. 'Zanhuangdazao' gained from Zanhuang, Hebei province was selected. The jujube fruits were washed under running water to remove the adhering mud particles followed by double distilled water and drained completely. Then we divided the fruits into three groups. Immersed the first group fruits into 1%, 2% and 3% salt solution for 0.5 h, 1.5 h, 2.5 h, 3.5 h, 4.5 h. Put the second group into 5%, 10% and 15% sugar solution for 0.5 h, 1.5 h, 2.5 h, 3.5 h, 4.5 h. At last treated the others by 60°C water for 5 min, 10 min, 15 min, 20 min, 25 min. The contents of ascorbic acid in jujube fruits were detected by high performance liquid chromatographic methods. To prevent the loss of vitamins, all operations were performed in the absence of direct sun light, using amber glassware. All tests were performed in triplicate.

During the crushing, we put the 0.01%, 0.05% and 0.10% citric acid into the mix of water and jujube pulps, then determined the content of ascorbic acid in the juice and metered the preservation rate of ascorbic acid. All tests were performed in triplicate.

To protect ascorbic acid in the jujube juice, we investigated three kinds of sterilization methods, just like pasteurization (65°C, 30 min), boiling water sterilization (100°C, 15 min) and autoclaving (121°C, 10 min).

The results were compared by one-way analysis of variance (ANOVA) and Duncan's test was carried out to identify significant differences between the mean values. All analyses were performed using the software SPSS 17.0 and differences at $P < 0.05$ were considered statistically significant.

RESULTS AND DISCUSSIONS

Effect of preprocessing on preserve rate of ascorbic acid

As can be observed in Figure 1, after 1% salt solution treating the jujube fruit about 0.5 h, the preserve rate of ascorbic acid was 68.2% which higher than the contrast (66.8%).

As Figure 2 showed, 5% sugar solution treating the jujube fruit less 1 h, the preserve rate of ascorbic acid was 68.9%, it was also better than the contrast (66.8%).

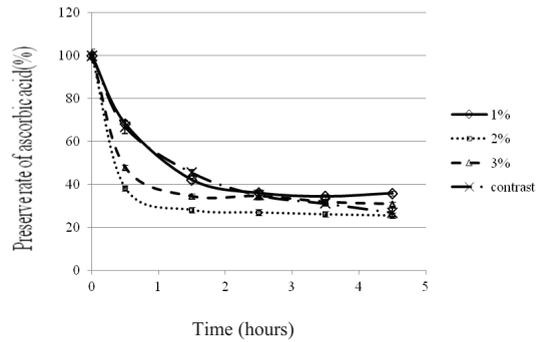


Figure 1. Influence of salt solution to the preserving rate of ascorbic acid

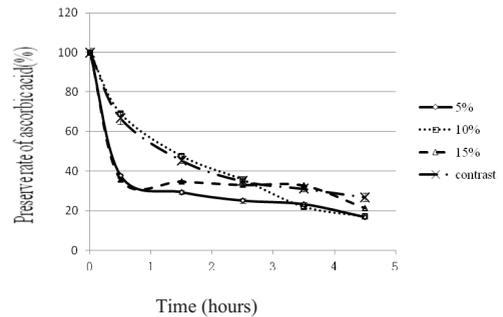


Figure 2. Influence of sugar solution to the preserving rate of ascorbic acid

Figure 3 indicated that putting the jujube fruit in 60°C water about 5 minutes, the preserving rate of ascorbic acid reached to 121.9% which obviously higher than the contrast (66.8%), this will have practical value to the processing industries of jujube fruits.

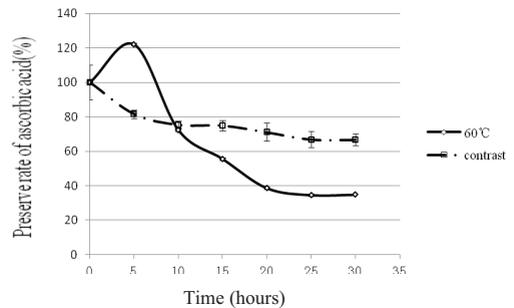


Figure 3. Influence of softening treatment to the preserving rate of ascorbic acid

Effect of citric acid on preservation of ascorbic acid

As can be observed in Figure 4, during the crushing, putting into 0.01% and 0.05% citric

acid could rise the preserve rate of ascorbic acid to 43% and 46% respectively, compared by the contrast (29%), especially after the 0.10% citric acid treatment, the preserve rate of ascorbic acid reach to 79%, much higher than he contrast (29%).

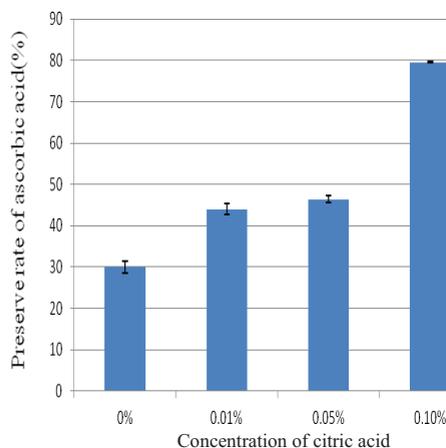


Figure. 4 Influence of citric acid on the preserving rate of ascorbic acid

Influence of the sterilization conditions on preservation of ascorbic acid

The results of the sterilization conditions (Table 1) indicated that the result of pasteurization and boiling water sterilization were ideal with the content of ascorbic acid were 226.5 mg/100 g and 225.9 mg/100 g, the preserve rate of ascorbic acid reached to 44.2% and 44.1%. However the result of autoclaving was less than the others.

Table 1 comparison of sterilization of jujube juice

Sterilization conditions	Content of ascorbic acid (mg/100g)
Pasteurization (65°C, 30 min)	226.5±3.8a
boiling water sterilization (100°C, 15 min)	225.9±1.9a
Autoclaving (121°C, 10 min)	99.4±3.6b

Each value is expressed as means ± standard deviation of n=3 determinations; Different letters within a column (a-d) denote significant differences (p<0.05) between cultivars.

CONCLUSIONS

Putting the jujube fruit in 60°C water about 5 minutes before crushing fruits could keep the preserving rate of ascorbic acid to 121.9%.

During the crushing, putting the 0.10% citric acid into the mix of water and jujube pulps could raise the preserving rate of ascorbic acid to 79% compared to the contrast (29.9%). These methods were proved to be useful technique to increase stability of ascorbic acid.

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