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Analysis of Nutrient Substance Contents in Blueberry Pulp

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Abstract. The processing of blueberry pulp has great significance on its quality and nutrient. In this experiment, based on the optimized hot dipping method, we compared the nutrient of blueberry pulps adding two food flavor additives, citric acid and cocktails. The blueberry fruits of verity 'O'Neal' with different maturity were used. The results showed that the nutrient content of blueberry pulp was positively correlated with the fruit maturity. The nutrient content of blueberry pulp added cocktails was greater than that added citric acid. Under the two treatment methods, different differences are exhibited depending on the functional substances.

Introduction

Blueberry (*Vaccinium* spp.) belongs to the Genus *Vaccinium*, family Ericaceae. They are perennial deciduous or evergreen shrubs. Blueberry fruit is rich in nutrient substances, such as anthocyanins, polyphenols, flavonoids, polysaccharides, vitamins and minerals. Therefore, blueberry is high economically valuable and has broad prospects for development [1-3]. In addition to fresh fruits, blueberry fruits are also used to produce processed products and natural extracts such as blueberry wine, beverages, jams, yoghurts and ingredient additives [4,5]. Functional substance contents is important indicators for evaluating the nutritional value of blueberry processed foods. The indicators mainly include total phenols content, vitamin c (Vc) content, anthocyanin content and soluble protein content [6,7].

The processing method of commercially available blueberry pulp is under developing [8]. In this experiment, an optimized thermal impregnation method [9] was adopted to overcome the shortcomings of the traditional pulp production process. After adding the flavoring agent, the functional substance was added. This experiment evaluated nutritional indicators of blueberry pulp produced from different maturity fruits and adding different flavor additives. This research is aiming to provide experimental theory for industrial production of blueberry pulp.

Materials and methods

Material. The material was the southern highbush variety 'O'Neal'. Immature, mature, and over-mature fruits were harvested at the beginning of May, middle of May, and late May of May 2016 at the blueberry orchard in Qionglai, Sichuan.

Medium preparation. The experiment was consisted of 6 treatments: 1) Immature blueberry pulp added citric acid; 2) Ripe blueberry pulp plus citric acid; 3) Blueberry slurry plus citric acid; 4) Immature blueberry pulp plus cocktail; 5) Ripe blueberry pulp plus cocktail; 6) Over ripe blueberry pulp plus cocktail.

Experimental design. The blueberry fruits of different periods were picked and stored in a fresh box and placed in a 4℃incubator. Remove the wounded fruit, select a fresh blueberry fruit of uniform size and color, and clean the fruit to remove the dirt on the surface of the fruit and the branches and leaves mixed during harvest. The molybdenum blue colorimetric method [10] was used to determine the Vc content of the pulp; the Coomassie brilliant blue method [11] was used to determine the soluble protein content of the pulp; the Folin-Ciocalteu method [12] was used to determine the total

phenol content of the pulp; the fruit anthocyanin content was determined using the Greesy formula method [13].

Results and discussion

Vc contents. From Fig.1, there was no significant difference in the Vc content of the blueberry pulp with various degrees of citric acid added. The Vc content of the blueberry pulp was between 1.78 and 2.21 ug·ml^{-1}. The Vc content of the overcooked blueberry pulp added to the cocktail was significantly higher than that of the other fruits. The degree of maturity, while the immature blueberry pulp has the lowest Vc content. At the same time, as the fruit maturity increasing, the Vc content of blueberry pulp added with citric acid and cocktails gradually increased. Under the two processing conditions, the blueberry pulp had no significant difference in the Vc content of the blueberry pulp of each maturity. The Vc content distribution corresponding to the maturity of the added citric acid was more concentrated, and the cocktail was more dispersed, indicating that adding the cocktail to the Vc, the effect of the content was significantly greater than adding citric acid.

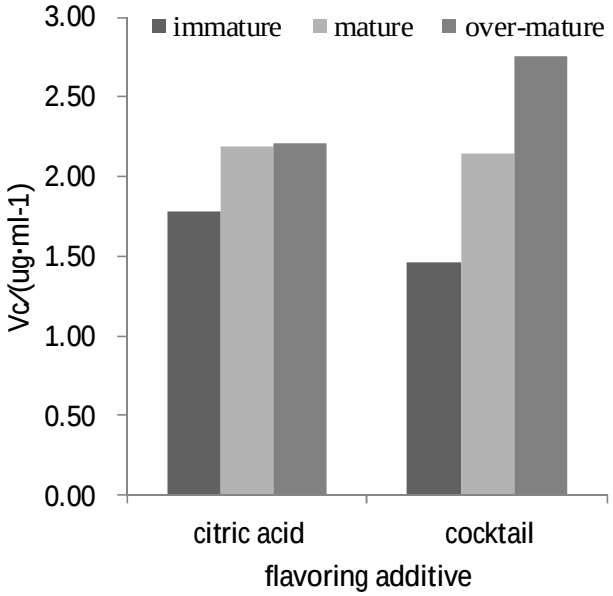

Fig.1. Vc contents of blueberry pulp

Soluble protein contents. From Fig.2, the blueberry pulps of various maturity levels contain abundant proteins, with contents ranging from 53.93 to 139.29 ug·ml^{-1}. The content of soluble protein in overcooked blueberry pulp added with citric acid was significantly higher than other maturity, followed by immature blueberry pulp and mature blueberry pulp. The soluble protein content of the mature blueberry pulp added to the cocktail was 89.05 ug·ml^{-1}, which was significantly higher than that of the blueberry pulp made from immature fruits, but not significantly different from that of the over-mature blueberry pulp made from over-mature fruit. The soluble protein content of citric acid was significantly higher in blueberry pulp than in cocktails under both processing conditions.

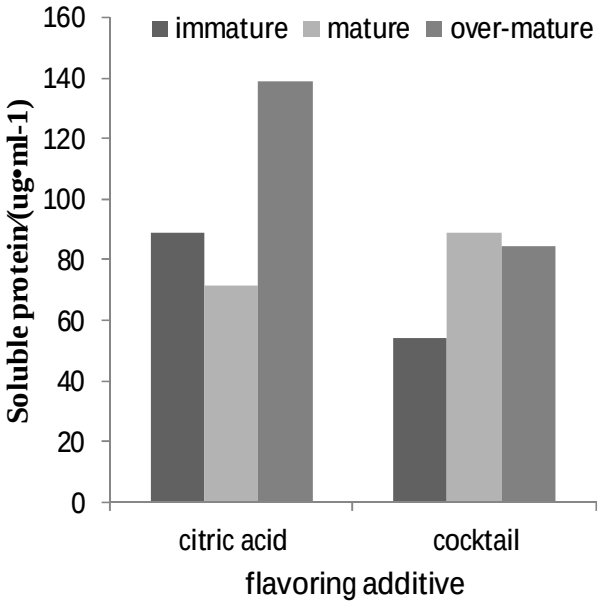

Fig.2. Soluble protein content of blueberry pulp

Total phenol contents. From Fig.3, the total phenol content of the over-mature blueberry pulp added with citric acid was as high as 24.06 ug·ml^{-1}, which was significantly higher than that of mature blueberry pulp, but not significantly different from that of immature blueberry pulp. The cocktail of mature blueberry pulp had the highest total phenolic content, which was 24.53 ug·ml^{-1}, which was significantly higher than that of other mature blueberry pulps. The immature blueberry pulp had the lowest total phenolic content, which was 18.75 ug·ml^{-1}. The blueberry pulp had no significant difference in the total phenolic content of the blueberry pulps at all matureness levels of citric acid and cocktails under both processing conditions.

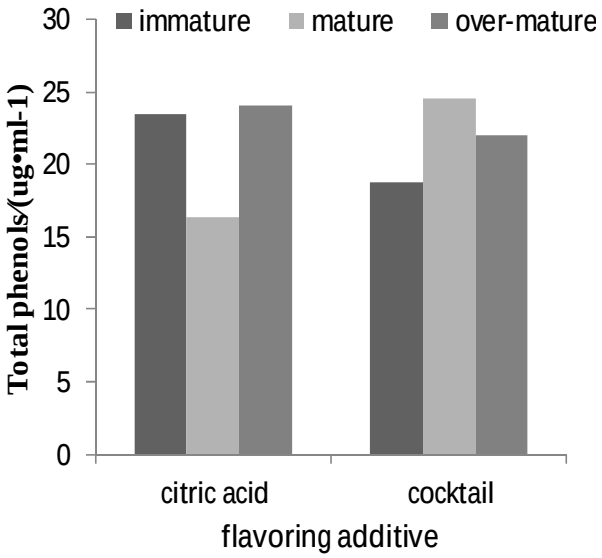

Fig.3. Total phenol content of blueberry pulp

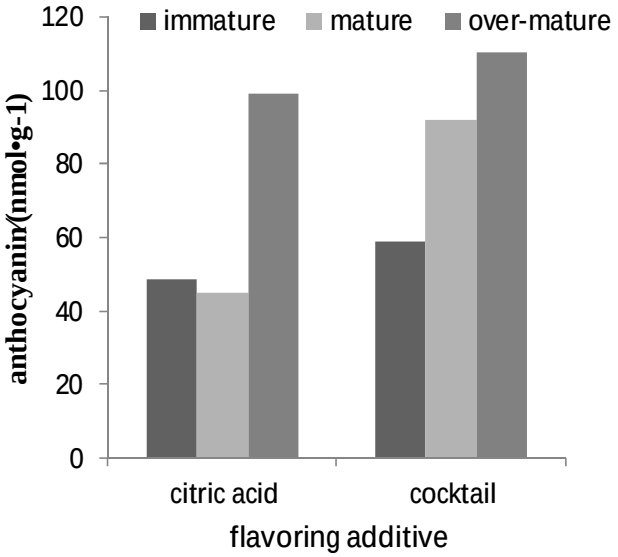

Fig.4. Anthocyanin content of blueberry pulp

Anthocyanin contents. From Fig.4, the anthocyanin content of the over-mature blueberry pulp added with citric acid was significantly higher than that of mature and immature, up to 99.28 nmol·g^{-1}. The anthocyanin content of the over-mature blueberry pulp added to the cocktail increased with the increase of fruit maturity, and the anthocyanin content of the blueberry pulp increased gradually up to 110.30 nmol·g^{-1}, which was significantly higher than other maturity levels. The anthocyanin content of blueberry pulp added with citric acid was significantly higher than that of cocktails under the two processing conditions, while the anthocyanin content of blueberry pulp treated with citric acid and cocktails was overdone. The highest levels respectively reached 99.28 nmol·g^{-1}and 110.30 nmol·g^{-1}.

Conclusions

The results showed that the Vc content of blueberry pulp added with two food flavor additives was not significantly different at all fruit maturity levels, but the Vc content of blueberry pulp added to cocktails was much greater than that of blueberry pulp added with citric acid. The soluble protein content of blueberry pulp, made from over-mature fruits, added with citric acid was much higher than that of other soluble protein content. There was no significant difference in the total phenolic content of the blueberry pulps at each fruit maturity of the citric acid and cocktail additions. After adding the flavoring agent, the anthocyanin content of the blueberry pulp made from over-mature fruits was much greater than that of other maturity.

By comparing the contents of functional additives of blueberry pulp made from fruits with different maturity, it was shown that the functional substances of blueberry pulp made from fruits with different maturity increased with the increase of fruit maturity, and the nutritional value in the that made from over-mature fruits was the highest, and the nutritive value in the immature period was lowest. Comparing the changes of the content of functional substances in blueberry pulp added with two flavor additives, it showed that the nutritive value of the cocktail added in blueberry pulp made from mature fruit period was obviously better than that added citric acid, on the contrary, the nutrition of the blueberry pulp added citric acid increased with fruit maturity.

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