Fermentation and Characterization of Pitaya Wine

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Abstract. Juice was extracted from pitaya pulp. After fermentation, the wine produced contained 11.2% vol (v/v) alcohol, total sugar content is 7.3g/L, 7.8% °Brix, the content of titratable acid and amino acid nitrogen are 2.34 g/L and 0.46 g/L, respectively. Dragon fruit wine of the communist party of detect aroma components is 56 kinds, content is more than 0.5%, 17 kinds, 9 esters are among those kinds, 5 kinds alcohol, there are 2 kinds of acids, one kind of alkanes. The physicochemical characteristics of wines produced from pitaya is attractive, with unique flavor and rich nutritional value, which makes it widely accepted and even liked.

1. Introduction
Pitaya is native to central and South America, has been gradually introduced to Guangxi, Guangdong, Hainan, Fujian, Yunnan, Guizhou and other provinces and regions, as pitaya planting area expands unceasingly in our country, plant diseases and insect pests of pitaya problem is increasingly serious, plus the pitaya itself, sensitivity to temperature, temperature is not resistant to storage, often appear serious unsalable phenomenon\textsuperscript{[1]}. And made into wine, namely to plant fruit or fruit juice as raw material fermented low alcohol drink, to preserve the original fruit sugars, amino acids, organic acids and minerals, such as composition, is the use of a very healthy way. But a lot of researchers are studying how to screen for dragon fruit wine special yeast fermentation, this team after previous research work, screening into a natural saccharomyces cerevisiae strains for dragon fruit wine fermentation\textsuperscript{[2]}. This experiment is mainly to explore the natural yeast fermentation process of red meat of pitaya change rule of physical and chemical properties and nutritional quality, in order to provide high quality fire dragon fruit wine provide theoretical basis for the research and development.

2. Materials and Methods

2.1 Preparation of Juice
Mature, high sugar content and no rotten deterioration, no pests of red heart dragon fruit were from
Zhanjiang. After artificial peel, cut into pieces, into the freezer full frozen 5 days after the agglomeration, the frozen pulp removed from the thaw. To the thawed out of the fruit juice by adding 0.5mg/100ml of sodium bisulfite for disinfection. The addition of sucrose and citric acid or tartaric acid adjusts the juice to a sugar content of 20 °Brix with an acidity of 3.7, and then the juice was cooled to 20°C and pumped into a tank.

2.2 Preparation of Yeast
1 L of dragon fruit juice was prepared and autoclaved at 70°C for 30 min. After cooling to room temperature, 0.05% active dry yeast was added and activated at a temperature of 28°C for 24 h.

2.3 Fermentation
The filtered fruit juice is pumped into the fermentor, and 5% yeast is added for fermentation. The temperature is kept at 20°C for 7d. During the fermentation process, titratable acidity (TA), pH value, soluble solids (SS), alcohol and sugar content were measured daily. When the sugar content changes very small, you can determine the end of fermentation. The wine in the 10°C under the conditions of storage for a month for aging, to improve the flavor of wine while also play a role in clarifying the wine. Brewed wine in accordance with product quality standards for deployment, according to a certain percentage of added sugar, citric acid, distilled wine. After the wine is filtered and sterilized, it can be filled into the bottle and stored in the refrigerator.

2.4 Analytical Methods
The total sugar is estimated by the method of Dubois et al[3]. The alcohol content was determined by GB/T 15038-2006[4]. The titratable acid and amino acid nitrogen content are determined as described in GB/T 13662-2008[5], and the soluble solids are determined using an Abbe refractometer (Model 60 E / A, England). Volatile compounds is determined as Yin et al. reported[6].

3. Results and discussion
3.1 Changes in sugar and alcohol during Fermentation
The change trend of °Brix in the fermentation process is showed figure 1. Table 1 showed changes of total sugar and alcohol content in the fermentation process. The fermentation speed is very fast in first on the 6th, total sugars reduce by 149.32g/L. On the 6 d in the fermentation, the content of convertible sugar showed a straight line, while the alcohol content also appeared linearly. After 6 days of fermentation, the convertible sugar was consumed and no residual sugar was detected, the content of total sugar only is 7.5g/L. At this point, the alcohol concentration reached the maximum (11.2% vol). At the end of the fermentation, the alcohol content was no longer elevated due to the absence of available conversion sugars, and the alcohol content decreased slightly due to self evaporation and yeast aerobic metabolism[7].

Fig.1 Changes of the °Brix during fermentation of pitaya wine
Tab.1 Changes of the total sugars and alcohol content during fermentation of pitaya wine

| Time (day) | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
|------------|----|----|----|----|----|----|----|----|
| Total sugars (g/L) | 173.69 | 156.82 | 131.91 | 81.29 | 58.74 | 16.31 | 7.50 | 7.30 |
| Alcohol (% vol) | 0 | 1.51 | 2.80 | 7.24 | 9.65 | 10.81 | 11.22 | 11.27 |

3.2 Changes in pH, titratable acid and amino acid in wine

It can be seen from Fig.2 and table 2 that the pH value, titratable acid and amino acid nitrogen of the fermented fruit is slowly increasing during the fermentation period. After the fermentation, pH increased by 0.21, which indicates that the growth and metabolism of the bacteria in the whole fermentation process are weak, and the sugar can be used to maintain the growth and transformation of the alcohol almost. The slow rise in pH during fermentation of the dragon may be related to the use of some physiological alkaline salts in the dragon pulp[8]. Correspondingly, the titratable acid content increased slowly in four days before fermentation, increase by 0.2g/L. The content of amino acid nitrogen is smaller; after the fermentation, amino acid nitrogen increased by 0.05g/L.

![Fig.2 Changes of the pH during fermentation of pitaya wine](image)

Tab.2 Changes of the titratable acid and amino acid nitrogen during fermentation of pitaya wine

| Time (d) | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
|----------|----|----|----|----|----|----|----|
| Titratable acid (g/L) | 2.13 | 2.26 | 2.29 | 2.33 | 2.34 | 2.35 | 2.34 |
| Amino acid nitrogen (g/L) | 0.41 | 0.41 | 0.43 | 0.45 | 0.47 | 0.47 | 0.46 |

3.3 Detection aroma components in pitaya wine

Aroma is one of the necessary quality wine. The aroma of fruit wine is mainly composed of esters, alcohols and acids, etc[9]. The results show that the dragon fruit wine of the communist party of China detect 56 kinds of aroma components, Its content is more than 0.5% of 17, Esters are among those nine, alcohol has 5 kinds, there are two kinds of acids, alkanes one. The higher alcohols are the byproducts of yeast amino acid synthesis and catabolism, and their contents are related to the nutrient content of raw materials and the physiological characteristics of yeast strains. It can be seen from Fig.6 that three higher alcohols of 1-Butanol, 2-methyl and 2,3-Butanediol were detected in the fruit of the dragon. Similarly, the peak area percentage of decanoic acid, ethyl ester in the fruit wine is highest, reach to 27.27%. The total alcohol content also in the range of normal wine content[10].

Tab.3 Determination of major aroma in the pitayawine

| Retention time | Peak area | percentage | component |
|---------------|-----------|------------|-----------|
| 3.534         | 21082202  | 4.8        | 1-Butanol, 2-methyl |
| 3.709         | 14529834  | 3.31       | Silanediol, dimethyl |
| 5.013         | 20580125  | 4.69       | 2,3-Butanediol |
| 6.665         | 3421894   | 0.78       | 1-Butanol, 3-methyl-acetate |
| 7.802         | 3602718   | 0.82       | Oxime-, methoxy-phenyl |
| 10.38         | 7198913   | 1.64       | Hexanoic acid, ethyl ester |
| 14.066        | 30922656  | 7.05       | Phenyethyl Alcohol |
| 16.088        | 11616752  | 2.65       | Octanoic acid |
4. Conclusion
The results of this study show that the *Saccharomyces cerevisiae* is particularly suitable for the fermentation of dragon fruit wine, especially its fermentation rate and conversion sugar utilization rate, which can be regarded as a yeast strain for fermenting wine. After fermentation, the wine produced contained 11.2 % vol (v/v) alcohol, in line with the requirements of low-alcohol health wine. Total sugar only is 7.3g/L, 7.8% of °Brix, the content of titratable acid and amino acid nitrogen are 2.34 g/L and 0.46 g/L, respectively. It has appropriate sugar acid ratio so good taste. Dragon fruit wine of the communist party of detect aroma components is 56 kinds, content more than 0.5% has 17 kinds, esters are among those 9 kinds, alcohol has 5 kinds, there are 2 kinds of acids, and one alkanes.

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