

Production and Quality Evaluation of Pineapple Fruit Wine

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Abstract: The fermentation process of pineapple fruit wine was studied. The juice was inoculated with 5% (v/v) active yeast and held at 20 °C for 7 days. Total sugar and pH decreased while the alcoholic strength increased with increasing length of fermentation. The fermented fruit wine contains 2.29 g/L total acid, 10.2 % (v/v) alcohol, 5.4 °Brix soluble solids, pH 3.52. Pineapple wine detected 68 kinds of aroma components, including 34 esters, 13 alcohols. The ester material accounted for 52.25% of the main aroma components. The quality and sensory evaluation results indicated that pineapple fruit wine belongs to a kind of low alcohol wine, so it is easy to be accepted by the public.

1. Introduction

Pineapple (*Ananas comosus* [L.]), a tropical and subtropical fruit, is mainly produced in Guangdong, Hainan, Guangxi, Yunnan and other regions. In 2010, the production of pineapple in Guangdong province continued to accumulate in zhanjiang area, a region of planting area and production accounted for 69.4% and 88.2% of the province and the yield per unit area was significantly higher than other areas in the province^[1]. Pineapple has a moderate sugar and acidity, in addition to a strong aroma. So, using pineapple to produce a fruit wine is an attractive direction for deep processing. In this study, fresh pineapples was used as the main raw material for fermentation and inoculated with active yeast and then investigated the brewing process and quality evaluation of pineapple fruit wine. With a view to provide certain reference data for the development of pineapple wine.

2. Materials and Methods

2.1 Preparation of Juice

Firstly, the pineapple were be washed, then peeled and cored. After chipping and pressing, add 0.1 mg/L pectinase for enzymolysis and held for 2 h in water at 40 °C. The slurry was filtered through a double folded cheese cloth. Adding SO₂ to the juice immediately to prevent the growth of the bacteria. White sugar was added to the juice to adjust the sugar level and added the citric acid to the pH to enhance the flavor of the wine. Finally, the juice was pasteurized (65 °C, 30 min).



2.2 Preparation of yeast

Prepared a specialized yeast medium 1 L and autoclaved for 15 min at 121 °C. After cooling to room temperature, 0.05 % active dry yeast was added and, activated for 24 h at 28 °C. Then the culture medium that was prepared by 1 L pineapple juice was autoclaved for 15 min at 121 °C. Lastly, adding 5 % yeast has been activated for 24 h at 28 °C after cooling to room temperature.

2.3 Fermentation of pineapple Juice

The treated juice was added into the fermentation jar, then sugar is adjusted for 20 °Brix. The jar was inoculated with 5 % activated yeast and closed. Then the mixture was incubated at 20 °C for 7 d. The total sugar, total acid and alcohol content were monitored periodically during the fermentation. When the main fermentation finished, the upper liquid was transfer to the other clean container in order to remove impurities. Then the mixture continued to ferment at 20 °C for 10 d. After that, under the storage conditions of 20 °C aged 2 months. The clarifying treatment of the fruit wine was followed by the gelatin tannin clarification method^[2].

2.4 Analytical Methods

The total sugar was determined by Fehling reagent method. Total acid was determined by potentiometric titration. With the distillation gravity method^[3], the alcohol was determined. pH was measured with a digital pH meter. The sugar was determined using a handheld saccharimeter. Titratable, fixed and volatile acidities were determined as described by Amerine and Ough^[4], the aroma components of pineapple wine were analyzed by GC-MS^[4].

2.5 Sensory Evaluation

The pineapple fruit wine was evaluated with color (30 points), aroma (30 points) and taste (40 points) by a group of 10 experts with relevant experience. The sensory ratings were analyzed using the method described by Zhaojian Gao^[6].

3. Results and Discussion

3.1 Sensory Evaluation

Pineapple wine accept degree is higher, color is 28 points, with the color of pineapple wine, clear transparent, no obvious suspended solids, the smell of the coordination, the aroma is outstanding reach 25 point. , good representativeness. It has pineapple fruit aroma, with the scent of yeast fermentation. But Pineapple peel slag, tannins and flavonoids content is higher, can cause with pineapple wine is acidity, so its taste is 30 point.

3.2 Change in °Brix

Yeasts grew and multiplied with sugar and produced alcohol, esters and other substances during the fermentation. When the sugar level is appropriate, the speed of yeast bred and metabolized is faster. As the length of fermentation was prolonged, the total sugar decreased. Early stage of fermentation, the change is obvious. It showed that the °Brix was reduced rapidly, During 4 th fermentation, sugar fell by 13.58 %. At the 4-7 d, the phenomenon that the sugar content tended to stabilize indicated the process entered into the post-fermentation stage. Arianna Roda et al.^[7] founded that the enzymatic hydrolysis decreased the polysaccharide amount and increased reducing sugars and soluble solids, thereby improving the fermentation process.

3.3 Change in pH

The initial pH of the fermentation fluid was 3.81, and the overall pH change in the fermentation process was not much changed. The pH was fluctuating at the time of 1-2 d, decreased by 0.24. At the early fermentation, the pH of fermentation liquid was reducing gradually and achieved the minimum value. Along with the fermentation, the pH was on the rise because of the consumption of nutrients

and the autolysis of yeast, which indicated that the fermentation is near the end.

3.4 Determination of total acid

The acid in the wine is mainly organic acid. Part of these organic acids comes from the fruit, such as tartaric acid, malic acid, citric acid, some parts from alcohol fermentation, acetic acid or malic acid, lactic acid fermentation, such as acetic acid, succinic acid^[8]. The next day, total acid content decreased by 0.21 g/L. At the end of fermentation, total acid content is 2.29 g/L. Acids material is not directly constitute the fragrance of wine, but the proper amount of acid can make the wine have a refreshing feeling.

3.5 Changes in alcohol content

The level of alcohol in the brewing of fruit wine is influenced by many factors, such as initial sugar content, acidity, fermentation time, yeast inoculation. Three days before fermentation, the alcohol content increased and changed significantly. The maximum value was 10.2% vol. It means that the pineapple fruit wine is a low-alcohol wine.

Table 1 Change of alcohol content during pineapple wine fermentation

Time (d)	1	3	5	7
Alcohol content (% vol)	4.8 ± 0.01	9.5 ± 0.02	9.8 ± 0.01	10.2 ± 0.01

3.6 Change in aroma

The wine ingredients include non-volatile matrix components and volatile aromatic compounds. The former determines the nutritional value of the wine and the latter gives the wine a unique characteristic flavor. Elss et al.^[9] founded that the esters were the main aromatic substance in the analysis of the aromatic substance of pineapple. This experiment used GC-MS technology to analyze the aroma components of pineapple wine. The main aroma substances detected in the Table 1). Pineapple wine detected 68 kinds of aroma components, including 34 esters, 13 alcohols. The ester material accounted for 52.25% of the main aroma components. Proportion of phenylethyl alcohol, Octanoic acid ethyl ester, Decanoic acid ethyl ester and Dodecanoic acid ethyl ester is more than 10%. Yongli Lan et al.^[10] founded that the major changes of flavor qualities occurred in the initial fermentation stage and fermentation reduced the relative content of aldehydes, ketones, heterocyclic and aromatic compounds, but promoted the formation of esters and alcohols. Besides, it can be seen that the content of esters in pineapples is higher, which is of great significance to the aroma of fruit wine.

Table 2 Pineapple wine aroma components types

Aroma components	ester	alcohol	acid	alkanes	alkene	aldehyde	others
Total number	34	13	4	8	4	2	3

Table 3 Pineapple wine main aroma components

Main aroma components	Peak area	Percentage of peak area
1-Butanol,3-methyl-(impure)	35386369	6.58
2,3-Butanediol	10813379	2.01
1-Butanol, 3-methyl-, acetate	25642750	4.77
Butanoic acid, 3-hydroxy-, ethyl ester	5591696	1.04
Hexanoic acid, ethyl ester	5845074	1.09
Phenylethyl Alcohol	64421447	11.99
Octanoic acid	25078093	4.67
3-Cyclohexen-1-ol,		
4-methyl-1-(1-methylethyl)	16989859	3.16
Octanoic acid, ethyl ester	57436224	10.69
Acetic acid	42560035	7.92
Decanoic acid	14601314	2.72
Decanoic acid, ethyl ester	92224838	17.15
3-(1-Ethoxy-ethoxy)-butyraldehyde	28219587	5.25

Dodecanoic acid, ethyl ester	58620475	10.91
Iso amyl decanoate	4717189	0.88

4. Conclusion

The research results indicated that the pineapple fruit wine has good sensory characterization and chemical properties by fermenting with the conditions of 260 g/L initial sugar, temperature of 20 °C, 5 % yeast inoculation. The pineapple wine contains 2.29 g/L total acid, 10.2 % (v/v) alcohol, 5.4 °Brix soluble solids, pH 3.52. Pineapple wine detected 68 kinds of aroma components, including 34 esters, 13 alcohols. The ester material accounted for 52.25% of the main aroma components. The wine Low alcohol consumption has become a consumption trend, so the low-alcohol wine made with pineapple juice is in line with modern consumer habits. And the processing of fruit wine is not only satisfies people's consumption demand but also makes the value of pineapple can be improved.

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