Fermentation technology of Chayote wine

XU Xiaochun, LIN Chaopeng

(Department of Food Science and Engineering, Institute of Shaoguan, Shaoguan 512005, China)

Abstract: In this paper, fermentation technology of Chayote wine was introduced. After adjusting the sugar content of Chyote juice and pasteurization, the yeast cells immobilized with sodium alginate and aluminum sulfate were added and then fermentation at constant temperature. The orthogonal experiments results showed that the optimized condition were: the addition of yeast 0.1%, fermented after the permutation of immobilized strains by aluminum sulfate liquid, fermentation temperature 15℃. Then the higher alcohol content, better color and flavor Chayote wine was obtained. The clarity of Chayote dry wine was enhanced after added proper content of clarifier such as agar, glutin and benotonite.

Key words: immobilized cells; Chayote dry wine; fermentation; clarify

Chayote (Sechium edule Swartz), Department of chayote is cultivated Cucurbitaceae species, also known as clap your hands together melon, fragrant cucumber, fist melons, eternity melons, etc. Chayote is not only tender, but also crisp and juicy, delicious taste and rich nutrition. Chayote has high content of benefit element. Besides calcium, it is also high in magnesium, iron, zinc, etc. But the harmful trace elements such as arsenic, lead, cadmium, and so are very low [1]. Therefore, chayote set rich nutritional value, medicinal value and health care functions in one, has good effects on human. As the chayote production season is short, and perishable in storage and transportation, so it is imperative to deep processe chayote. At present, Chayote processed products more common in juice drinks[2], soy milk and other chayote products [3], etc., The whole chayote vegetable juice brewed wine in the market is very rare. As Immobilized cells have the characters of growing fast, quick reactions, strong anti-pollution, continuous usable, and conducive to the separation of the product, chayote is more and more widely used in food and fermentation industries [4-5]. Research and development of chayote dry vegetables wine can not only solve the issue of deep processing of chayote, also are in line with the development trend of domestic and international wine industry. In this paper, chayote dry vegetable wine immobilized fermentation process studied with a view to provide reference to production of chayote dry vegetable.

1 Materials and methods

1.1 Experimental material

Chayote juice: laboratory-made, raw materials collected from the Xinfeng County, Guangdong Province. White sugar: commercially available; Angel brewing Active Dry Yeast: Angel Yeast Company; citric acid, gelatin, agar, bentonite, etc. which were analytical reagent.

1.2 Experimental equipment

Hand-held sugar meter, water-sealed glass fermentation bottle, acidmeter, alcohol meter, electronic balance, S22PC spectrophotometer, biochemical incubator, electric heated water bath pan.

1.3 Immobilized cell fermentation process

Immobilized yeast cells

↓

Chayote juice→ Adjustment elements→ Pasteurization→ Inoculation→ Pre-fermentation→ Invert cans→ post-Fermented→ Filter→ clarify the wine with clarifying agent→ Sterilization → Aging→ Mix → Finished

1.4 Chayote juice composition adjustment

In order to achieve the appropriate alcohol content, add the sugar in the juice to make soluble Solids content to 240 g / L. About the same time, adding 0.01% Gioia potassium (Equivalent to 0.005% SO2), use citric acid transferred to pH4.3, and pasteurize and cool the juice before inoculation.

1.5 Yeast cells immobilization

Angel brewing active dry yeast activated 30 min in 2% sucrose solution at 37 ℃. Prepared 3.0% sodium alginate solution, after sterilization and cooling mixed it with the yeast activator solution. using syringe injected it into the 4% CaCl2 solution to form small gel Balls, cross-linked 30 min, washed it three times with sterile water. Using different concentrations of aluminum sulphate solutions(0%,1%,2%) cured the gel ball for 4 hours. At last, use sterile water washing the gel ball 3 times.

1.6 Fermentation conditions

Examine the amount of yeast inoculation, the concentration of aluminum sulfate, fermentation temperature and other factors which affect the quality of chayote wine. Orthogonal test factor level see Table l. Added prepared immobilized cell in processed chayote juice which was in water-sealed glass fermentor. The chayote juice fermented at different constant temperatures, detected the related indicators at certain period of times from regular samplings. Flitted the juice when the total sugar content reduced to about 0.4%, and then study the clarification of the wine.

Table 1. Factors and levels of orthogonal test of fermentation technology

Level	Yeast inoculum	The concentration of	Fermentation temperature

		aluminum sulfate	
1	0.1	0	15
2	0.2	1	20
3	0.3	2	25

1.7 Index Determination

Total sugar content: tested with Fehling's titration solution; alcohol content: determined by alcohol hydrometer, after the sample be distilled; Color: using lcm cuvette to determine the color at a wavelength of 510mm which was tested by spectrophotometer. Color was counted by absorbance values (A), using distilled water as blank; taste score: Invited 10 persons panel of judges to rate(out of 10 points). A comprehensive score for each product is the average score of the 10 people。

1.8 Wine clarification

Did single-factor test with gelatin, agar, betonite, and other clarifying agents respectively. Took the appropriate amount of agar, gelatin and bentonite adding into chayote original wine, shaked well and placed, observed the effect of the clarification after 48h.

2 Results and analysis

2.1 orthogonal test of Chayote vegetables wine fermentation（see table 2）

Table 2. Analysis of orthogonal test results

Test No.		A-The amount of yeast /%	B Aluminum sulfate Concentration /%	C Fermentation temperature /℃	Results		
					Alcohol /%	Color	Taste ratings
1		1（0.1）	1（0）	1（15）	12.1	0.123	8
2		1（0.1）	2（1）	2（20）	12.7	0.265	7
3		1（0.1）	3（2）	3（25）	12.6	0.244	6
4		2（0.2）	1（0）	2（20）	12.8	0.197	7
5		2（0.2）	2（1）	3（25）	12.3	0.278	6
6		2（0.2）	3（2）	1（15）	12.6	0.136	9
7		3（0.3）	1（0）	3（25）	12.1	0.240	5
8		3（0.3）	2（1）	1（15）	12.8	0.102	7
9		3（0.3）	3（2）	2（20）	12.6	0.185	8
Alcohol	K1	12.467	12.500	12.500	Threshold F0.1=9		
	K2	12.567	12.700	12.700	FA=0.064; FB=0.057; FC=0.811		
	K3	12.500	12.333	12.333	FA, FB, FC Insignificant		
	R	0.100	0.376	0.376			
Color	K1	0.211	0.187	0.120	Threshold F0.1=9		
	K2	0.204	0.215	0.216	FA=1; FB=1; FC=14		

	K3	0.176	0.188	0.254	FC Significant， FA,FB Insignificant
	R	0.035	0.028	0.134	
Taste ratings	K1	7.000	6.667	8.000	Threshold F0.1=9
	K2	7.333	6.667	7.333	FA=1; FB=3; FC=13
	K3	6.667	7.667	5.667	FC Significant， FA,FBInsignificant
	R	0.666	1.000	2.333	

We can see from Table 2, the amount of Yeast Inoculation, The concentration of aluminum sulfate and fermentation temperature produced significant impact on all indicators of the Chayote vegetables wine. Chayote vegetable wine's quality determined by high content of alcohol, high taste score and small absorbance (the color of wine is the more light the better). Of various factors impact on alcohol, the effect order is C> B> A. the optimal combination is A2B2C2 or A2B3C2; Of various factors impact on the color (absorbance value), the effect order is C> A> B. the optimal combination isA1B2C3; Of various factors impact on taste, the order is C> B> A. the optimal combination is A2B3C1. The impact of 3 factors on alcohol strength was not significant, Only fermentation temperature had significant impact on the color and taste at F0.1 Levels, while the remaining two factors not significantly impact on the color and taste. The factors that affect the product quality indicators are considered in different orders. According to the results of variance analysis, in determining the optimum the priority should be given to the fermentation temperature Impact; meanwhile, the above-mentioned three indicators, under the same conditions, according to product requirements, Priority should be given to taste, followed by the color, the last to consider is alcohol content. Comprehensively, we can identify fermentation temperature to be 15 ℃; Aluminum sulfate concentration do not have significant effect on color, while the impact on alcohol and taste is significant, so choose the most appropriate concentration of 2%; Similarly, the impact of yeast inoculation rate on color significantly better than the other two indicators, so choose the best inoculation content of 0.1%. The optimal chayote vegetable wine fermentation conditions are A1B3C1, or the addition of yeast 0.1%, fermented after the permutation of immobilized strains by aluminum sulfate liquid, fermentation temperature 15℃. The measured alcohol content of chayote wine is 12.5%, Absorbance value is 0.163, and taste score is 8. This chayote wine has high alcohol content, light color and good flavor.

2.2 **comparing the clarification effect of different fining agents on chayote.**

As to retain the original flavor and nutrition of chayote as much as possible, chayote juice was made with chayote skin, which led to contain more phenolic substances. In the aging and storage process, these phenolic substances occur aggregation or condensation effects, increasing molecular weight and colloidal particles, finally led to the color change or precipitate. This process was speeded up due to the presence of oxygen and oxidative enzymes, so that darken the color of wine and then produce cloudy precipitate. Add gelatin, agar, and bentonite are mainly let them electrostatic neutralize with phenolic substances and generate precipitation [7]. Therefore,

remove most of phenolic substances in clarification process play a very important role in improving the taste and color of chayote wine. Results of clarification experiment through the addition of agar, glutin and benotonite to Chayote wine is in Table 3.

Table 3. Results of clarification experiment through the addition of agar, glutin and benotonite to Chayote wine

The amount of agar /%	0.005	0.01	0.015	0.02	0.025
Effect of clarification	No clarifying effect	Slightly clarifying effect on the upper body of the wine	Relatively clarifying effect on the upper body of the wine，but no significant interface	Relatively clarifying effect on the upper body of the wine with interface	clarifying effect on the upper body of the wine with significant interface
the amount of gelatin /%	0.005	0.01	0.015	0.02	0.025
Effect of clarification	No clarifying effect	Slightly clarifying effect on the upper body of the wine	Clarifying effect on the upper body of the wine，but no significant interface	Relatively clarifying effect on the upper body of the wine with interface	clarifying effect on the upper body of the wine with significant interface
the amount of bentonite/%	0.05	0.10	0.15	0.20	0.25
Effect of clarification	No clarifying effect	Slightly clarifying effect on the upper body of the wine	Clarifying effect on the upper body of the wine，but no significant interface	Relatively clarifying effect on the upper body of the wine with interface	clarifying effect on the upper body of the wine with significant interface

As can be seen from Table 3, when the amount of agar and gelatin respectively rose to 0.02%, the clarification effects are significantly improved. Therefore, the selected amount of agar and gelatin are both 0.02%.The addition of bentonite, the clarify cutoff point is 0.20%, Therefore, selected bentonite as a clarifying agent, and the dosage of 0.20% is appropriate.

3 Conclusion

The orthogonal experiments results showed that the optimized condition were the addition of yeast 0.1%, fermented after the permutation of immobilized strains by aluminum sulfate liquid, fermentation temperature 15℃. Then the higher alcohol content, better color and flavor Chayote wine was obtained. The clarity of Chayote dry wine was enhanced after added proper content of clarifier such as agar, glutin and benotonite.