

Study of Ageing and Production of Wine from Pineapple by Fermentation Process

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Abstract

This study was aimed at investigating the suitability of fruits (Pineapple) as substrates for wine production and some physical parameters were monitored during anaerobic phase of fermentation. The fermentation was done in the anaerobic phase which lasted for 6 months. Pineapple wine was produced by anaerobic fermentation method. Some physical parameters of pineapple wine such as pH, specific gravity, percent alcohol and color density were examined. The mature pineapple wine (after six months of fermentation) has pH 3.4, specific gravity 1.11, percent alcohol 9.96% and color density 0.29. Moreover, preliminary phytochemical test of wine sample such as phenolic compound and polyphenol were determined. Elemental analysis of pineapple wine was performed by EDXRF (Energy Dispersive X-ray Fluorescence) Spectrophotometer. In addition, nutrition values of pineapple wine were examined. More research is still required to determine the shelf stability of the pineapple wine.

Keywords: phytochemical test, pineapple fermentation, Wine Production, yeast

Introduction

Pineapple (*Ananas comosus* (L) Merr.), a leading member of the family Bromeliaceae comprises about 2,000 species mostly epiphytic and many strikingly ornamental and varies from nearly white to yellow in Color.[1]

Pineapple is an important source of sugars, organic acids and some essential minerals for human nutrition and its quality of good flavor, aroma, juiciness and sweetness is well known and appreciated by consumer. In addition, pineapple is also rich in health-promoting antioxidants, such as ascorbic acid, flavonoids, and other phenolic compounds related to antioxidant activities, which are important indexes for fruit acceptability to the consumer and processor.[10]

Pineapple contains good sugar proportion which makes its suitable for wine making. Wine is an alcoholic beverage typically made of fermented fruit juice. Any fruit with good proportion of sugar may be used in producing wine and resultant wine is normally named after the fruit. The type of wine to be produced dictates the fruit and strain of yeast to be involved. [5] Preservative used in wine making include sulphurdioxide, potassium sorbate, ascorbic acid, lemon juice (citric acid) and metabisulphides. High concentration of these preservative in wine, aside causing off odours, can induce lots of systemic disorderliness such as breathing problems in Anathematic patients and gastrointraion disturbances in allergic persons. [15] Since, the yeasts that bring about alcoholic fermentation can attack soluble sugars but do not produce starch splitting enzymes, wines can be made by direct fermentation of the fruit juices by yeasts, as a preliminary step.

Wine has importance in many social and religious contexts in our society today, as it has for thousands of years. The basic fermentation process whereby alcohol is produced from the sugar in grapes is very simple, but its chemistry is still not completely understood. As this knowledge increases, winemakers are being helped to improve the quality of their wine.

In the production of wines, chemistry is important, and as some of the complexities of wine chemistry have begun to be understood chemists have been able to contribute greatly to

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the improvement of wine quality. Wine has enormous health benefit similar to those of fruits from which they are derived. Wine is rich in plant chemicals called polyphenols which may protect against certain kinds of disease. One polyphenol in wine, called resveratrol may offer heart protective benefits, including reducing damage to blood clots. Also an antioxidant, resveratrol may produce anti-cancer, anti-aging and anti-inflammatory effects, according to a laboratory study published in "inflammatory" in 2011. Additionally, the alcohol in wine can help lower bad cholesterol and prevents blood clots.

In the present study, pineapple sample was collected from Mong Latt Village, Kyaing Tong Township, Eastern Shan State. Then pineapple juice was prepared. Pineapple wine was produced by using fermentation method. The physical parameters of wine were determined. Moreover, elemental analysis and nutritional values of pineapple wine were examined. In addition, some phytochemical constituents such as phenolic compound and polyphenol were determined.

Botanical Description



Figure (1). Plants of *Ananas comosus* (L) Merr.

Family name	-	Bromeliaceae
Botanical name	-	<i>Ananas comosus</i> (L) Merr.
Common name	-	Pineapple, bromelian, Phlogenzym, Debridase
Myanmar name	-	Nar nat
Part used	-	Fruit

Experiment

Collection of Sample

Ripe and undamaged fruits of pineapple plant (*Ananas comosus* (L) Merr.), used as raw materials for wine fermentation were purchased from Mong Latt Village, Kyaing Tong Township, Eastern Shan State.

The ripe pineapple fruits of such variety were washed with distilled water to remove impurities. The sample was cut into small pieces. 1.5 kg of sugar was dissolved in 1.5 Liters of boiled water. Then 1.5 kg of pineapple sample was mixed with sugar solution.

Production of Pineapple Wine

Ingredients for making white wine

Pineapple (fruits)	1.5 kg
Sugar	1.5 kg
Yeast (<i>Saccharomyces cerevisiae</i>)	15 g
Lemon Juice	2 tea spoons
Distilled Water	1.5 Liters

Process of making wine

Wine was prepared by the following procedure. Ripe and undamaged fruits of pineapple (*Ananas comosus* (L) Merr.) were washed well with distilled water, and cut into small pieces. 1.5 kg of sugar was completely dissolved into 1.5 Liters of boiled water. Then 1.5 kg of peel off pineapple was added into the sugar solution. It was heated and stirred with paddle about 20 minutes. The mixture solution was filtered and filtrate was cooled. Two tea spoons of lemon juice was added to the filtrate. 15 g of yeast was dissolved in 400 mL of distilled water follow by one tea spoon of sugar. Then this yeast solution was added to the pineapple filtrate and was stirred thoroughly until the bubbles clear. This solution was poured in sterilized bottle and was closed with stopper and does not permit to contact with air (anaerobic region). Fermentation was allowed to continue for three weeks at the dark place.

Wine-bottle is kept in the dark for wine-ageing because light bleaches out the color as well as damage the compounds which give wine color. Correct ageing of wine is a slow process in which complex color and aroma compounds are formed by slow joining together from simple compounds. So, wine ageing must be kept at constant temperature and away from many source of vibration. In this step, the compounds of many medicinal values are also formed. So, ageing of wine is the crucial step of wine making to obtain wine of good flavor and aroma. Therefore, color of wine is the best sign of correct ageing.

Some Physical Profile of Pineapple Wine

Some physical parameter of pineapple wine such as specific gravity, alcohol strength and pH value were determined at Department of Chemistry, Kyaing Tong University. These results are tabulated in Table (2).

Determination of pH

pH measurements are made in solutions that contain relatively large amounts of acid or base. Under these conditions, conventional pH electrodes make measurements quickly and precisely.

pH meter was rinsed with deionized water and the pH electrode was dried by using tissue paper. It was adjusted with pH 7.00 buffer solution. 30 mL of wine sample was placed into 50 mL beaker. Then pH of wine was measured by using pH meter.

After measuring pH, the pH meter was rinsed by pH 7.00 buffer. Measurement was taken by every month.

Determination of specific gravity

500 mL of wine sample was added to the cylinder. The hydrometer was pressed into the wine solution and then free from this pressure. The specific gravity of wine sample was obtained.

Determination of percent alcohol by hydrometer

For determination of percent alcohol by hydrometer the initial specific gravity and final specific gravity were measured by hydrometer. Percent alcohol was calculated from these specific gravity values.

Detection of color density

Color density of wine sample was determined by Reflection Transmission Colour Densitometer (Noritsu DM-1) in University Research Center, Yangon. The result is shown in Table (2).

Detection of Phenolic Compounds in Wine

General test of phenol

A drop wine was placed on the blue litmus paper. Change of color on litmus paper was studied. Results for phenols and anthocyanins in wine were described in Table (3).

Tests for detection of anthocyanins in wine (H₂SO₄ Test)

Three drops of cold, dilute sulphuric acid was added to the wine sample and the mixture was warmed gently in water bath. After cooling, amyl alcohol was added to the solution and the mixture was shaken well. Separation of amyl alcohol layer was studied.

Phenolic test (FeCl₃ Test)

A small amount of sodium acetate and 5 drops of 5% FeCl₃ solution were added to the wine sample solution in the test tube. The formation of color in test tube was studied.

Polyphenol test

One mL of wine sample was in the test tube and 5 drops of 1% FeCl₃ is added. Then a few drops of K₃Fe (CN)₆ is added. Occurrence of green blue color indicates polyphenol may be present.

Determination of Elemental Contents by EDXRF Method

The determination of minerals containing in sample was carried out by EDXRF technique. The experimental data were determined in Department of Physics, Mandalay University, and the results were shown in Table (4).

Determination of Nutritional Values of Pineapple Wine

The experiment was carried out at the food industries Development Supporting Laboratory, Myanmar Food Processors and Exporters Association, Yangon and the results are shown in Table (5).

Results and Discussion

Physical Parameters of Pineapple Wine

Some physical parameters of pineapple wine such as pH, specific gravity and percent alcohol were determined. These experiments were done by each month. The results are shown in Table (1) and Figure (2) to (4). The pH value of wine was found to be 4.0 to 3.4. Specific gravity of pineapple wine was found to be range of 1.15 to 1.11. Alcohol percent of pineapple wine was found to be range of 5.53% to 9.96%. It was observed that decrease the pH value and specific gravity with increase the time. Percent alcohol value is increase with time increase. After six months of fermentation, pH value, specific gravity, alcohol percent as ethyl alcohol at 25 °C and color density of pineapple wine were shown in Table (2).

pH value of wine was found to be 3.4. The pH of wine is the major variable in the taste of sourness. The pH has major influences beyond taste. A wine's clarity is also affected by pH. For table wines, preferred pH levels are 3.1-3.4 for white wines and 3.3-3.6 for red wines. This value (pH 3.4) was agreed with literature value.

Specific gravity of mature pineapple wine was found to be 1.11 and alcohol percent (9.96%) was obtained. The range of alcohol percent (5-10%) stand for good quality of wine. The color density of wine sample was found to be 0.29.

Table (1). Physical Characteristics of Pineapple Wine for Each Month

No	Parameters	Jun (1)	July (2)	Aug(3)	Sep (4)	Oct (5)	Nov (6)
1	pH	4.0	3.8	3.6	3.5	3.4	3.4
2	Specific Gravity	1.15	1.14	1.13	1.12	1.11	1.11
3	% alcohol	5.53	6.65	7.75	8.86	9.96	9.96

Table (2). Physical Characteristics of Mature Pineapple Wine

Sample	Items	Result
Pineapple Wine	pH	3.4
	Specific Gravity	1.11
	Alcohol Percent as Ethyl Alcohol at 25 °C	9.96 %
	Color density	0.29

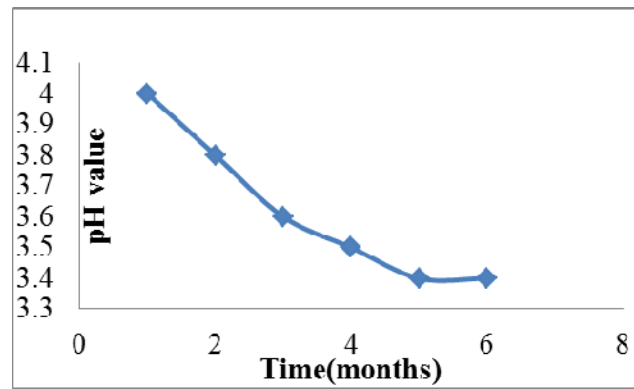


Figure (2). Evolution of pH during fermentation

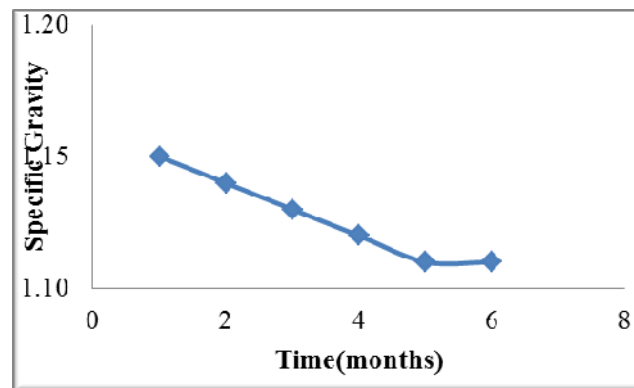


Figure (3). Evolution of specific gravity during fermentation

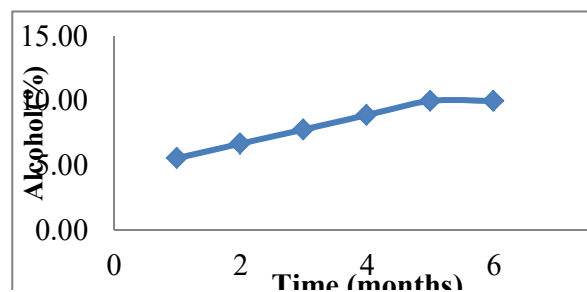


Figure (4). Evolution of the alcohol percent during fermentation

Phytochemical Constituents of Pineapple Wine

Detection of phenolic compounds in pineapple wine was described in Table (3). According to this table pineapple wine contains phenolic compounds, polyphenol and anthocyanin.

Phenolic compounds, flavonoids (anthocyanin) and polyphenol all possess potential effects on human health. So, these compounds are especially detected in pineapple wine for many medicinal values to prevent and treat such diseases as hypertension, diabetes, obesity, damage of blood vessel, damage of brain cells, leukemia, cardiovascular diseases, various types of cancers at breast, skin, stomach, colon, prostate, lung and age-related diseases.

Elemental Contents of Pineapple Wine

The elemental analysis of pineapple wine was determined by EDXRF. The results are shown in table 3.4. According to this table, the amount of phosphorus, chlorine, potassium and calcium are more present than the other elements.

The health benefits of phosphorus include healthy bone formation, improved digestion, regulated excretion, protein formation, hormonal balance, improved energy extraction, cellular repair, optimized chemical reactions and proper nutrient utilization. The health benefits of phosphorus make it an important constituent of any diet. Phosphorus is an important constituent of human bones, meaning that it would be impossible to one function normally without an adequate amount of this mineral in the body. In fact, phosphorus is regularly noted as the second most profuse mineral in the human body and is the second most important element when it comes to maintaining bone health and integrity, behind calcium.

Chlorine has been an essential element survival without sodium chloride salt, there would be no life. Chlorine has been saving life and making the world a safer, more enjoyable and more protective. The use of chlorine and chlorine related compounds as disinfectants and pharmaceuticals have saved more lives than any other chemical in the history of the human race.

The health benefits of potassium include relief from stroke, blood pressure, heart and kidney disorders, anxiety and stress, as well as enhanced muscle strength, metabolism, water balance, electrolytic functions and nervous system. Calcium aids in maintaining bone health and dental health as well as the prevention of colon cancer and the reduction of obesity.

Nutritional Values of Pineapple Wine

The nutritional value of pineapple wine was described in Table (5). According to this table, the pineapple wine contains moisture 60.48%, ash 0.11%, protein 0.06%, fat 0.04%, carbohydrate 39.30% and fibre 0.01%. The energy value of pineapple wine was found to be 156/100g.

Table (3). Result from Detection of Phenolic Compounds in Pineapple Wine

No	Typeof Compounds	Tests	Test Reagents	Observa-tions
1	All Phenol	Group Test	Blue litmus	Turned red
2	Flavin Derivatives (Anothocyanins)	H ₂ SO ₄	Cold, dil H ₂ SO ₄ & amyl alcohol	Pale pink color in alcohol layer
3	Phenolic Compound	FeCl ₃	Sodium acetate & 5% FeCl ₃	Reddish brown color
4	Polyphenol	-	1% FeCl ₃ & K ₃ Fe(CN) ₆	Greenish Blue color

Table (4). The Elemental Contents of Pineapple Wine Sample Determined by EDXRF Method

No.	Mineral	Content (%)
1.	Potassium	0.1663
2.	Chlorine	0.06154
3.	Silicon	0.03500
4.	Calcium	0.03124
5.	Phosphorus	0.01186
6.	Aluminum	0.01095
7.	Manganese	0.00285
8.	Rubidium	0.00135
9.	Zinc	0.00130
10.	Iron	0.00010

Table 5. The Contents of Nutritional Values in Pineapple Wine

No	Chemical constituents	Experimental value
1	Moisture	60.48%
2	Ash	0.11%
3	Protein	0.06%
4	Fibre	0.01%
5	Fat	0.04%
6	Carbohydrate	39.30%
7	Energy Value	156 Cal/100g

Conclusion

This study demonstrated that the production of wine from pineapple by fermentation process. According to my research, pH of wine sample was found to be 3.4. Specific gravity of wine sample was found to be 1.11 and percent alcohol (9.96%). Color density of pineapple wine was found to be 0.29.

According to preliminary phytochemical screening, wine sample contain phenolic compound, flavonoid (Anthocyanin) and polyphenol. According to EDXRF method, the

amount of phosphorous (0.0119%), chlorine (0.0615%), potassium (0.1663%) and calcium (0.0312%) were contained in pineapple wine.

Nutritional values of pineapple wine contain high amount of carbohydrate (39.30%). In addition, it gives the energy value 156 Cal/100g. Moreover, pineapple wine contains ash 0.11%, protein 0.06%, fibre 0.01% and fat 0.04%. From the experimental data, it can see that, the selected fruit was rich of nutrient composition which was responsible for health benefit of human.

Therefore, wine helps safeguard your memory. Wine reduces your body mass index and can maintain it at this low level. Moreover wine aids in constructing stronger, more durable bones. Therefore, people should drink wine regularly and moderately.

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