

## Production of Sweet Wine from Mixed Fruit Watermelon (*Citrulluslanatus*) and Pineapple (*Ananascomosus L*)

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### ABSTRACT

Fruit wine are fermented alcoholic beverages made from a variety of base ingredients other than watermelon and pineapple, they may also have additional flavour. Mixed fruit wine are mine made from two or more different fruit, for example, watermelon and pineapple wine which is made from juice of watermelon and pineapple. The aim of this study is to have an in-depth knowledge on the production of wine from mixed fruit particularly on Watermelon and pineapple to determine the physicochemical and organoleptic properties of fermented wine. Sample analysis such as pH, Titratable acidity, colour, taste etc were carried out. The results obtained from physicochemical of the wine show the results of the day 1 and day 2 respectively, show the pH of 4.0 and 3.8. The organoleptic properties of the wine indicated about 12% of the participants reported an extremely likelihood of the wine and about 2% indicated for indifference. In conclusion the pH reported in this study is acceptable as it contributes to the shelf life of the wine.

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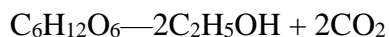
### INTRODUCTION

Watermelon (*Citrulluslanatus*) which is grown in both tropical and subtropical regions have a lot of nutritional and health benefits. It is known to be rich in electrolytes and water content; low in calories and fats and yet a very rich source of numerous health promoting phyto-nutrients and antioxidants that are essential for optimum health.

Pineapple (*Ananascomosus L.*) is a tropical fruit belonging to the family of Bromeliaceae (Ayala-Zavala *et al.*, 2019), having a short stem and slender hard leaves that grow to medium to large-sized fruit. It is the third most important tropical fruit produced globally after bananas and mangoes. It is native to South America in Brazil and Paraguay, and often referred to as pineapple. The fruit was spread from native to South and Central America, when the Guarani Indians took *A. comosus* on sea voyages as provisions and to prevent scurvy. When Columbus found the fruit in 1493 called it pina, because he thought it looked like a pin cone. The hybrids known today first appear, when the Dutch improved the fruit by cross-breeding, around 1700. The cuttings of the plants were sold to English, who grew them as pot-house plants (Painet *et al.*, 2018; Jovanovic *et al.*, 2018).

Wine is an alcoholic beverage typically made from fermented grape juice. The natural chemical balance of grape is so complete that they can ferment naturally without the addition of sugar, acids, enzymes or other nutrients. However, any fruit such as watermelon and pineapple with a good proportion of sugar may be used for wine production, and the resulting wines are normally named after the fruit hence watermelon, banana, apple, orange, pineapple, strawberries and coconut may be used to produce wine. These types of wines are also referred to as fruit wine (Alexander and Charpenter, 2019). Wine is produced by fermenting crushed fruits of choice using various types of yeast. Yeast consumes the sugar present in the fruit juice producing alcohol and carbon dioxide as by products. The type of wine to be produced dictates the fruit and the strain of yeast to be involved (Alexander and Charpenter 2019). Fermentation is the partial breakdown of organic compounds generating energy, in the form of Adenosine Triphosphate (ATP) by substrate level phosphorylation using organic compound as both electron donor and acceptor (Uraih, 2019). Wine plays almost indispensable roles in the life of man ranging from social function, religious rites/rituals as well as economic benefits to producers and merchants. After woman, man's oldest love has undoubtedly been wine. Indeed, some event put it first and quote man's three joys as being "wine, woman and song" (Alexander and Charpenter 2019).

Fermentation is a process of extracting energy from the oxidation of organic compounds such as carbohydrates, using an endogenous electron acceptor, usually pyruvate, an organic compound (Robinson, 2022). Fermentation has made it possible to obtain wine from the fruits with the application of a variety of microorganisms, especially yeasts. The microbial cell utilizes the nutrition present in the fruits to produce alcohol through fermentation. The alcoholic content in the wine is mainly due to ethanol production (Akuboret *et al.*, 2019).



Yeast species are used in many industrial fermentation processes including alcoholic beverages production. The quality of wine produced greatly depends on the yeast strain (Kunkee, 2019; Okunowo *et al.*, 2020). Development of improved starter organisms for fermentation of citrus juice may offer a relative simple avenue for reducing post-harvest wastage of citrus fruits in low utilization environment and in places where the production of citrus concentrates is low or nonexistent. Juice concentrates are readily storable and can be used for production processes even when the fruit is out of season (Ramachandra and Arun, 2019). The fermentation of wine is known to be a complex process with various ecological and biochemical processes involving yeast strain (Fleet, 2019).

### ***Saccharomyces cerevisiae***

As modern fungal taxonomy would have it, classic ethanolic fermentations are carried out by strains of the yeast, *Saccharomyces cerevisiae*, regardless of whether the end product is ale, lager, wine, or a distilled beverage. Over the years, there has been a variety of specific synonyms given to certain industrial strains of this fungus that have been used to produce specific alcoholic beverages, and some of these names have elevated the organism concerned to species status. Examples are *Saccharomyces carlsbergensis*/*saccharomyces uvarum* for the bottom-fermenting yeast used in Lagerbeer production, and *Saccharomyces ellipsoideus* for the wine yeast. Such

names have now largely disappeared from the literature, and are only used by microbiologists in the specialized fields in which they have been relevant historically. In their monumental study, Barnett *et al.*, (2020) report 678 recognized yeast species for which cultures and the results of standard physiological tests were available. The aim of this study is to produce sweet wine from watermelon and pineapple.

## **MATERIAL AND METHODOLOGY**

### **Study Area**

The study was carried out in Federal Polytechnic Bida, Bida Local Government Area of Niger state. Bida is a Local Government Area in Niger State. The LGA has an area of 51 km<sup>2</sup> and a population of 188,181 at the 2006 census. The postal code of the area is 912. Bida is the second largest city in Niger State with an estimated population of 178,840. It is located southwest of Minna, capital of Niger State, and is a dry, arid town. There are other places in Bida such as Bamisu estate, Ramatu Dangana, ECWA poly road, Small Market, Main Market and the Federal Medical Centre (Bida) others. There are also different schools like Federal Government Girls College Bida, Federal Polytechnic Staff Secondary School, Government College, Bida and others. It is also the home to the Federal Polytechnic, Bida, Federal Medical Centre and Niger, State School of Nursing.

Federal Polytechnic, Bida is a polytechnic school based in Niger State, in north central Nigeria. Federal Polytechnic Bida was established 1977 following a decision of the Federal Government Nigeria to move the institution to Bida, Before then it was Federal College of Technology, Kano. The first academic session started April 1978 with the population 211 students and 11 senior staff, 33 junior staff. Federal Polytechnic Bida is a Federal Government tertiary institution situated in Bida, Niger State, Nigeria, currently there seven faculties in the institution.

### **Sample Collection**

The sample of ripped watermelon and pineapple, yeast, sugar were bought in Bida main markets and were taken to the Federal polytechnic Bida, Microbiology Laboratory for further analysis.

### **Preparation of Pre-fermenter Culture**

The diluted solution of Pineapple juice extracted from the pulp was taken as a Pineapple must using sieve cloth. The musts were treated with 0.05% amylase and 0.05% pectinase for 24 hours (Satav and Pethe, 2021). Then, the must were filtered and pasteurized. 0.05% of wine yeast was added to the pasteurized musts. The musts were incubated in normal room temperature for 4 days. This was the prefermenter culture for Pineapple wine. In the case of watermelon prefermenter culture, similar processes as of pineapple were carried out except that there were no dilution and the must were treated with 0.05% pectinase only.

## Preparation of Wine

The juices extracted from Pineapples using muslin cloth were diluted by the addition of a 2/3<sup>rd</sup> amount of distilled water. Its sugar concentrations were maintained to 20° Brix by the addition of sugar as per Pearson's Square Law (Shrestha, 2019). It was treated with amylase and pectinase for 24 hours then filtered and sterilized by the addition of 50 ppm potassium metabisulphite (Akuboret *et al.*, 2019). To this 5% Pineapple pre-fermenter culture were added which were then incubated at room temperature.

2 kgs of watermelon were taken for the must to prepare wine. The main process carried for the preparation of watermelon wine were similar to the pineapple wine. However, the musts were not diluted and were treated with pectinase only. By the end of the incubation time, the wine was siphoned to another sterile container to leave behind the sediment.

## Determination of the Physicochemical Characteristics of Wine

In the incubation period, its pH and titratable acidity, specific gravity, were determined on each consecutive day. The alcohol contents were determined only at the end of the fermentation. All these processes were carried out as per the methods in Manandhar and Sharma (2019).

## Study of Organoleptic Characteristics of Wine

The Organoleptic characteristics of wine were tested using Idise (2021) method which consist of colour, smell, Taste, clarity, Texture of the wine were studied. The sensory quality of the watermelon and pineapple wine were examined by 30 panelists using a questionnaire.

## RESULT AND DISCUSSION

### RESULTS

Table 4 showed the physicochemical analysis of wine produced from day 1 and day 2. The results obtained showed that day 1 had a high pH value (4.0) and day 2 had the lowest value (3.8) the highest Total Reducing Sugar (TRS) value was obtained in day 1 and day 2 had the least. The Percentage Alcohol (PA) for day 1 had 7% and day two had 10%. The specific gravity (SG) for day 1 had 28.2% and day 2 had 12.2%.

Table 4: Physicochemical analysis of the mixed fruit wine (Day one and two productions)

Wine Produced	pH	TRS (g/L)	PA (%)	SG	TA
Day 1	4.0	11.70	7%	28.2	18.04
Day 2	3.8	8.56	10%	12.2	10.2

Table 5 shows the organoleptic properties of the wine produced. The organoleptic result had a high value for extremely liked of 40.0%, like very much of 36.7%, like slightly of 16.7%, and low value for indifference. Table 6 shows the appearance and taste of the wine. The percentage of the parameter is shown in figure 1.

Table 5: Organoleptic properties, frequency, and the total percentage (%) of the sensory evaluation

Organoleptic Properties	Frequency	Percentage
Extremely like	12	40.0
Like very much	11	36.7
Like slightly	5	16.7
Indifference	2	6.7
Total	30	100.0

Table 6: Organoleptic properties of mixed fruit wine

<b>Appearance (Mixed Wine)</b>	
Clarity	Limpid and bright
Presence of bubble	Light bubble formation when wine is poured into a wine glass
Colour	Light red
<b>Taste (Mixed Wine)</b>	
Tasted	Semi-sweet
Acidity	Sharp
Structure	Full
Persistence	Long
Maturity	Ready

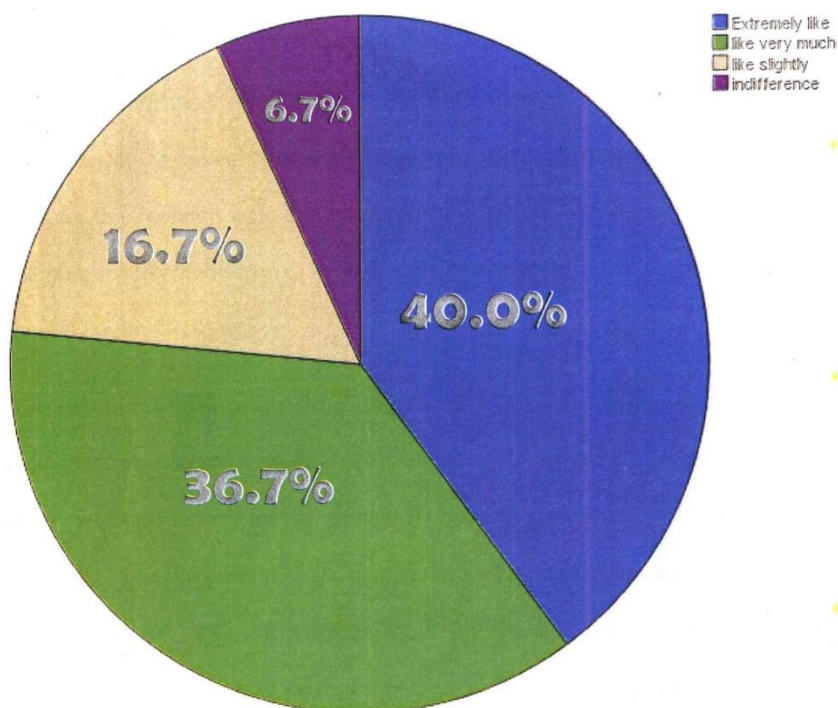


Fig. 2: shows the percentage of the parameters for organoleptic properties

### Discussion

In this research work, the Choice of the fruits: watermelon and pineapple were deliberated from table 1, it was observed that the pH ranges of the mixed fruit juice used for the production of the wine for this research were carried out while there was significant difference in the value of the reducing sugars, in the case of specific gravity there was no obvious differences for the day 1 and day 2 (Okafor, 2020).

Also revealed are consistent decreases in acidity (Titratable) of the wine. Studies have shown that during fermentation of fruits low pH is inhibitory to the growth of spoilage organisms by creates conducive environment for the growth of desirable organisms, also low pH and high acidity are known to give fermenting yeast competitive advantage in natural environment. In this study mixed fruit wine produced compared well with standard wines with respect to organoleptic and physico-chemical attributes as shown in table 2. This is in agreement with the work of (Agboret *al.*, 2021). The Titratable acidity of the wine is expected to be between 0.5 to 1.0% (Reddy, 2022).

In general, the percentage alcohol produce from the fruits used for the fermentation by the yeast strain was above 2% which is comparable with moderate grape wine (Querolet *al.*, 2019).

Reports have shown that alcoholic fermentation leads to a series of by-products in addition to ethanol. The specific gravity of the fruit wine produced in this study reduced as the fermentation

days of the wine increases (Ayogu, 2018), reported that *Saccharomyces cerevisiae* has been reported to reduce the specific gravity of the fruit wine during fermentation.

The specific gravity value of the wine were observed to determine the type and aroma produced during wine production is reported to depend on yeast, environmental factors and physicochemical characteristics and organoleptic of the “musts”.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

The result of this work show that table wine of the characteristic alcoholic contents and pH were produced from sweet mixed fruit watermelon and pineapple using commercial yeast and locally isolated wine yeast from well rippled watermelon and pineapple (*Saccharomyces cerevisiae var ellipsoideus*). The locally isolated yeast could serve as an alternative source of yeast for making wine from fruits since it is readily available and cheap.

### RECOMMENDATIONS

- i. In view of the ease of cultivation of watermelon and pineapple and their availability all-round the year in Nigeria, wine industry based on orange and banana as the main raw materials can be easily established.
- ii. Government should encourage the farming of watermelon and pineapple and also the establishment of industries for the production of wine.
- iii. Government should provide storage facilities for fruits like, watermelon and pineapple that are wasted due to lack of storage facilities.

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