RODUCTION OF WINE FROM AVAILABLE LOCAL FRUITS (APPLE, PINEAPPLE AND ORANGE)

BY

USMAN NMA GBATE
2001/11670EH

DEPARTMENT OF CHEMICAL ENGINEERING
FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA.

NOVEMBER 2007

DEDICATION

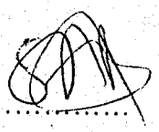
report was dedicated to Allah Subhanahu Wata'ala for His infinite mercy,
nce and protection.

DECLARATION

, USMAN NMA GBATE (2001/11670EH hereby declare that this research
ct, "Production of wine from available local fruits (Apple, Pineapple and Orange)"
ed out under supervision of Engineer Abdul Azeez. and presented in partial
ment of the requirement for the award of Bachelor of Engineering (B.Eng)
ee in Chemical Engineering has not been presented for any degree elsewhere,
e best of my knowledge.

CERTIFICAION

This to certify that this research project title 'production of wine from available local fruits (apple, pineapple, orange)'. Was carried out by Usman Nma Gbate (2001/116679EH) and submitted to the department of chemical engineering, school of engineering and engineering technology, federal university of technology minna. Niger state. In partial fulfillment of the requirement for the award bachelor of engineering (B.Eng.) degree in chemical engineering.



.....

Engr. Abdul azeez.

26/11/2007.

.....

Date

.....

Dr. Edoga

.....

Date

.....

External Examiner

.....

Date.

TABLE OF CONTENTS

ABSTRACT

This research work was carried out to produced wine from available local fruits, such as apple, pineapple and the orange .Along with sugar, yeast and sodium benzoate. This is because the are cheap and readily available. The overall equation for alcoholic fermentation of sugar which was converted later in molecular terms is $C_2H_{12}O_6CHOH+2CO_2$. The reaction start from hexose (6-carbon) sugar being fermented and phosphorillated to trios (3-carbon). The trios units are converted to actaldelycle which is then reduces to alcohol. The alcohols produced are non-toxic and inflammable.

From the analysis of the wine produced using different fruits shows the following result, pineapple has alcoholic content of 7.975%, PH value 5.9, refractive index 1.354, brix value 14.5 specific gravity 1.01.For apple, the alcoholic content is 6.05%, PH value 5.8, refractive index 1.3199, brix value 11.0, specific gravity 1.04.for orange; alcoholic content 7.15%, PH 4.6, refractive index 1.3499, brix value 13.0, specific gravity 1.035.

ocused towards the development of small scale industry for the production of wine, hich creates job opportunities and makes young chemical engineers self employed.

Wine is a popular and important beverage that accompanies and enhances a ide range of European and Mediterranean – style cuisines, from simple to the most ophisticated and complex. Wine is important in cuisine not just for its value as a everage, but as a flavour agent (primarily in stocks and braising) in which its alance to rich savory or sweet dishes. RCL, White and Sparkling wines are the most opular, and also known as light wines, because they only contain approximately 10–4% alcohol. (Alcohol percentages are usually by volume.) The desert wines contain 4 – 20% alcohol, and are fortified to make them richer and sweeter than the light ines.

.1 Aims and Objective

The aim is to produce wine from available local fruit (Apple, Pineapple and range).

.2 Scope

The scope of the research covers the review of literature, obtaining the raw aterials, the manufacturing process and product quality evaluation.

CHAPTER TWO

2.1 HISTORY OF WINE

Wine has been around for thousands of years from ancient civilizations to modern times, wine has been produced and enjoyed by many, from peasants to kings. Evidence of wine production as far back as 6000BC, to early Mesopotamian culture, the Mesopotamians were the first known people to cultivate grapes.

Grapes have been cultivated for making wine for centuries in many part of the world. By the 21st century the industry was most prominent in southern and central Europe, the United States, Australia and South America. The wine grape, Vitis Vimfera, and its varieties are the principal source. Growing grapes requires knowledge of the best environmental condition and many other factors to be successful.

Alcoholic beverages have been a part of the human diet from the earliest history. In Nigeria, alcoholic beverages were known before the British Colonialists arrived, even before the coming of the Atlantic Slave traders. For ages the local peoples had practiced the art of manufacturing drinks. Despite access to a huge variety of indigenous liquors, however, Nigeria did not have the knowledge to brew lager beer or distill spirits. Tapping palm wine or fermenting grain beers was the limit of their expertise. During the Atlantic Slave Trade, slaves were sometimes purchased for imported alcohol, and Nigerians developed the habit of using western style liquors. Indigenous alcoholic beverages were not completely displaced by imported drinks, they coexisted, complemented and compared with each other. Yet, because it was far more potent in terms of alcoholic strength than anything produced locally.

substitution will be analyzed within the context of general colonial policy towards such enterprises. The battle of "control versus revenue" forms this article's underlying theme for analyzing alcohol as an aspect of the political economy of colonialism. Industrializing trends which started under colonial rule continued during Nigeria's First Republic when domestic alcohol production reached the stage in virtual import substitution.

Wines vary in their characteristics. The alcoholic content varies from 7.5 –14 percent. It is not possible to produce a wine naturally with a higher content because the yeast is killed under such conditions and further fermentation is precluded. The sugar content of the grapes varies from 12 – 18percent. Fermentation of the fruits or the juice is carried on in vats, usually with the addition of selected yeasts. The preferred temperature is 68deg. Fahrenheit. The agreeable aroma and flavor are due to various aromatic principles present in the fruit. The characteristic bouquet develops only after the wine has been aged for period that varies from 2- 5years to several decades. Clarification is at times required.

Red wines are from grapes with colored skins and derive their own color from the pigments and other substances present in the skin. White wines are made from white grapes, or expressed juice. In the dry wines or sour wines, the sugar is almost entirely fermented. In sweet wines fermentation is stopped before all the sugar is converted and at least one percent is still present. In sparkling wines the wine is bottled before fermentation is complete so that carbon dioxide is produced within the bottle. About 90percent of the world's wines are such natural or table wines. Fortified wines are wines that have a higher alcoholic content due to the addition of brandy or alcohol.

Making fruit wines can be economically rewarding. A certain segment of the population enjoys these wines. A winemaker can produce high quality fruit wines as a specialty product and benefit from this existing niche in the marketplace. Compared grape wines most of the fruit wines take less time to process and, therefore, the capital is tied up for a shorter period of time. This translates into a quicker return on invested capital. Fruit wines can also be made during a less busy time (after grape harvest) of the year, thus permitting efficient use of winery facilities. Sometimes a decision to make a fruit is made because surplus fruit is available at a very attractive price. Often in such cases, the fruit quality is poor and the appeal of low prices can induce a winemaker to produce mediocre wine that he or she would not otherwise make if the price were not so cheap. Although the price of the raw material is an important consideration, it should not be the sole criteria. Remember that the cost of the raw material is a small portion of the total cost and devoting valuable resources to produce a poor to mediocre product amounts to under utilization or even misuse of precious resources. The important point is that the choice of making wine should be based on sound business reasons.

2 TYPE OF WINE

Wine can be classified under SEVEN main classes as follows:

1. Red or white wine
2. Rose wine
3. Table wine
4. Sparkling wine
5. Desert wine
6. Fortified wine

7. Cooking wine

.2.1 **Red or White Wine**

The colour of wine is not determined by the juice of the grape, which is almost ways clear but rather by the presence or absence of the grape skin during rmentation. Grapes with coloured juice, for example alicante bouchet, are known as inturier. Red wine is made from red (or black) grapes, but red colour is bestowed by process called maceration, whereby the skin is left contact with the juice during rmentation. White wine can be made from any colour of grape as the skin is eparated from the juice during fermentation.

2.2 **Rose Wine**

A blush wine can be made by removing the skins from the juice part way through rmentation, by blending reds and whites, or by concentrating liquid removed during rmentation.

2.3 **Table Wine**

Table wines may have an alcohol content that is no higher than 14% in the U.S. In urope, light wine must be within 8.5% and 14% alcohol by volume. As such, unless wine as more than 14% alcohol, or it has bubbles, it is a table wine.

2.4 **Dessert Wine**

Dessert wine ranges from slightly sweet (with 50 less than 50g/l of sugar) to credibly sweet wines (with over 400g/l of sugar). Late harvest wines such as batlese are made from grapes harvested well after they have reached maximum eness. Dried grape wines, such as Recioto and Vin Santo from Italy as well as

Vinsanto from Santorini Greece, are made from grapes that have been partially aisined after harvesting.

.2.5 Fortified Wine

Fortified wines are often sweeter, and generally more alcoholic wines that have ad their fermentation process stopped by the addition of a spirit, such as brandy, or ave had additional spirit added after fermentation, examples include port, Madeira nd Banyuls.

.2.6 Cooking Wines

Cooking wines or cooking sherry refers to inexpensive grape wine or rice wine (in hinese and other East Asian Cuisine). It is intended for use as an ingredient in food ather than as a beverage. Cooking wine typically available in North America is eated with salt as a preservative and food colouring. Cooking wines are convenient r cooks who use wine as an ingredient for cooking only rarely. However, they are ot widely used by professional chefs, as they believe the added preservative gnificantly lowers the quality of the wine and resultantly the food made with that ine.

.2.7 Sparkling Wines

Sparkling wines such as champagne, contain carbon dioxide which is produced aturally from fermentation or force-injected later. To have this effect, the wine is rmented twice, once in an open container to allow the carbon dioxide to escape into e air, and a second time in a sealed container, where the gas is caught and mains in the wine.

.3 BASIC RAW MATERIAL FOR ORANGE, PINEAPPLE AND APPLE WINE PRODUCTION

The basic raw material used for orange, pineapple and apple wine making and as ollows:

(i) Apple

(ii) Pineapple

(iii) Orange

(iv) Sugar

(v) Yeast

(vi) Sodium Benzoate

.3.1 APPLE

The apple fruit is a very healthy fruit containing the vitamins A and C, pectin and otassium. It is a fruit with a fleshy outer layer, a paper-like core and has more than ne seed. The colour of the flesh is cream. The seeds of the apple fruit are enclosed the core like the pear, the apple is a pome.

.3.2 PINEAPPLE

The pineapple (Annas Comosus) is a tropical plant and fruit (multiple) probably ative to Uruguay, Brazil or Paraguay. It is a tall (1 – 1.5m) herbaceous perennial ant with 30 or more trough – shaped and printed leaves 30 -100cm long, rrounding a thick stem. The pineapple is an example of a multiple fruit: multiple, irally – arranged flowers along the axis each produce a fleshy fruit that becomes essed against the fruits of adjacent flowers, forming what appears to be single eshy fruit. The leaves of the smooth cayenne cultivar mostly lack spines except at

the leaf tip, but the Spanish and Queen cultivars have large spines along the leaf margins. Pineapples are the only bromeliad fruit in widespread cultivation.

2.3.3 **ORANGE**

The orange specifically, the sweet orange is citrus tree citrus Sinensis and its fruits. The orange is hybrids of ancient cultivated origin, possibly between pomelo (citrus maxima) and tangerine (citrus reticulata). It is a small flowering tree growing to about 10m tall with evergreen leaves, which are arranged alternately, of ovate shape with Crenulate margins and 4 – 10cm long. The orange fruit is a hesperidium, a type of berry, orange originated in southeast Asia, in either India, Vietnam or Southern China. The fruit of Citrus Sinensis is called sweet orange to distinguish it from citrus aurantium, the bitter orange. In a number of languages, it is known as a "Chinese apple" (e.g. Dutch Sinaappel, "China's apple").

2.3.4 **SUGAR**

Sugar is one of the most important measures in wine making because it gives wine its optimum alcoholic content. Originally a luxury, sugar eventually became sufficiently cheap and common to influence standard cuisine. Sugar forms a major element in confectionary and in desserts, Cooks uses it as food preservatives as well as for sweetening.

2.3.5 **Yeast**

Yeats are a growth form of eukaryotic microorganisms classified in the kingdom fungi, with approximately 1,500 species described most reproduce asexually by budding, although a few do by binary fission. Yeasts are unicellular, although some species with yeast forms may become multicellular through the formation of starting

connected budding cells known as pseudohyphae, or true hyphae as seen in most molds. Yeast size can vary greatly depending on the species typically measuring 3 - 4μm in diameter, although some yeasts can reach over 4μm. Yeast is used in wine making where it converts the sugars present in fruit juice or must into alcohol.

2.3.6 **Sodium Benzoate**

Sodium benzoate also called benzoate of soda, has chemical formula C_6H_5COONa. It is the sodium slat of benzoic acid and exists in this form when dissolved in fermented juice. It can be produce by reacting sodium hydroxide with benzoic acid. Sodium benzoate is used as a preservative. It is not bacteriocidal, only bacetriostatic. It is effective only in acidic conditions (pH <3.6) making it use most prevalent in foods such as preserves, salad dressings (vinegar), carbonated drinks (carbonic acid) are fermented fruit. It is used in many soft drinks and can be identified on the label of bottle or can as 'sodium benzoate' or E211. The taste of sodium benzoate cannot be detected by around 25 percent of the pollution, but for those who can taste the chemical, it tends to be perceived as sweet, salty or sometimes bitter.

2.3.7 **Antioxidant: -**

This pure vitamin "C" ascorbic acid and is used in small quantities, whenever the wine is transferred or racked another vessels and prior to bottling antioxidant prevents wine from being oxidized from contact with air. It is not required in the early stage of fermentation because the ongoing fermentation provides its own protection.

2.4 Composition of Wines

The composition of wines varies with types of wine as well as the sugar context. The red, white are sparkling wines are the most popular, and are also known as light wines, because they only contain approximately 10 – 14% alcohol. The aperitif and desert wines contain 14 – 20% alcohol, and are fortified to make them richer and sweeter than the light wines.

2.5 Quality Standard in Wines

The basic ingredients of a completed wine are water and alcohol, though other components present in Minuscule quantities account for quality and character.

2.5.1 Water (80 to 85 percent)

The water in wine derives entirely from fruit juice, so it is the base for all the complex biochemical phenomena that occur as wine is made and aged.

2.5.2 Alcohol (10 to 17percent)

Alcohol in wine are attained by yeast converting sugars. Besides adding their own characteristic flavour and odors, alcohols are the main carries of aroma or bouquet. The most important alcohol in quantity is ethyl, a monoalcohol. Then glycerol, a polyalcohol that adds a degree of sweetness, Butylenes glycol is among other polyalcohols and cyclic alcohols present. In some fortified wines, alcohols present. In some fortified wines, alcohol attained by distillation may be added.

2.5.3 ACIDS (0.4 to 1percent)

Acids give wine the sour or sharp aspect that enhances flavour when in balance with other components. Of the three organic acids that originate in fruits, tartaric is

prevalent as the base measure of total acidity in wine, followed by mellic and citric. Three other acids are succinic, lactic and acetic (source of volatile acidity) are produced by fermentation.

2.6 Wine Production

Making fruits wines can be economically, rewarding. Many fruit varieties can be used for making wine. Generally the choice is largely governed by locally available fruit. Fruits used for making wine should be sound, free of decay and rot and of overall good quality. The following procedure used in wine production are as follows:-

2.6.1 Sorting and Granding

To prepare fruit for granding, they should be sorted to remove decayed fruit and washed to remove dirt and chemical residue. Various kinds of equipment are available for cleaning fruit. The next step is to grind the fruit into a pulp. A hammer mill is commonly used for grinding fruits but other kinds of machines can also be used.

2.6.2 Pressing

Crushed fruit are pressed to extract the juice. Various types of presses are available in the market. The traditional method involves the use of a hydraulic press. In this method a rack is placed in the press rack, and then the cloth (usually nylon) is placed on the rack. The pulp is spread in thin uniform layer on the process is repeated.

2.6.3 Preparing Juice for Fermentation

Juice treatment - fresh fruit juice is very much susceptible to oxidation and browing. A decrease in delicate fruit flavour is often associated with browing of the

fruit. The oxidative reaction is enzyme catalyzed but it can also occur without the mediation of enzymes. As with grapes, the phenolic substances serve as substractes for oxidation and browing reactions. Sulfur dioxide can be added to prevent oxidation and browing, as well as to inhibit the growth of coil yeast and harmful bacteria. The amount commonly added is between 50 to 100ppm. If the fruit is to be held for a longer period to facilitate settling, a somewhat higher dose of SO_2 may reached to delay the onset of fermentation.

2.6.4 **Fermentation**

Fermentation and post-fermentation processing of fruit wine is somewhat similar to the production on of white table wines. After sodium benzoate or SO_2 addition, clarification, and sweetening, the most is ready for fermentation. Various kinds of fermenters such as wood, plastic and stainless steel are available, however, stainless steel tanks with temperature control should be preferred to conduct fermentation. Temperature control during fermentation is crucial to the preservation of delicate fruit flavour in resulting wine. The fermentation temperature commonly employed by the wine makers ranges between 50 to 70F. Generally lower temperatures ranging from 55^0 to 60^0F yield favourable results.

2.6.5 **Testing**

Wine may be classified by their primary impression on the drinker's palate. They are made up of chemical compounds which are similar or identical to those in fruits, vegetables and spices. The sweetness of wine is determined by the amount of residual sugar in the wine after fermentation, relative to the acidity present in the wine. Dry wine, for example, has only a small amount of residual sugar. However, a

technically dry wine might taste sweet when it is not for example, fennel might taste sweet, but does not contain much sugar.

2.6.6 **Packaging and Storage**

Most wines are sold in glass bottles and are sealed using a cork. Recently a growing number of wine producers have began sealing their product with alternative closures such as screwcaps or synthetic plastic "corks". Some wines are package in heavy plastic bags, which are typically packaged further within cardboard boxes, similar to the packaging of breakfast cereal. One advantage of boxed-wine is that it can stay fresh for up to a month after opening, while bottled wine will start to oxidize immediately after opening. The wine cellars often the opportunity to protect alcoholic beverages from potentially harmful external influences, providing darkness and a constant temperature. Wine is a natural perishable food product. Left exposed to heat, light, vibration of fluctuations in temperature and humidity, all types of wine, including red, white, sparkling, and fortified, improve in aroma, flavor, and complexity as they mature.

2.6.7 **Biochemistry of Wine fermentation**

Fermentation are metabolic processes that brings about the chemical changes in organic substrate through the action of enzymes of micro-organism or other cells. The term "fermentation" originally applied only to anaerobic contains such as Beer and wine production.

The overall equation for alcoholic fermentation of sugar which was converted later in molecular terms is as follow: - $C_5H_{12}O_6C_2HOH + 2CO_2$, the reaction starts from hexose / 6 – carbon) sugar being fermented and phosphorillated to triose (3 –

carbon). The triose units are converted actaldelycle which is then reduces to alcohol. The yield of alcohol is of obvious practiced importance to the wine water.

2.6.8 **Clarification: -**

As the fruit get ferment, the product obtained is wine in a cloudy form (primarily with yeast cells), care and time are taken to remove the hazy (cloudness) and foul tasting liquid into a clear, pleasant and drinkable product. This process involves reducing the temperature, storage in various types of containers, racking, filtration and other process. The main purpose of fruit and wine treatment are removed of suspend material, off – taste and odour, off flavour. Removal of foreign toxic materials, removal of substances which could later make the wine cloudy. Also to make fruit and wine filtrate as prevention measures against future undesirable changes.

2.6.9 **Ageing**

Ageing it is the process of keeping wine to get matured. As it aged properly, all these factors that is hash taste of wine and yeastily odour diminish, leaving a mellow flavor and clear, odour free wine. The bouquet also develops during ageing. Wines are aged in Barrels, puncheons or tanks. The tanks may be of wood, concrete or metals. The principal charges in flavor and bouquet during ageing are generally believed to be due is slow oxidation. However for ordinary quality wines, the small improvement in quality during ageing frequently does not justify the longer ageing.

2.7 Spoilage of Wine

2.7.1 Microbiological

The spoilage of wine microbiological is connected with the initial contamination of the fruit substrate. The bulk of those microorganisms are eliminated during the fermentation process. The contamination is first from the natural flora as well as the soil to suppress this organisms, the wine maker adds C_6H_6COONa to pasteurize the fruit. Wine defects are mainly from metal or their salts, enzymes and sediments such as combined iron compounds. Wine undergo spoilage microbially by the action of bacteria and yeast with condition mycodema being the most important yeast. Growth of this organisms attack alçohol are other constituents from this layer and create an appearance that is sometimes referred to as wine flower. Among the bacteria that cause wine spoilage are members of the genus Acetobacter which oxidized alcohol to acetic acid (produce vinegar). This can be eliminated by keeping air away from wine.

The most serious and the most common disease of table wine is tourne. This (tourne) is caused by a facultative anaerobic or aerobic which utilizes sugars and Seechs to prefer conditions of low alcohol content. This type of spoilage is characterized by an increased volatile acidity a silk e.g. type of cloudiness and later in the course of spoilage a "mously" odour and taste.

Another type of spoilage of importance is the mala-lectic fermentation which is a spoilage condition in wines, malic and fertaric acids are two of the predominant organic acids in grape fruit and wine. In the malon lactic fermentation contaminating bacteria degrade malic acid to lactic acid, CO_2 thus reducing the acid content and

affect flavour. This is carried out by lactic acid bacteria including leuconstoes, pediococia, as lactobacilli.

2.8 FACTORS AFFECTING THE GROWTH OF MICROORGANISM IN WINES

2.8.1 ACIDITY /pH

The lower the pH, the less growth of micro-organisms. They are however, pH varies with the type of wine and alcohol content.

2.8.2 Concentration of alcohol

The varies with the spoilage organisms, for example acetic acid bacteria are normally inhibited by about 14 – 15% alcohol, while lactobacilli trictiodes grows in wine with over 20% alcohol.

2.8.3 Temperature of Storage

Spoilage is most rapid at 20 – 30^{0}c but slows down as the temperature is dropped toward freezing. Refrigeration of wine is done at a temperature range 3.9^{0}c to 5.5^{0}c.

2.8.4 Sugar Content

The higher the sugar the more likelihood of spoilage.

2.8.5 Concentration of growth substance

Sources of growth substance are mainly yeast which produced growth substance riboflevin by autolysis of yeast cells. The more these substance are present the greater the spoilage by lactic acid bacteria.

2.8.6 **Amount of C_6H_5COONa Present**

The more C_6H_5COONa added the greater the retardation of spoilage organisms. However, 100 – 150ppm is considered appropriate.

2.8.7 **Availability of Air**

Absence of air prevents growth of aerobic micro-organism such as acetobacter but increase the rate of growth of aerobic lactid acids bacteria such as lactobacillis.

CHAPTER THREE

3.0 **Experimental work.**

3.1 **Raw Material**

Over ripped local fruits (orange pineapple and apple), which are available in the Minna central market.]

3.2 **Apparatus / Equipment /Reagents**

The table below shows the apparatus equipment and Reagents used.

APPARATUS / REAGENTS	MANUFACTURERS
Measuring cylinder	Pyrex glass England
Beaker	Pyrex glass England
Pipettes	Pyrex glass England
Transparent wine bottles	
Refractor meter	
Electric pH meter	
Weighing balance	Ohaus scale USA
Blender	Sharp corporation Japan
Juice Extractor	
Meshed nylon	
Knife	
Sodium benzoate	
Sodium hydroxide	
Distilled water	
Phenolphthalem indicator	
Thermometer	Lab-line instruments Illinois
Conical flask	Pyrex glass England

3.3 **Methodology.**

3.3.1 The procedure used for manufacture of orange, pineapple and apple wine are as follows;-

3.3.2 **Orange Wine**

Overripe oranges was used, the production started with the sorting, washing cleaning, and weighing of the orange fruit. Peel the orange (500g) and remove all white pith (it is bitter and will ruin the wine). Break the oranges in to section and remove all seeds. Drop them in a blender and liquefy. Mix, the liquefied oranges with the10g of sugar, 5g of yeast as a fermenting agent 1g and sodium benzoate as preservative. The mixture was left to ferment at room temperature (25^0c) for (7-10)days. The fermented liquor way then filtered and bottled. The product (wine) was then analysed for quality test. The test include pH specific graving and brix value.

3.3.2 **Pineapple Wine.**

Overripe pineapples was used, the production started with the sorting, washing cleaning and weighing of the pineapple fruit used 500g of pineapple, remove the topknot (leaves)and skin of the pineapple, capturing any juice produce in the process. Cut the flesh away from the core and chop the flesh into small pieces. Again collect all juice liberated by cutting. Drop them in a blender and liquefy. Mix the liquefied pineapple with 10g of sugar, 5g of yeast nutrient as a fermenting agent and sodium benzoate as a preservative. The mixture was left to ferment at room temperature (25^0) for 7 -10days. The fermented mixture was then filtered and bottle. The product wine was then analyzed for quality test. The test includes pH, specific gravity and brix value.

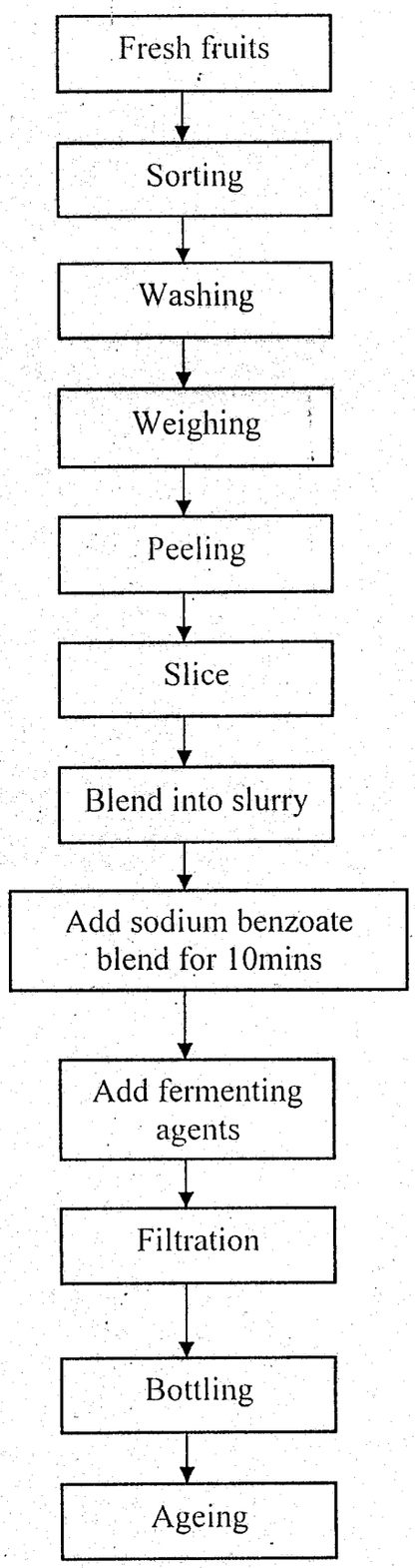
3.3.3 APPLE WINE

Overripe apples was used, the production started with sorting, washing, cleaning and weighing. 500g of Apple, slice with the cores and bad bits removed. Drop them in a blender and liquefy. Mix the liquefied apple with 10g of sugar, 5g of yeast nutrient as a fermenting agent and 1g of sodium benzoate as a preservative. The mixture was left to ferment at room temperature (25^0c) for 7 -10days. The ferment mixture was then filtered and bottle. The product wine was then analysed for quality test. The test includes pH, specific gravity are brix value.

3.4 Acceptability test

Acceptability test determines the quality of the wine produced, the aroma (flavour), test colour and appearance (clarity). The senses were used which describe physical or chemical nature depending on their stimuli through comparison of two or more sets of number of eyes is termed crude. A scientific comparison was conducted by statistical test of various categories or level of two treatment variable called 2-way ANOVA (Analysis of variation). A major advantage of ANOVA is that it permits the analysis of situation in which the measure of interest affected by 2 or more variables.

3.5 Production Flow Chart



3.6 **Analysis of Parameters**

3.6.1 **pH**

The pH of the wine was determined using pH metre by standardizing the pH metre with standard buffer solution. The electrode of the pH metre was then dipped into each of the wine produced and the corresponding reading on the pH metre was recorded.

3.6.2 **Acidity**

The acidity can be measure by titration with alkaline to an end point depended on the selected indicator and the result may be expressed in debus of a particular acid. The titration value doe sat indicate whether the acid present are strong or weak. During food storage and in food spoilage changes may occur which are due to enzymatic action and ingo biological growth. Extent of these changes is strongly influenced by hidden ion concentration rather than intractable acidity. 10mls of the sample is inveighed and 3 drops of phenolphtahlem indicator added into a beaker, sodium hydroxide (Noah 0.1mls) placed independent the burette, the primary titration was first carried out, followed by the full titration.

3.6.3 **Soluble Solids**

The soluble solid is determined by using a refractometer the referactometer is an instrument calibrated infractive index form as well as in percentage or brie of the solids can be read directly from the instrument.

3.6.4 **Ash Content**

Procedure: Empty crucible were first dried to constant weight. The sample 5mls is pipetted into the crucible and the weight is noted. This is charred over a electric cooker. It is removed and ashed in a furnace at 580^0c for 4hours. Cooling and weighing follow this.

Calculations

To determine the ash content the following is noted:

Weight of empty crucible = W_1

Weight of crucible of sample = W_2

Weight of crucible of Ash = W_3

Formula % Ash = $\frac{W_3 - W_1}{W_2 - W_1} \times 100\%$

CHAPTER FOUR

4.0 RESULT

4.1 Table 4.1: Some physical properties of the pineapple fruit before fermentation

Parameter	Values
pH	5.7
Brix	25
Refractive index	1.3723
Specific gravity	1.1009

Table 4.2: Some physical properties of the Apple fruit before Fermentation

Parameter	Values
pH	5.2
Brix	25
Refractive index	1.3723
Specific gravity	1.1009

Table 4.3:Some physical properties of the orange fruit before fermentation

Parameter	Values
pH	5.3
Brix	25
Refractive index	1.3723
Specific gravity	1.1009

Table 4.4: Standard properties of wine

Parameter	Values
pH	3.5 – 6.8
Brix	<15
Refractive index	1.33 – 1.355
Specific gravity	1.00 – 1.050
Ash content	<1%
Alcohol content % (v/v)	7.5 – 14.00

Table 4.5: Some physical properties of the wine produced

Properties	Pineapple	Apple	Orange
pH	5.0	5.8	4.6
Brix	14.5	11	13
Refractive index	1.354	1.3199	1.3499
Specific gravity	1.08	1.04	1.065
Ash content (%)	0.3	0.6	0.5
Alcohol content % (v/v)	7.975	6.05	7.15

4.6 DISCUSSION OF RESULT

Wine was produced from local fruits (pineapple, orange and apple). The juice extracted was tested as the following result were obtained, for pineapple juice pH is equal to 5.7, pH(5.2) for apple juice and pH 5.3 for orange and soluble context (Brix) for pineapple juice 25%, for apple 25% and for orange 25%. To juice extracted was added 1g of sodium benzoate in order to sterilize it and to inactive the growth of unwanted yeast and micro-organisms.

The wine had an alcoholic content for pineapple wine 7.975% for apple wine 6.05% and for orange wine 7.15%, which compared with the set standard of between 7.5 – 14.00% the amount of sodium benzoate added to the fruits juice for sterilization was important since excess will not only delay the fermented ion but will also lead to wine having a high fixed sulphur properties in the finished wine.

The pH value for pineapple wine was 5.0, for apple wine 5.8 and orange wine 4.6 which fall within the acceptable range of 3.5 – 6.8. The ash content 0.3% for pineapple wine, 0.6% for apple wine and 0.5 for orange wine, which fall within the acceptable range <1%. The refractive index 1.354 for pineapple, 1.3199 for apple and 1.3499 for orange which fall within the acceptable value of 1.35 – 1.555. The Brix value 14.5 for pineapple, 11 for apple and 13 for orange which fall within the acceptable value of <15. The specific gravity 1.01 for pineapple, 1.04 for apple and 1.035 for orange which fall within the acceptable value of 1.00 – 1.050.

CHAPTER FIVE

5.0 CONCLUSION

From the result obtained it shows that good wine can be produce from available local fruits such as pineapple, apple and orange fruits which is cheap and affordable to common man and biologically non-toxic and non inflammable. From the analysis it more economical to produce wine from pineapple juice when compared to orange and apple.

5.1 RECOMMENDATION

It will be interesting to note that the wine can be produced and available throughout the year. Therefore, I strongly recommend that local fruit (pineapple, apple and orange) should be used for future production of wine for commercial purposes.

APPENDIX A

To determine the alcoholic content

For pineapple wine

Alcoholic content % (v/v) = Brix value x 0.55

= 14.5 x 0.55

= 7.975.

For Apple wine

Alcoholic content % = Brix value x 0.55

= 11 x 0.55

= 6.05

For orange wine

Alcoholic content % = Brix value x 0.55

= 13 x 0.55

= 7.15

APPENDIX B

To determine the Ash content the following is noted.

Weight of empty crucible = W_1

Weight of crucible + sample = W_2

Weight of crucible + Ash = W_3

Formular %Ash = $\frac{W_3 - W_1}{W_2 - W_1} \times \frac{100}{1}$

For Apple wine

Weight of empty crucible (W_1) = 13.62g
Weight of crucible + sample (W_2) = 14.62g

Weight of crucible + Ash (W_3) = 13.62g

$$\% \text{ Ash} = \frac{13.626 - 13.62}{14.62 - 13.62} x \frac{100}{1} = \frac{0.006}{1} x100 = 0.6\%$$

For Orange wine

Weight of empty crucible (W_1) = 13.62g

Weight of crucible + sample (W_2) = 14.62g

Weight of crucible + Ash (W_3) = 13.625g

$$\% \text{ Ash} = \frac{13.625 - 13.62}{14.62 - 1362} x100$$

$$= \frac{0.005}{1} x100 = 0.5\%$$

For Pineapple Wine

Weight of empty crucible (W_1) = 13.62g

Weight of crucible + sample (W_2) = 14.62g

Weight of crucible + Ash = 13.623g

$$\% \text{ Ash} = \frac{13.623 - 13.62}{14.62 - 13.62} x100 = \frac{0.003}{1} x100 = 0.3\%$$

REFERENCES

1. Burroughs L.F. 1957g J.Sc. Fd Agric. 8, 12 – 31.
2. Claque, J. A and C. R Fellers 1936. Apple Cider Products. Mass Agr. Expt. Sta.
3. Hulme, A. C 1958. Some Aspects of the biochemistry of apple and pear fruits. Advan. Food Research. 8, 297 – 413.
4. Rose A. H. and Morris G. J. (1972). Economic Microbiology, Vol. 1, pp.366 – 411, Academy Press London.
5. Nakayana T.O (1985), Tropical fruits wines, 4th Edition, Pp.17 – 25. AVI Publishing Company West Port.
6. Marrison L. V. V. (1959), Wines and Spirits, Penguin, 1st Edition, pg.316, AVI. Publishing Company West Port.
7. Amerine M. A. Berg. H. W. and Cruess, W. U (1978) The Technology of Wine Making, 3rd Edition, pp.96 – 99. The AVI Publishing Company West Port USA.
8. Barre P. (194) The Technology of Wine Making, 2nd Edition, pp. 6, 31 – 36. AMS Enol Publishing Company, Los Angeles.
9. White J. W. Jr. 1950 Composition of Volatile fraction of apples. Food Research.
10. Joslyn M. A. 1950 Method in Food analysis applied to plant products. Academic press, New York.
11. Hulme A. C. 1958. Some aspects of the biochemistry of apple and pear fruits. Advan Food Research.