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RAFFIA PALM AND THE OIL PALM AND TEST THE EFFECT OF PASTEURIZATION ON PALM WINE AND IT'S ABILITY TO AFFECT THE SHELF LIFE

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***Abstract*—This work was carried out with the dual aim of comparing the properties of two species of palm wine (the raffia palm and the oil palm, and to also test the effect of pasteurization on palm wine and its ability to affect the shelf life. From the results, it was seen that the sugar content of the pasteurized palm wine did introduce as opposed to that of the unpasteurized control. Since the enzyme feeds on sugar and produces ethanol (reducing the sugar content), it can be concluded that pasteurization has a significant impact and increases the shelf life of palm wine. Results also showed that the ethanol content of the pasteurized palm wine didn't increase as opposed to the unpasteurized control which did. The result of the analysis of the fresh raffia and oil palm oil showed that the raffia palm wine had a higher pH, total soluble sugar, reducing sugar, ascorbic acid vitamins c and protein, while the oil palm had higher ethanol and specific gravity.**

***Keywords*—Pasteurization, Palm oil, Shelf life, Ethanol, Raffia.**

I. INTRODUCTION

Palm wine is a customary beverage created from the palm sap of different kinds of palm trees and is appreciated by numerous individuals living in sub-Saharan Africa (Akhbari et al., 2020). The tapping of the beverage from the palm tree gives a significant monetary action for individuals living outside both in urban areas and towns, where numerous individuals have taken it up as expert to tap the wine from the palm tree (Elaesisguinensis). The beverage assumes a significant job in the socio-social exercises of individuals in Nigeria, particularly in the South-eastern locale, where it is served in most customary occasions (Eze &Uzoechi, 1988).
The extraction of the wine from the palm tree and the raffia palm is a profession that has over the years been passed down from generation to generation. It requires some level of skill and expertise of some sorts, which if not properly learned might not yield the required product (wine). There have been researches on developing a mechanized way of extracting from these trees and has in recent times yielded some measure of success (Mbuagbaw & Noorduyn, 2012).

Although, there may be variations in the methods of tapping wine, they generally follow a well-known sequence of steps. The following flowchart illustrates the steps in the production of palm wine from palm trees.

Palm wine has different names in different tribes/cultures, it is known as mantango, mbuh, tumbu liquor, white stuff in Cameroon, nsafufuo in Ghana, and in Nigeria it is known as eme, nkwu and ogogoro (Akinyanju & Oloruntoba, 1986).
Ezeagu et al. (2003) states that among the Igbo tribe of Nigeria, palm wine comes from two sources

(a) Nkwu/Elu (Oil palm tree)
(b) Ngwo (raffia palm or raffia)

This drink has a huge significance in the cultural settings of these local tribes as it is mainly used for many different reasons such as in conflict resolution, in events such as: weddings, meetings and funerals, and spiritual and prayer purposes (Ukhum et al., 2005).
Given the extensive uses and wide adequacy that palm wine directions in Nigeria today, all that is left to transform it into a national brand that can similarly pull in tremendous outside trade for the administration is to reserve subsidize for examination into the farming, pharmaceutical, nourishment and refreshment possibilities of this fundamental item with view to tackling the outcome for the general improvement of palm wine generation, stockpiling, bundling and advertising.

II. CUTTING DOWN ALCHOL CONSUMPTION

Individual who are reducing liquor utilization at times resort to newly tapped palm wine which is sweet and absent a lot of liquor.

Culinary Benefits
Palm wine can be utilized for culinary purposes for instance, it very well may be

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Utilized as a yeast substitute for leavening food products

Eye Treatment
Eye experts avow yeast is generally excellent for the eyes. The availability of yeast in palm wine subsequently makes it accommodating for boosting vision.

Malaria Treatment
Fresh Palm wine is typically combined with local herbs and devoured by home grown treatment followers during material assaults.

Milk Production in Lactating Mothers
Lactating mothers who want to enhance breast milk production usually drink the fresh palm wine.
Therefore, the inhibition of palm wine fermentation will be more beneficial to majority of palm wine consumers.

III. NATURAL PALM WINE

Natural palm wine is the wine obtained from the trees of the oil palm tree (Elaesisguineensis) and the raffia palm (Raffia farinifera) (The Sweet Palm Wine, 2019). It comes from the tissues of these palm trees and is produced as a result of the metabolic processes that takes place in the tree's system (Faparusi&Bassir, 1972). These have lots of vitamin A content due to the high amount of yeast in it (Karamoko et al., 2012) and has been certified by most nutritionist to be good for the eyes. These wines have their alcohol content increased due to the activities of micro-organisms in it-most especially yeast (Obire, 2005). Many people especially sources and its medicated uses (the sweet Palm Wine, 2019).

A. FERMMENTATION
Fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes (Amao-Awua et al., 2007). In food processing, fermentation is the process of converting carbohydrates to alcohol or organic acids using microorganisms-yeast or bacteria-under anaerobic conditions (Ayogu, 1999). Karamoko et al.(2012) states that the term fermentation may sometimes refers specifically to the conversion of sugars into ethanol, producing alcoholic drinks such as wine, beer, and cider.

B. PASTEURIZATION
Pasteurization is a heat-treatment process that destroys a pathogenic microorganism in certain foods and beverages (Pasteurization, 2019). The treatment devastates a large portion of the microorganisms that reason deterioration thus prolongs the shelf life. It is named after the French researcher Louis Pasteur, who during the 1960s exhibited that anomalous maturation of wine and lager could be counteracted by warning the drinks to about 570℃ (135℉) for a couple of moments (Obire, 2005). He demonstrated that thermal processing would inactivate unwanted microorganisms in wine. Spoilage enzymes are also inactivated during pasteurization. Today, pasteurization is used widely in the dairy industry and other food processing industries to achieve food preservation and food safety (Ghosh et al., 2012).

C. TAPPING
Palm wine is gotten from palm tree by the procedure of 'Palm Wine Tapping (Lasekan et al., 2007). Individuals who tap palm wine are particular people called 'palm wine Tappers'. A run of the mill 'palm wine tapper' ought to have a grappling rope, a short cutlass for cutting palm fronds, a tapping blade, and a gallon.
In their statement, Ogbulie et al., (2007) states that palm wine tapping includes removing the palm fronds to uncover the delicate tissues at the highest point of the Palm Tree. The 'tapping blade' is utilized to penetrate an opening into the tissue to take into consideration the exit of the palm wine. Uniquely cut little bamboo, empty metallic channels. Or different instruments are associated with the gaps to pass on the wine to the gallon. The gallon could be attached to the palm tree with a rope on account of a standing palm tree, or basically bolstered by sticks in felled palm trees.

D. ALCOHOL
In chemistry, an alcohol is any organic compound in which the hydroxyl functional group (-OH) is bound to a carbon (Alcohol, 2019). The term alcohol originally referred to the primary alcohol ethanol (ethyl alcohol). Alcohol is formed when yeast ferments (separate without oxygen) the sugars in various nourishment (Obire, 2005). For instance, wine is produced using the sugar in grapes, lager from the sugar in malted grain (a kind of grain), juice from the sugar in apples, vodka from the sugar in potatoes, beets or different plants, and palm wine from the sugar in palm sap (Eze & Uzoechi, 1998).

D. SUGAR
Sugar according to Eze &Uzoechi (1998) is the nonexclusive name for sweet-tasting, solvent sugars, a significant number of which are utilized in nourishment. The different sorts of sugar are gotten from various sources. Basic sugars are called monosaccharides and incorporate glucose (otherwise called dextrose), fructose, and galactose. "Table sugar" or "granulated sugar" alludes to sucrose, a disaccharide of glucose and fructose (Sugars, 2019). In the body, sucrose is hydrolyzed into fructose and glucose.

E. ENZYMES
Enzymes are macromolecular biological catalyst (Ezymes, 2019). Enzymes increase the level of chemical reactions in mainly and sometimes, non-living systems. The molecules upon which enzymes may act are called substrates and the enzyme converts the substrates into different molecules known as products (Ayogu, 1999). It is well known that almost all metabolic processes that occur in the cell need enzyme catalysis in order to occur at rates fast enough to sustain life.

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Enzymes are efficient catalyst for biochemical reactions. They speed up reactions by providing an alternative reaction pathway of lower activation energy (Ejiofor et al, 1994).

In this report we are considering two palm wine producing species,

Oil palm tree (Elaesis guineensis)

Raffia palm tree (Raffia farinifera)

IV. OIL PALM TREE (ELAESISGUINEENSIS)

Elaesisguineensis is an evergreen, single-stemmed palm tree that can grow up to a tallness of 20-30 meters (Akinyanju and Oloruntoba, 1986). Mbuagbaw et al. (2021) affirms that the erect, round, and hollow, unbranched stem can be 22-75cm in distance across, it is beaten by a crown of around 40-60 live dull green surrenders that can be over to 8 meters in length, and a skirt of dead leaves.

In different terms, the oil palm is a multi-reason tree critical in Africa, where it supplies nourishment, medications, and numerous different items to the neighbourhood populace (Ukhum et al., 2005). Progressively going under development, this species is quickly getting one the world's most developed plants, being developed particularly for its oil-bearing seeds and natural products. The tree is likewise planted as a nursery elaborate and along roads products. The tree is likewise planted as a nursery elaborate and along roads and doesn't create any known peril.

Range

Tropical west and central Africa-Sierra Leone to Uganda and Kenya, south to Angola and Mozambique (Van Pee & Swings, 1971).

Habitat

Pretty much open woods in sodden, sandy soils that are frequently inadequately depleted, and it is often found along the edges of rivers.

Properties

Habit: Evergreen Tree
Height: 15.00m
Growth Rate: Slow
Pollinators: Insects
Selfie-fertile: No
Cultivation Status Cultivated, Ornamental, Wild.

Cultivation Details

Ogbulie et al. (2007) states that the palm tree prevails in moist to very wet tropical atmosphere uo rises of 1,300 meters, however business development is limited to zones underneath 700 meters and ideally lower than 300meters. It develops best in zones where yearly daytime temperatures are inside the range 20-35℃, yet can endure 12-38℃. The plant is very tolerant, however and prevails in southern China where there are light ices and mean every day temperatures can dip under 10℃ for a consideration length of time (Chandrasekhar et al.,2012).

As per Eze and Uzoechi (1998) it favours a mean yearly precipitation in the range 1,500-3000mm, yet endures 1,000-8000mm. Ideally, there ought to be at any rate 150mm of downpour every long stretch of the year, preferably falling generally around evening time. The tree develops well in full sun, in any event, when little. It additionally requires a humus-rich soil. Waterlogged, exceptionally impermanent flooding, gave the water isn't dormant. Lean towards a pH in the range 4.5-6, enduring 3.2-8.

The root framework is extrinsic, shaping a thick tangle with a range of 3.-5 meters in the upper 40-60cm of the dirt (Ogbulie et al., 2007). Some essential roots are legitimately beneath the base of the storage compartment dropping for port for more than 1.5meters, the roots produce pneumatodes under exceptionally wet conditions.

The African oil palm is a progression animal types supported by slice and consume, and its genetic stock has extended as ranchers clear land and make increasingly open environment for the germination of its seeds.

Table1.1 Composition and specific gravity of fresh coconut wine

Ethanol	2-5ml per 100ml
Ascorbic	16-30mg per 100ml (little change during fermentation)
Total solids	15.2-19.7g per 100ml
Sucrose	12.3-17.4g per 100ml
Ash	0.11-0.41g per 100ml
Protein (N × 6.25)	0.23-0.32g per 100ml
Specific gravity at 29℃	1.058-1.077

Table 1.2Composition and space gravity of 12hrs fermented coconut palm wine

Ethanol	5-5.7%
Acidity (as acetic)	0.32-0.67%
Water	90.3-96.3%
Protein	0.2%
Ether extractives	0.1%
Carbohydrates	1.3%
Mineral matter	0.01%
Calcium	lt;0.01%
Phosphorus	0.01%
Vitamin B_1	<5IU per 100ml
Specific gravity at 29℃	0.998-1.033

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V. EXPERIMENT AND RESULT

A. Material preparation

i. Beakers/Plastic Containers
ii. Brush
iii. Clock
iv. Electronic Weighing Balance
v. Spectrophotometer
vi. Masking Tape
vii. Measuring Cylinders
viii. Cuvette
ix. Resort Stands
x. Round-bottom flasks
xi. Thermometer
xii. Thermostatic water bath
xiii. Whatman No. 42 grade filter paper

Reagents

i. Ethanol concentration
ii. Blank solution
iii. Sample solution
iv. Distilled water

Phenol sulphuric acid.
Source of raw materials.
The main sources of getting palm wine Nigeria are the oil palm. Palm tree and the raffia palm wine is obtained by tapping the respective palms. The main limitation of the palm wine drink is that wine ferments rapidly and turns sour within a period of twenty-four (24) hours of being harvested from the palm tree.
With this in mind, the palm wines used for this study were sourced directly from south-eastern Nigeria.

B. Method

i.TEST FOR PH

A sizeable amount of the wine was poured into beaker. Then a pH meter was inserted into the beaker to read the pH value, which was then noted down.

ii. TEST FOR REDUCING SUGAR

0.1ml of the sample was collected and made up to 3ml, by adding 2.9ml of deionized water. 3ml of DNS was then added which turns the solution yellow. The resulting solution was then heated for 5minutes. Then 1ml of Rochelle's salt was added. It turns the solution dark brown. The solution was then allowed to cool. Then these samples were analyzed by the UV spectrophotometer at a wavelength of 510mm.
The procedure was repeated for a blank solution.

iii. TEST FOR ASCORBIC ACID

3-5g samples were weighed and collected, with the aim of taking the average/mean value 1% starch was prepared by adding 0.2g of starch to 20ml water. 50ml deionized water was then added to the 5g sample. 5ml of the 1% starch was added to the sample. The solution was then Titrated using 0.1M Iodine.

Calculation is as follows:

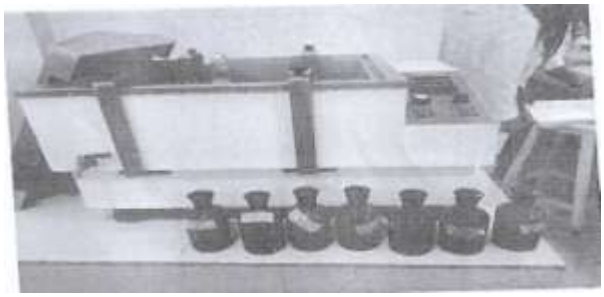
$$\text{Ascorbic acid (mg/L)} = \frac{\text{volume of iodine used} * 8.826 * 1000}{\text{volume of sample used}} \quad 1.1$$

$$\text{Concentration of vitamin c (mg/100g)} = \frac{\text{volume of iodine used} * 8.826 * 100}{\text{volume of sample used}} \quad 1.2$$

iv. PASTEURIZATION

The samples were poured into bottles and corked and then kept inside a water bath. The water bath's temperature was raised to 100 ℃ and the bottles were kept in the water bath for 30minutes. The bottles were not opened to prevent air from entering the samples.
The bottles were kept for time periods of 0hour, 24 hours, 48 hours, and 72 hours. After each time period was reached, the appropriate sample was withdrawn and analyzed.
Control samples that were unpasteurized were kept and also analyzed at the same time periods as the pasteurized.

v.TEST FOR PROTEIN



50ml of formaldehyde was measured out with measuring cylinder and the pH was adjusted to 8.0 by addition of IM NaoH. After this, the palm wine was filtered with the whatman filter paper. 10ml of the filtered wine was put into a volumetric flask and made up to 25ml by adding deionized water. Take 10ml of the solution and put into a beaker and adjusted the pH with In NaoH to 8.0 (it was 3.87).

vi. DISTILLATION

The wines samples are placed in the distillation setup which. The wine is the distillation bottle is then kept in the heating mantle and is distilled until the first drop of distilled condenses. The time was set for 50minutes after which the distillate is collected and corked.

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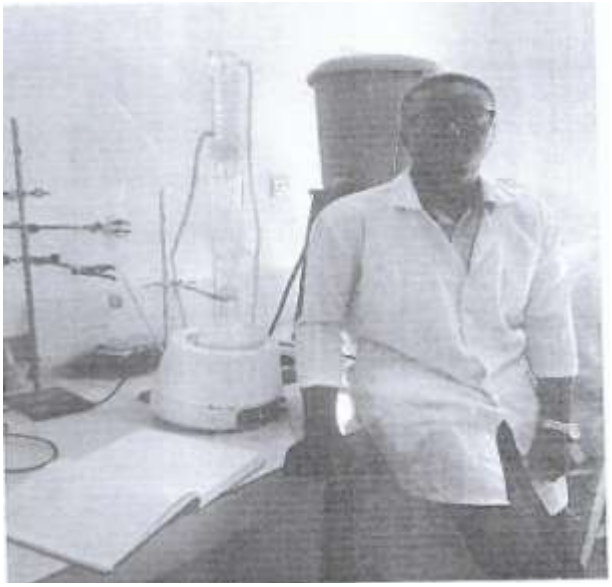

vii.TEST FOR SPECIFIC GRAVITY

A 50ml specific gravity bottle is oven-dried to ensure that there is no moisture in it then allowed to cool in a desiccator. Then the bottle weight is obtained as m_1. The bottle was then filled with 50ml of water and the weight $m_2$recorded. The bottle was then emptied and oven-dried again after which it was filled with 50ml of the distillate and the weight obtained as m_3.

VI. TESTING FOR HIGHER ALCOHOLS

i. TEST FOR VOLATILE ACIDITY

50ml of the distillate sample was withdrawn and 50ml of deionized water was added to it to make it a blank solution. This blank solution was then stopped when the solution turns pink indicating the presence of volatile acids.

ii TEST FOR ESTER

10ml of 0.1M Noah solution was to the samples (volatile acidity samples). The flask containing the solution was then corked to prevented evaporation of the volatile content. The samples were withdrawn and titrated against 0.1M H_2SO_4 until the pink colour disappears and the sample becomes colourless.
The experiment was repeated with a blank solution that doesn't have the Noah solution.

METHODS: Extraction/Titrimetric method

The solution obtained from the determination of esters was transferred into a separating funnel and 50ml of distilled water was added. The solution was then saturated with sodium chloride and extracted four times with successive portions of 40.30,20 and 10ml of carbon tetrachloride. The extracts were pooled out and washed 3times with saturated sodium chloride solution and twice with saturated sodium sulphate solution. After this the extract was mixed 50ml of oxidized mixture (which is a mixture of H_2SO_4 and $K_2Cr_2O_7$). This oxidized solution brings about an exothermic reaction with the evolution of a choking gas. The solution was then refluxed for 2hours and then transferred into the distillation assembly alongside 50ml of water. Then 100ml of the sample was ensuring that charring does not occur. Then this solution was then titrated against standard NaOH using phenolphthalein indicator.
The experiment was repeated with a blank solution using 50ml of distilled water instead of the distillate of the liquor.

Calculation

Higher alcohol expressed amyl alcohol, in gms. =

$$\frac{v \times 0.0088 \times 100 \times 1000 \times 2}{v_1 \times v_2} 1.3$$

100litres of abs. alcohol.
Where,
v = different of titre value of std. alkali used for the blank and sample, in ml.
v_1 = Volume of sample taken for estimation
v= alcohol % by volume
Note: 1ml of 0.1N NaOH is equivalent to 0.0088g of Amyl alcohol.

VII. RESULTS AND DISCUSSION

TABLE 2:1 Result of palm wine analysis

Parameters	Pasteurization		
	0hrs	24hrs	48hrs
pH	3.32	3.41	3.61
Total soluble sugar, % Brix	5	5	5
Reducing sugar, ug		2,207.0	2,244.6
Specific gravity	0.9832	0.9856	0.9701
Vitamin c	18.34	17.65	28.24
Protein mg./I	244.5	201.25	127.75
Ethanol yield, %		26.5	18.5
Parameters	Unpasteurization		
	24hrs	48hrs	72hrs
pH	3.76	3.75	3.72
Total soluble sugar, % Brix	6	5	5
Reducingsugarug	3,427	2,238	1,860.0
Specific gravity	0.9851	0.901	0.9946
Vitamin c	31.6	23.1	17.65
Protein mg./I	208.5	164.2	122.5
Ethanol yield, %	28.1	36.4	42.4

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TABLE 2:3

Parameters	Raffia wine	Oil palm (Elu) wine
	Fresh (0hr)	Fresh (0hr)
pH	3.78	3.21
Total soluble sugar, % Brix	6	3
Reducing sugar, ug	7,715.4	160.02
Specific gravity	0.9771	1.0199
Vitamin c	35.30	22.95
Protein mg./I	245.00	215.25
Ethanol yield, %	19.40	20.0

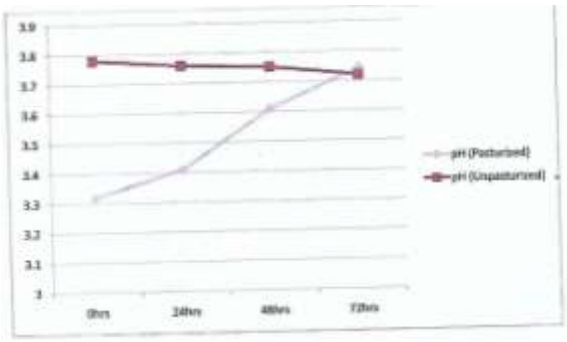

Figure 1.1: Plot of pH against time

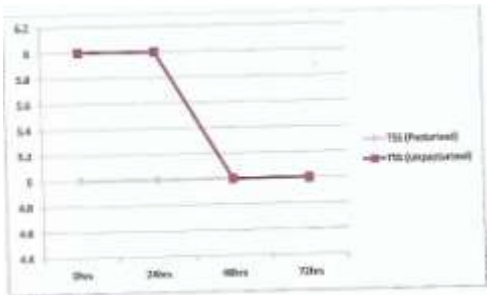

Figure 1.2: Plot of total soluble sugar against time

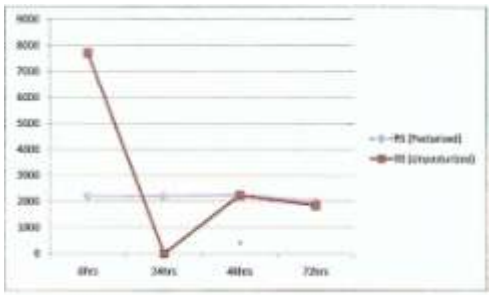

Figure 1.3: Plot of reducing sugar against time

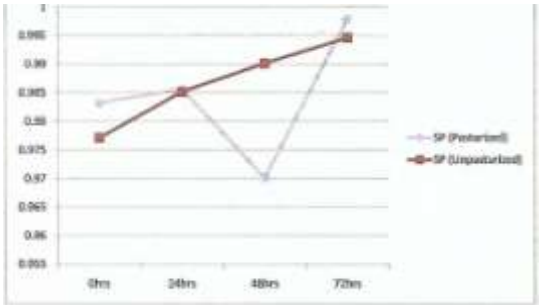

Figure 1.4: Plot of specific gravity against time

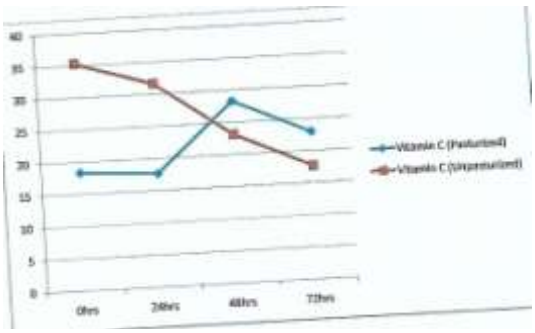

Figure 1.5: Plot of vitamin c against time

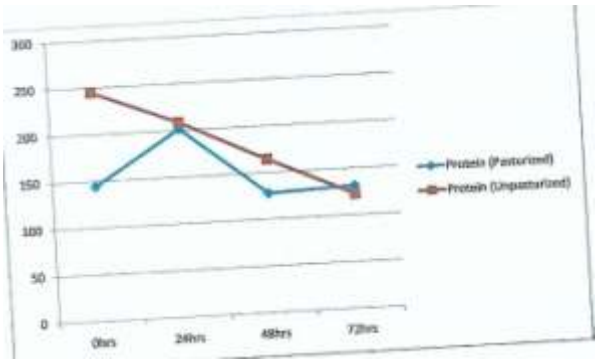

Figure 1.6: Plot of protein against time

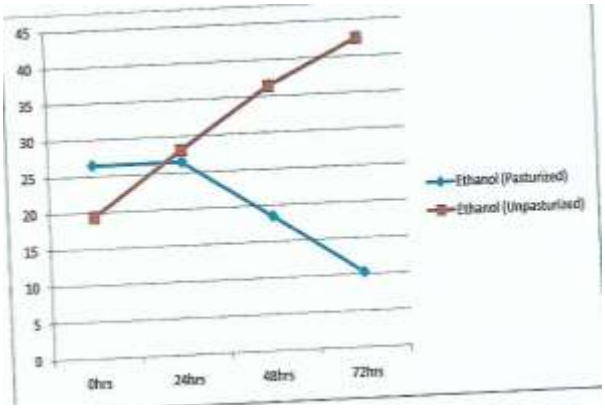

Figure 1.7: Plot of ethanol concentration against time

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VIII. DISCUSSION

From the above plot, it can clearly be seen that the pasteurization had an effect on the palm wine.
The plot of figure 1.1 the pH of the pasteurization increased while that of the unpasteurized decreased.
From the plot on figure 1.2, it can clearly be seen that the soluble sugar of the pasteurized wine remained constant, while that of the unpasteurized decreased. This is a clear indication that fermentation on the pasteurized palm wine was greatly reduced and possibly stopped, while that of the unpasteurized continued.
From figure 1.3, it can be seen that the amount of reducing sugar in the pasteurized sample remained relatively constant, while that of the unpasteurized reduced significantly. Again, that is a clear indication that the fermentation process was stopped in the pasteurized wine as opposed to the unpasteurized, since the yeast feeds on sugar, converting it to alcohol.
Finally, from figure 1.7, it is clear that the fermentation process didn't occur in the pasteurized sample since the ethanol concentration reduced while the ethanol concentration of the unpasteurized palm wine increased significantly.
This means that pasteurized has a significant effect in reducing the rate of fermentation of palm wine and hence increases the shelf life.
The different species of palm wine, raffia and oil palm (Elu/nkwu) were also compared, and their results placed side by side and it can be seen that the oil palm wine has slightly higher ethanol content than raffia counterpart

IX. CONCLUSION

From the parameters measured, it was seen that there were changes (increase/decrease) as appropriate for the individual property (for example ethanol increases over time, while sugars decrease) for both the pasteurized and unpasteurized wine, with the unpasteurized wine showing greater degree of change from the original fresh palm wine properties.
It can therefore be seen that pasteurization has a significant effect in reducing the rate of fermentation of palm wine and hence increases its shelf life.

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