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Full Length Research Paper

Production and Sensory Analysis of Wine from Cocos nucifera Water

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Wine was produced at 1:4 (must: sugar) from coconut (*Cocos nucifera*) using natural yeast (Recipe A), natural yeast augmented with granulated sugar (Recipe B), natural yeast augmented with Baker's yeast, granulated sugar (Recipe C), a control consisting of granulated sugar and Baker's yeast (Recipe D). On fermentation for 120 h, pH values were 4.68±0.191, 4±0.029, 4.08±0.023, 3.65±0.058, temperature values (°C) were 28.75±0.61, 27.75±0.26, 28.25±0.43, 27.5±0.58, specific gravity values were 1.003±0.0006, 1.012±0.00171, 1.001±0.0006, 0.99±0.0023, optical densityvalues were 0.6918±0.019, 0.715±0.017, 0.774±0.0023, 0.752±0.005, % alcohol(v/v) values were 1.359±0.002, 1.371±0.006, 1.357±0.007, 1.354±0.008,% titratable acidity values were 0.16±0.001, 0.809±0.044, 0.302±0.002, 0.382±0.015, R_f values were 4.7±0.017, 4.9±0.058, 4.25±0.052, 4.95±0.058 and total aerobic counts were 7.308±0.036, 7.183±0.067, 6.72±0.046, 7.175±0.014 for Recipes A to D respectively. Malo-lactic fermentation after 48h was evident. Taste testing showed very little differences in wines from Recipes A to C. Statistical analyses at 95% confidence level showed no significant differences in coconut wine produced with different recipes for the tested parameters. The wine from the control had similar taste and characteristics with natural palm wine. Coconut wine could thus be produced for immediate consumption within 48 h using the Recipes A - C.

Key words: Coconut, flora, fermentation, sugar, wine, flavor, yeast.

INTRODUCTION

Coconut is the fruit produced by the coconut palm (*Cocos nucifera*) which belong to the family of Arecaceae. Coconut is found in tropical regions generally within 22°N and S of the equator and most commonly near sea coast. The coconut palm is found throughout the west tropical lowlands but will grow anywhere if there is sufficient rain and warmth. It has been known for thousand of years and nobody knows its original home. Perhaps the most likely places are Malaysia or Indonesia, but one thing is certain, it has been spread through the tropics almost entirely by man and has become a typical feature (Satyabalan, 2003).

Literature is replete with wine making from many fruits but little or no work on wine production from the coconut fruit (endosperm) is found. The coconut wine that is widely drank is from the fermentation of the coconut sap obtained by tapping the coconut palm which ultimately results in the death of the palm tree, thus, limiting our natural resources. Wine plays almost an indispensable role in the life of man ranging from social function, religious rites, rituals as well as economic benefits to produce and merchants. In religious sector, wine had been held sacred throughout history (Hallgenten, 2006).

Most wines produced in Africa and Nigeria in particular, are preserved with chemicals such as bottled palm wine from Nigeria institute of oil palm research (NIFOR). Such chemical preservatives – sodium nitrate and benzoate may be toxic to humans. It is the fear of use of chemical preservatives for increasing the shelf-life of wines that prompted this research. This research was aimed at producing wine from coconut for immediate consumption or preservation using refrigeration whenever the need

Table 1. Compositions for the Coconut must fermentation.

Recipe	Composition
A	1.5L fruit slurry + 6.0l of water
B	1.5L fruit slurry + 6.0l of sugar solution
C	1.5L fruit slurry + 6.0l of sugar solution + baker's yeast
D	7.5L of sugar solution +baker's yeast

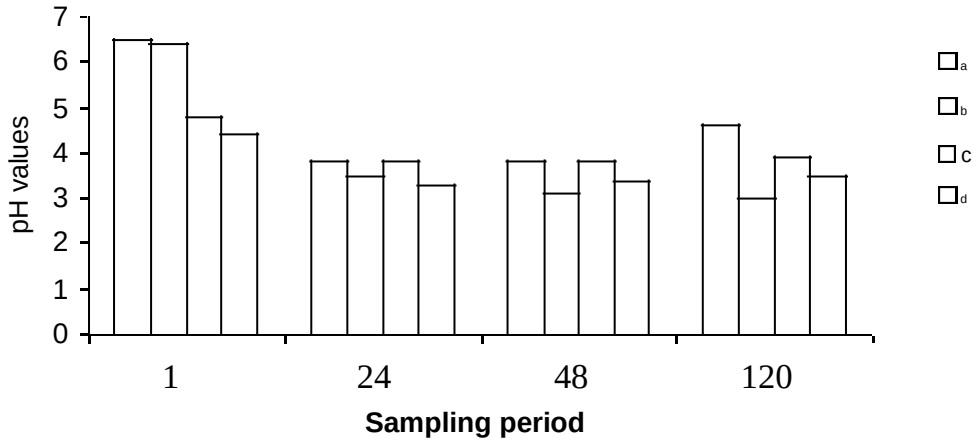

Figure 1. Changes in pH of coconut wine.

arises.

MATERIALS AND METHODS

Collection of samples (Coconuts)

Strong coconut fruits (*Cocos nucifera*), purchased from Obiaruku Market in Ukwani Local Government Area of Delta State, and were washed with tap water in the laboratory. They were further broken (dehusked) and the endosperm extracted to obtain the coconut milk (juice).

Preparation of sugar solution

Clean water was boiled for five minutes and allowed to cool. One teacup-full of granulated sugar was dissolved in one litre of water to obtain the sugar solution.

Preparation of must juice

This was carried in accordance with the method of Uraih (2003) thus: One kilogram of coconut fruit was weighed and then grinded using the mechanical grinder SAISHO S-748 Model. 6L of distilled water was added to the ground coconut paste in a clean 10l plastic bucket previously washed, rinsed with 95% alcohol and allowed to air dry (Table 1). Coconut must was then collected by allowing the mixture of filter through a clean white handkerchief previously disinfected with boiling water for 60 min. This was filtered into a clean bucket previously rinsed with 95% alcohol (Ibeh and Uraih, 2000).

Determination of physico-chemical and microbial parameters

These were carried out in accordance with standard methods reported by Ogunkoye and Olubayo (1977); Cowan and Steel (2004); Fawole and Oso (2008).

Organoleptic evaluation

This was carried out in accordance with the procedure reported by Maragatham and Panneerselvam (2011). The sensory evaluation was done using 8 judge panels after aging for 24 h. Observations recorded for color, clarity, body and taste on a 5 point scale with 5 points for excellent quality and 1 point for bad quality.

Statistical analyses

These were carried out using Microsoft excel 1995-2003 at 95% confidence level.

RESULTS AND DISCUSSION

Changes in the pH of coconut wine with period of fermentation are presented in Figure 1. It was observed that Recipe A decreased in pH up to 48 h and thereafter increased, Recipe B decreased all through the period of fermentation while Recipe C decreased up to 48 h and thereafter increased. This could be as a result of the production of acid through metabolic activities. These are in agreement with the reports of Okafor (2007).

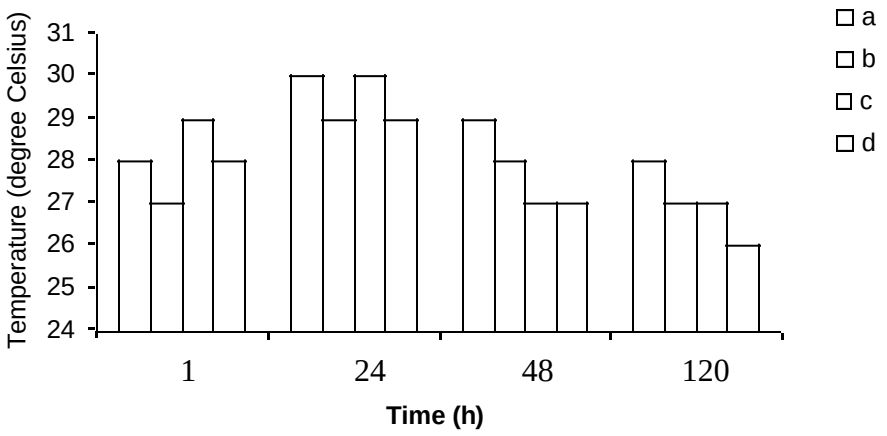

Figure 2. Changes in temperature of coconut wine.

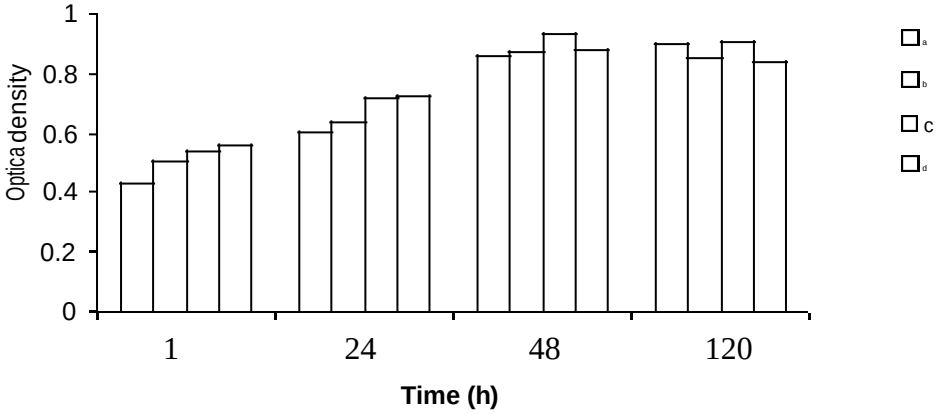

Figure 3. Changes in OD of coconut wine.

The changes in the temperature of coconut wine with period of fermentation are presented in Figure 2. It was observed to increase up to 48 h and decreased thereafter for all the recipes. This could be due to metabolic activities of the yeast converting sugar to ethanol with the release of heat.

These results agree with the reports of previous workers (Amerine and Kunkee, 2005; Okafor, 2007; Anon, 2010).

The changes in O.D of the coconut wine during fermentation are presented in Figure 3. It was observed that all the Recipes increased to 48 h and thereafter decreased. These could be due to increase in number arising from metabolic activities. These results agree with the reports of previous workers (Amerine and Kunkee, 2005;Harrias, 2005; Okafor, 2007; Anon, 2010).

The changes in SG of the coconut wine during fermentation are presented in Figure 4. It was observed that while Recipe A increased up to 24 h and decreased thereafter, all the other Recipes decreased to 48 h and thereafter increased. These could be due to increased metabolic activities leading to exhaustion of available nutrients with the concomitant production of alcohol. These results agree with the reports of Amerine and Kunkee (2005); Harrias (2005); Kunkee and Amerine (2007); Okafor (2007); Anon (2010).

The changes in the % alcohol of coconut wine with period of fermentation are presented in Figure 5. It was observed that this followed the same trend as for specific gravity above. These could be due to production of ethanol during metabolic activities. These results agree with the reports of Amerine and Kunkee (2005); Harrias (2005); Kunkee and Amerine (2007); Okafor (2007); Anon (2010).

The changes in the % titratable acidity of coconut wine with period of fermentation are presented in Figure 6. It was observed that in Recipe A, it decreased to 24 h, remained constant till 48 h and increased to 120 h; Recipes B and C decreased to 24 h and increased thereafter while Recipe D decreased throughout. The increase after 48 h and the R_f values in Table 3 indicate the presence of a Malo-lactic fermentation. These results

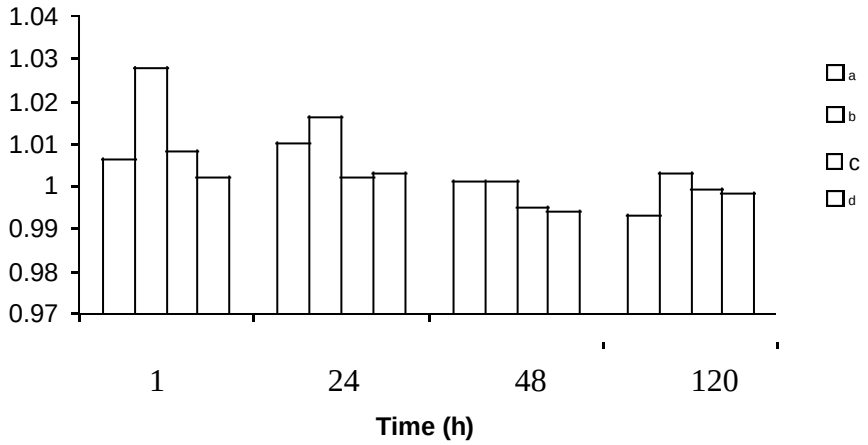

Figure 4. Changes in specific gravity of coconut wine.

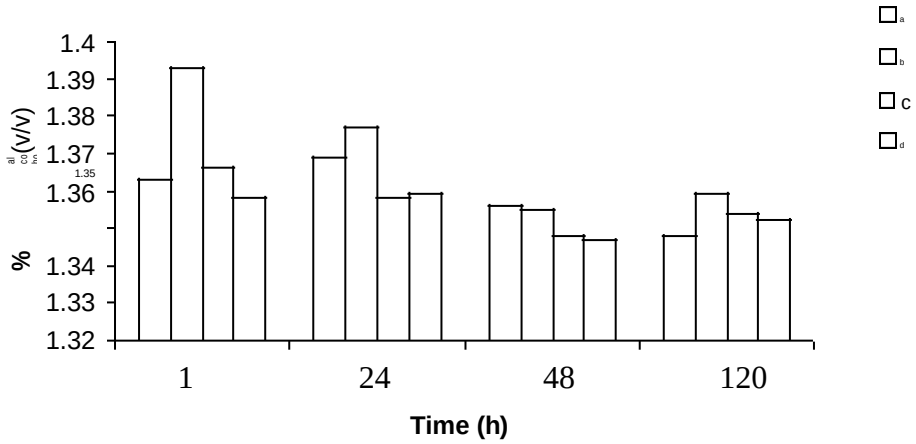

Figure 5. Changes in % alcohol (v/v) of coconut wine.

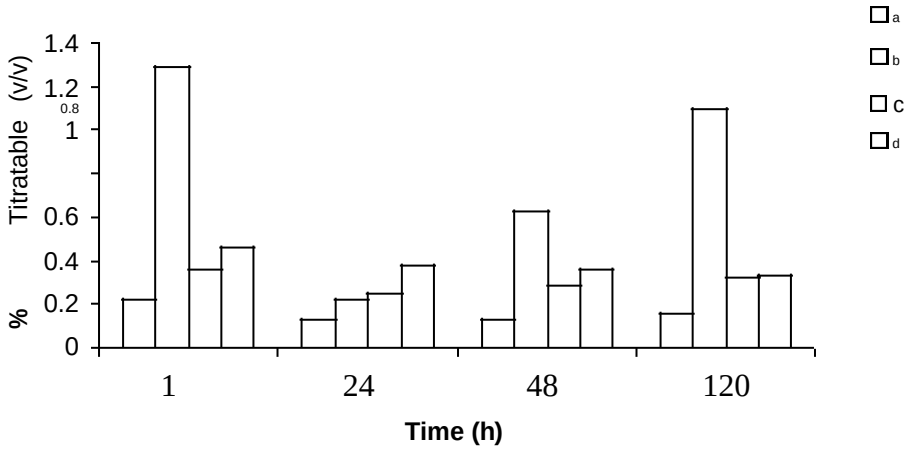

Figure 6. Changes in % titratable acidity of coconut wine.

agree with the report of Child (2002) and Okafor (2007).

The changes in the aerobic counts of coconut wine with period of fermentation are presented in Figure 7 It was observed that aerobic count in Recipes A and B increased all through the period of fermentation while Recipes C and D increased to 48 h and decreased thereafter. These changes could be attributable to a microbial succession from yeast to lactic acid bacteria as

Table 2. Average values of tested parameters.

Parameters	A	B	C	D
Optical density	0.698 ± 0.019	0.715 ± 0.017	0.774 ± 0.023	0.752 ± 0.005
Specific gravity	1.003 ± 0.006	1.012 ± 0.0017	1.001 ± 0.006	0.999± 0.0023
pH	4.68 ± 0.191	4.0 ± 0.029	4.08 ± 0.023	3.65 ± 0.058
% alcohol	1.359 ± 0.002	1.371 ± 0.006	1.357 ± 0.007	1.354 ± 0.008
Total aerobic counts	7.308 ± 0.036	7.183 ± 0.067	6.72 ± 0.046	7.175 ± 0.014
Temperature (°C)	28.75 ± 0.61	27.75 ± 0.26	28.25 ± 0.43	27.5 ± 0.58
R_f	4.7 ± 0.017	4.9 ± 0.058	4.25 ± 0.052	4.95 ± 0.058
% titratable acidity	0.16 ± 0.001	0.809 ± 0.044	0.302 ± 0.002	0.382 ± 0.015

Table 3. Physical and organoleptic properties of the coconut wines.

Recipe	Time (h)	Sweetness	Color
A	1	+	Cream
	24	-	Dirty cream
	48	-	Dirty cream
	72	-	Dirty cream
	144	-	Cream
B	1	++	Cream
	24	+	Dirty cream
	48	-	Dirty cream
	72	-	Dirty cream
	144	-	Cream
C	1	++	Cream
	24	+	Dirty cream
	48	-	Dirty cream
	72	-	Dirty cream
	144	-	Cream
D	1	++	Colorless
	24	+	White
	48	-	White
	72	-	Colorless
	144	-	Colorless

is evident from the Malo-lactic fermentation in Figure 6 and the R_f values in Table 3. These results agree with the reports of Idise and Izuagbe (1985); Child (2002) and Okafor (2007).

The morphology of isolated yeasts after 48h of fermentation showed that there were no significant differences between the yeast cells of the fermenting broths. This could infer that the wild yeast present in the banana could be of the same Saccharomyces species with the baker's yeast. These results are in agreement with the reports of previous workers (Robinson,2006; Okafor, 2007; Anon, 2010).

The average values of the tested parameters are presented in Table 2. It was observed that Recipe A had highest mean values for pH, TAC and Temperature; Recipe B had highest mean values for SG, %alcohol and %TA; Recipe C had highest mean value for OD while Recipe D had highest mean value for R_f . Statistical analyses showed no significant difference between the various Recipes at 95% confidence level as f-cal was less than f-crit. These results are in agreement with the reports of previous workers (Robinson, 2006; Kunkee and Goswell, 2007).

The changes in physical and organoleptic properties

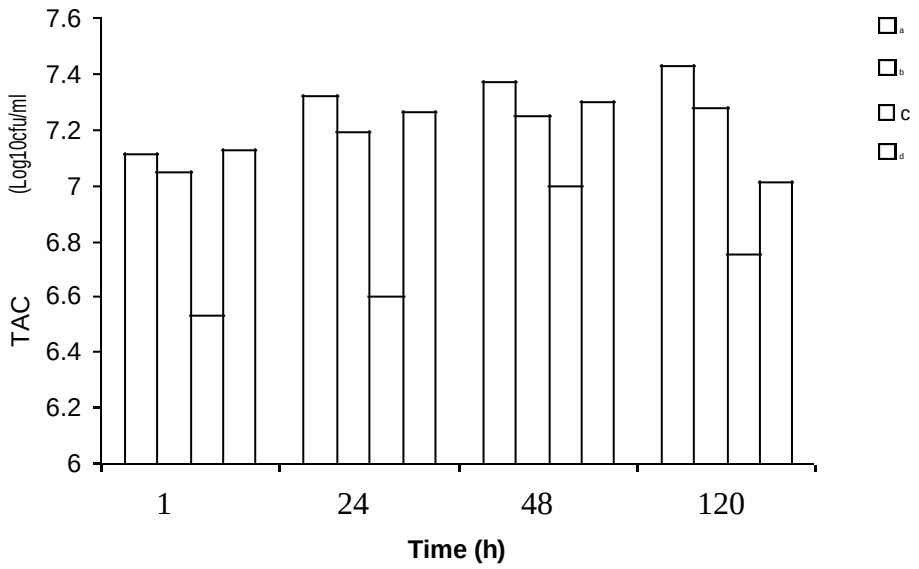

Figure 7. Changes in Total aerobic counts of coconut wine.

of coconut wines with period of fermentation are presented in Table 3. It was observed that there were significant differences in the wines of Recipes A to C. The wine produced with Recipe D (control) had similar taste with natural palmwine. Statistical analyses showed no significant difference between the various Recipes at 95% confidence level as f-cal was less than f-crit. These results agree with the reports by Ogunkoye and Olubayo (1977); Idise and Izuagbe (1988).

Conclusion and recommendation

Various wines could be produced with coconut using the different Recipes A to C. Recipe D could be used to produce artificial palm wine as it produced wine similar in color, flavor, effervescence and dregs with palm wine. This could form the basis for artificial palm wine production. All wines produced could be consumed within 48 h of production with storage by refrigeration. However, more research is required to determine the shelf stability of the various wines produced. The production of coconut wine using the flow chart is hereby recommended.

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