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RESEARCH ARTICLE

Different Parameters in Coconut (*Cocos Nucifera*) Wine Fermentation

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Abstract

Coconut (*Cocos Nucifera*) juice is an ancient tropical beverage whose popularity on the international market has been continuously increasing in recent years. The coconut (*Cocos nucifera* L.) is an important fruit tree in the tropical regions and the fruit can be made into a variety of foods and beverages. Coconut water is the clear liquid inside young coconuts. Coconut water (coconut liquid endosperm) is one of the world's most versatile natural products. This refreshing beverage is consumed worldwide as it is nutritious and beneficial for health. An attempt explored a wine fermentation from coconut juice by examining the effect of different parameters such as soluble solid content (14.0°Brix, 14.5°Brix, 15.0 °Brix, 15.5 °Brix), fermentation temperature (28.5°C, 29°C, 29.5°C, 30.0°C), yeast *Sacchromyces cerevisiae* ratio (1.0%, 1.5%, 2.0%, 2.5%) to coconut wine quality**.** Our results proved that 15.0°Brix of coconut juice; fermentation temperature 29.5°C with 2.0% *Sacchromyces cerevisiae* was adequate for coconut juice wine fermentation. Using coconut juice having medicinal and nutritional value as a substrate for wine production, its health benefits can be improved effectively.

Keywords: *Coconut juice, Wine, Fermentation, Sacchromyces cerevisiae.*

Introduction

Coconut (*Cocos Nucifera*) belongs to the family of Arecaceae. Coconut trees (*Cocos nucifera* L.) is one of the perennial oil crops of the tropics mainly been grown very popular in many developing countries to provide food and catering for industrial purposes. Natural conditions in our country and society favorable to the development of coconut trees from the Red River Delta to Ca Mau cape.

In particular, the coconut trees grow well in the Mekong Delta and central coast. Coconut tree has many uses and processing of a variety of products. Coconuts for food like fresh coconut, dried coconut, desiccated coconut, coconut jelly, coconut candy, coconut milk, coconut milk powder, coconut yogurt, cheese coconut, fresh coconut juice.

Other products from the body, ears flowers coconut, coconut leaf veins produced many handicraft items with consumer demand and high export value. Including coir coconut shell, coconut shavings and flock. Coconut fiber is used as cushioning, building materials, fibers are woven tangled rope, net ecosystem.

Cocos is a very good moisturizer is used in agricultural production and fertilizer. Coconut shell charcoal is produced as sintered, activated carbon for air filter, fine filter for other refined products. Products coconuts are harvested monthly, help stabilize income, creating jobs for rural workers through the processing of coconut products. In Vietnam, coconut tree is not only economic value but also the image associated with the homeland and its people.

Coconut water has a low matter content (2% to 5% wet basis), mainly comprising sugars and minerals. The quality of coconut water can not only be attributed to sugars and minerals because it also has a typical flavour and some original properties [1].

Coconut water is one of the world's most versatile natural products. This beverage is well-known for its health and medicinal value. This contains unique chemical composition of sugars, vitamins, minerals,

amino acids and phytohormones and a rich source of electrolytes and natural salts, especially potassium and magnesium. It is low calorie and nearly fat-free, low in sugar as well as containing a little fiber to moderate absorption and is rich in cytokinins, or plant hormones, which have anti-aging, anti-cancer, and anti-thrombolytic effects in humans.

Through these nutritional values on hand, young coconut water can be considered valuable food product. Wine is one of the functional fermented foods that have many health benefits. Commercially, wine is produced by the fermentation of yeast which involves the conversion of sugar to alcohol.

Wine can act as a nutrient supplement for seasonal fruits and vegetables throughout the year. Using fruits and vegetables having medicinal and nutritional value as a substrate for wine production, the health benefits of them can be improved widely.Fermentation is carried out with Saccharomyces cerevisiae commonly known as bakers yeast.

The wine produced resembled the commercial wine in terms of its composition, taste and aroma. During the fermentation period the wines were analyzed for pH, titratable acidity, specific gravity, biomass content, alcohol and reducing sugar on a daily basis. PH show a decreased trend then attains minima and then increased. As the fermentation days proceed, the specific gravity increased and the alcohol percentage increased gradually [2].

In the present, home-made wine production has been used various fruits including banana, apple, pineapple, cherry, berry, banana, cashew apple, pawpaw, water melon and orange [3, 6] or local fruits which obtained the different flavor, aroma and taste based on type of fruit. The alcohol content of home-made wines is only about 7-8% which makes it consumable for persons of any age group. Wine has great health benefits similar to those of fruits from which they are derived [7].

The yeast is responsible for the production of ethanol in alcoholic drink. The process produces ethyl alcohol (ethanol) is the way of yeast to convert glucose into energy. Fermentation can extract valuable components from the raw materials used for production. Yeast is the magical ingredient that turns fruit juices into wine.In spontaneous fermentations, the 1st stages invariably being dominated by the alcohol-tolerant strains of *Saccharomyces cerevisiae*.

This species is universally known as the `wine yeast' and is widely preferred for initiating wine fermentations *S. cerevisiae* has adapted in several important ways and be able to break down their foods through both aerobic respiration and anaerobic fermentation. It can survive in an oxygen deficient environment for a period of time [8].The use of *S. cerevisiae* as starter culture is the most widespread practice in winemaking.

However, the inoculation of musts using selected *Saccharomyces* strains does not ensure their dominance at the end of fermentation [9]. In fact, although possessing high competition, commercial strains do not completely inhibit wild strains until several days after the process has started. The starter culture should compete with not only non-Saccharomyces yeasts, but also with indigenous S. cerevisiae strains, which theoretically adapt better to must conditions [10,11].

There were several studies mentioned to coconut wine fermentation from its juice. Studies on wine production from coconut (*Cocos nucifera*) was examined [12]. Experiment was conducted with an aim to produce flavoured wine from unflavoured tender coconut water without using genetically modified yeast strain or any artificial ingredients at any stage of the process, thus keeping the end product entirely natural [13].

One study has attempted the wine production from Coconut water and Coconut milk. Also the good quality results for flavoring of coconut water wine have been obtained during this work [14]. Comparative studies of wine produced from coconut (*Cocos Nucifera)* and mango fruit (*Mangifera indica*) using yeast isolated from palm wine were conducted [15]. The study aimed to develop wine from young coconut water. This investigated the acceptability of the quality attributes of young coconut wine compared with commercial wine.

Results of the sensory evaluation showed that young coconut wine has a pale light

color, powerful aroma and sweet taste. Results also showed that panelists choose the color and taste of the young coconut wine as its desirable attributes. Statistical analysis ($p<0.05$) showed significant difference in the color and aroma between young coconut wine and commercial wine but no significant difference in terms of taste [16].Wine stimulates the release of digestive enzymes, which digest not only the alcohol but the many other nutrients found in wine.

The proper dosage, or a moderate intake of wine, in addition to affecting cholesterol levels favourably, decreases the tendency of blood to clot and assists in dissolving clots, all important factors in protecting against heart disease.

Research also indicates that moderate wine drinking may reduce the tendency of arteries to constrict during stress, lower blood pressure, and increase coronary artery diameter and blood flow. More recently, wine has been identified as a dependable source of quercetin, a potent anti-carcinogen, and of many flavonoids and other polyphenolic antioxidants [2]. Coconut is an underutilized fruit crop and still now there is very limited research available regarding to processing of this fruit into value added product. Therefore, we utilized this fruit juice as subtrate for wine fermentation. We focused on the effect of soluble solid content of juice, fermentation temperature, yeast *Sacchromyces cerevisiae* ratio to coconut wine quality.

Material & Method

Material

Coconut juice was collected from Ben Tre province, Vietnam. After harvesting, they must be conveyed to laboratory within 8 hours for experiments. Total soluble solid of coconut was adjusted to diffrent concentration (14.0^{o}Brix, 14.5^{o}Brix, 15.0 ^{o}Brix, 15.5 ^{o}Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68^{o}C in 1.5 minutes. *Saccharomyces cerevisiae* was added into coconut juice in different ratio (1.0%, 1.5%, 2.0%, 2.5%) and fermented in different temperature (28.5^{o}C, 29^{o}C, 29.5^{o}C, 30.0^{o}C) for 9 days.

Figure 1: Coconut (*Cocos Nucifera*)

Research Method

Effect of Soluble Solid Content in Coconut Juice to Coconut Wine Quality

Coconut juice was adjusted to different soluble solid content (14.0^{o}Brix, 14.5^{o}Brix, 15.0 ^{o}Brix, 15.5 ^{o}Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68^{o}C in 1.5 minutes. *Saccharomyces cerevisiae* was added into coconut juice in 1.0%, and fermented in 28.5^{o}C for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (^{o}Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine.

Effect of Yeast Ratio to Coconut Wine Quality

Coconut juice was adjusted to soluble solid content (15.0 ^{o}Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68^{o}C in 1.5 minutes. *Saccharomyces cerevisiae* was added into coconut juice in different ratio (1.0%, 1.5%, 2.0%. 2.5%), and fermented in 28.5^{o}C for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (^{o}Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine.

Effect of Fermentation Temperature to Coconut Wine Quality

Coconut juice was adjusted to soluble solid content (15.0 ^{o}Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68^{o}C in 1.5 minutes. *Saccharomyces cerevisiae* was

added into coconut juice in ratio (2.0%), and fermented in different temperature (28.5°C, 29°C, 29.5°C, 30.0°C) for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (°Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine.

Analysis of Coconut Wine

Soluble dry matter (°Brix) was measured by refractometer. Ethanol (% v/v) was determined by megapore polar column with direct injection gas chromatography [17]. Acidity (g/l) was measured by potentiometry method [18]. Sensory evaluation was carried out by a panel of 10 semi-trained judges.

Statistical Analysis

Data were statistically summarized by Statgraphics Centurion XVI.

Result & Discussion

Effect of Soluble Solid Content in Coconut Juice to Coconut Wine Quality

Sugar is the main substrate for fermentation of fruits juice into alcohol. Although other food nutrients such as protein and fats can be broken down by some microorganism in some cases where sugar is limited, as long as sugar is present, yeast cells will continue the process of fermentation until other factors that affect the growth of yeast become unfavorable. Sugars are the most common substrate of fermentation to produce ethanol, lactic acid, and carbon dioxide [19]. Although sugar is an important substrate of fermentation, higher sugar concentration inhibits the growth of microorganisms [20]. However, yeasts are fairly tolerant of high concentrations of sugar and grow well in solutions containing 40% sugar. At concentrations higher than this, only a certain group of yeasts - the Osmophilic type-can survive. There are only a few yeasts that can tolerate sugar concentrations of 65-70% and these grow very slowly in these conditions.

A winemaker who wishes to make a wine with high levels of residual sugar (like a dessert wine) may stop fermentation early either by dropping the temperature of the must to stun the yeast or by adding a high level of alcohol (like brandy) to the must to kill off the yeast and create a fortified wine [19].Coconut juice was adjusted to different soluble solid content (14.0°Brix, 14.5°Brix, 15.0 °Brix, 15.5 °Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68°C in 1.5 minutes.

Saccharomyces cerevisiae was added into coconut juice in 1.0%, and fermented in 28.5°C for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (°Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine. Results were depicted in table 1, 2, 3, 4. It's obviously seen that 15.0°Brix of coconut juice was adequate for coconut wine fermentation

Table 1: Effect of soluble solid content to soluble dry matter (°Brix) in wine

Fermentation time (days)	Residual soluble dry matter in wine (°Brix)			
	14.0°Brix	14.5°Brix	15.0°Brix	15.5°Brix
3	12.18±0.02^{b}	12.23±0.02^{ab}	12.59±0.04^{ab}	13.14±0.01^{a}
6	10.27±0.01^{b}	10.34±0.01^{ab}	10.45±0.01^{ab}	11.02±0.02^{a}
9	8.15±0.03^{b}	8.26±0.03^{ab}	8.58±0.02^{ab}	8.73±0.00^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 2: Effect of soluble solid content to ethanol formation (%v/v) in wine

Fermentation time (days)	Ethanol in wine (%v/v)			
	14.0°Brix	14.5°Brix	15.0°Brix	15.5°Brix
3	3.29±0.04^{b}	3.37±0.02^{ab}	3.60±0.02^{a}	3.65±0.00^{a}
6	4.17±0.01^{c}	5.40±0.01^{b}	7.29±0.01^{a}	7.34±0.01^{a}
9	5.62±0.03^{c}	6.79±0.02^{b}	8.35±0.01^{a}	8.40±0.02^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%				

Table 3: Effect of soluble solid content to acidity (g/l) in wine

Fermentation time (days)	Acidity in wine (g/l)			
	14.0°Brix	14.5°Brix	15.0°Brix	15.5°Brix
3	1.12±0.03^{b}	1.14±0.02^{ab}	1.17±0.01^{a}	1.18±0.00^{a}
6	1.25±0.02^{b}	1.32±0.00^{ab}	1.41±0.02^{a}	1.45±0.01^{a}
9	1.38±0.03^{b}	1.44±0.03^{ab}	1.63±0.03^{a}	1.65±0.02^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 4: Effect of soluble solid content to sensory characteristics in wine

Fermentation time (days)	Sensory score of wine (1-5)			
	14.0°Brix	14.5°Brix	15.0°Brix	15.5°Brix
3	2.61±0.02^{b}	2.77±0.03^{ab}	2.84±0.02^{a}	2.90±0.01^{a}
6	3.29±0.00^{b}	3.55±0.00^{ab}	3.99±0.01^{a}	4.03±0.00^{a}
9	4.16±0.01^{b}	4.44±0.02^{ab}	4.79±0.03^{a}	4.82±0.03^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Development of bioflavoured tender coconut water wine using native grape yeast was monitored. The tender coconut water after complete fermentation, filtration and six months of aging at 4°C gave pleasant rose flavour with red colour to the wine and tartness as in the grape wine. Mint leaves also gave flavour but not colour to the wine. The organoleptic and the alcohol test revealed appealing colour, better taste and alcohol content in rose flavoured wine compared to mint flavoured and control. Rose flavoured and control wine had up to 8% alcohol whereas mint flavoured had just 4% alcohol [13].

Effect of Yeast Inculate for Wine Fermentation

Yeast is a unicellular fungus which reproduces asexually by budding or division, especially the genus *Saccharomyces* which is important in food fermentations has the ability to reproduce much faster. In pure fermentation, the ability of inoculated *Saccharomyces cerevisiae* to suppress the wild microflora is one of the most important features determining the starter ability to dominate the process. During the winemaking process, various microorganisms coexist and interact influencing the dominance, the persistence of fermenting yeasts and the analytical profiles of wine [21]. Coconut juice was adjusted to soluble solid content (15.0 °Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68°C in 1.5 minutes.

Saccharomyces cerevisiae was added into coconut juice in different ratio (1.0%, 1.5%, 2.0%. 2.5%), and fermented in 28.5°C for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (°Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine. Results were depicted in table 5, 6, 7, 8. We found that the appropriate yeast inculate should be 2.0% to get the highest wine quality.

Table 5: Effect of yeast ratio to soluble dry matter (°Brix) in wine

Fermentation time (days)	Residual soluble dry matter in wine (°Brix)			
	Yeast ratio 1.0%	Yeast ratio 1.5%	Yeast ratio 2.0%	Yeast ratio 2.5%
3	12.59±0.04^{a}	10.53±0.03^{b}	9.64±0.03^{bc}	9.59±0.04^{c}
6	10.45±0.01^{a}	7.84±0.02^{b}	6.35±0.02^{bc}	6.27±0.03^{c}
9	8.58±0.02^{ab}	5.13±0.00^{b}	3.75±0.04^{bc}	3.56±0.02^{c}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 6: Effect of yeast ratio to ethanol formation (%v/v) in wine

Fermentation time (days)	Ethanol in wine (%v/v)			
	Yeast ratio 1.0%	Yeast ratio 1.5%	Yeast ratio 2.0%	Yeast ratio 2.5%
3	3.01±0.02^{b}	4.28±0.04^{ab}	5.63±0.01^{a}	5.70±0.02^{a}
6	4.28±0.02^{b}	5.71±0.00^{ab}	7.12±0.03^{a}	7.17±0.03^{a}
9	5.76±0.02^{b}	6.85±0.03^{ab}	7.34±0.03^{a}	7.41±0.01^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 7: Effect of yeast ratio to acidity (g/l) in wine

Fermentation time (days)	Acidity in wine (g/l)			
	Yeast ratio 1.0%	Yeast ratio 1.5%	Yeast ratio 2.0%	Yeast ratio 2.5%
3	1.17±0.01^{b}	1.22±0.02^{ab}	1.29±0.01^{a}	1.30±0.01^{a}
6	1.41±0.02^{b}	1.63±0.00^{ab}	1.74±0.01^{a}	1.77±0.03^{a}
9	1.63±0.03^{b}	1.79±0.03^{ab}	1.85±0.02^{a}	1.87±0.02^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 8: Effect of yeast ratio to sensory characteristics (score, 1-5) in wine

Fermentation time (days)	Sensory score of wine (1-5)			
	Yeast ratio 1.0%	Yeast ratio 1.5%	Yeast ratio 2.0%	Yeast ratio 2.5%
3	2.84±0.02^{b}	2.89±0.02^{ab}	2.92±0.03^{a}	2.95±0.00^{a}
6	3.99±0.01^{b}	4.03±0.01^{ab}	4.11±0.03^{a}	4.14±0.00^{a}
9	4.79±0.03^{b}	4.84±0.04^{ab}	4.87±0.01^{a}	4.91±0.02^{a}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Effect of different inoculum concentrations indicated that increased the inoculum concentration result in the increased of alcohol content.

The result showed that when the concentration of yeast was increased, yeast cells converted more sugar to alcohol.

However, at the higher inoculum concentration yeast cells grew not well because of the limited nutrient and were not able to convert more sugar in to it [7].

Effect of Fermentation Temperature to Coconut Wine Quality

In winemaking, the temperature and speed of fermentation are an important consideration as well as the levels of oxygen present in the must at the start of the fermentation. Juice temperature must be warm for fermentation. However, yeast cells will die if temperature is too hot. The most notable is that of the internal temperature of the must. The biochemical process of fermentation itself creates a lot of residual heat which can take the must out of the ideal temperature range for the wine [22].

Thus, fermentation is an exothermic process. However, in winemaking, the temperature must not exceed 29.4°C for red wines or 15.3°C for white wines. Otherwise, the growth of yeast cells will stop. Therefore, a lower temperature is desirable because it increases the production of esters, other aromatic compounds, and alcohol itself. This makes the wine easier to clear and less susceptible to bacterial infection [23]. In general, temperature control during alcoholic fermentation is necessary to facilitate yeast growth, extract flavors and colors from the skins, permit accumulation of desirable by-products, and prevent undue rise in temperature that might kill the yeast cells.

The low temperature and slow fermentation favor the retention of volatile compounds [24]. In most cases, fermentation at higher temperatures may have adverse effect on the wine in stunning the yeast to inactivity and even "boiling off" some of the flavors of the wines. Some winemakers may ferment their red wines at cooler temperatures more typical of white wines to bring out more fruit flavors [25]. Coconut juice was adjusted to soluble solid content (15.0 ^{o}Brix) by sucrose. Coconut juice was then steriled by pasteurization at 68^{o}C in 1.5 minutes.

Saccharomyces cerevisiae was added into coconut juice in ratio (2.0%), and fermented in different temperature (28.5^{o}C, 29.0^{o}C, 29.5^{o}C, 30.0^{o}C) for 9 days. Coconut wine was periodically sampled in 3 days of interval for 9 days based on the residual soluble dry matter (^{o}Brix), ethanol (%v/v), acidity (g/l) and sensory characteristics (score) in wine. Results were depicted in table 9, 10, 11, 12. It's obviously seen that fermentation temperature 29.5^{o}C was adequate for coconut wine fermentation.

Table 9: Effect of fermentation temperature to soluble dry matter (^{o}Brix) in wine

Fermentation time (days)	Residual soluble dry matter in wine (^{o}Brix)			
	28.5^{o}C	29.0^{o}C	29.5^{o}C	30^{o}C
3	9.64±0.03^{a}	9.41±0.01^{ab}	9.25±0.01^{b}	9.20±0.02^{b}
6	6.35±0.02^{a}	6.21±0.02^{ab}	6.03±0.02^{b}	6.00±0.03^{b}
9	3.75±0.04^{a}	3.44±0.03^{ab}	3.23±0.02^{b}	3.20±0.01^{b}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Table 10: Effect of fermentation temperature to ethanol formation (%v/v) in wine

Fermentation time (days)	Ethanol in wine (%v/v)			
	28.5^{o}C	29.0^{o}C	29.5^{o}C	30^{o}C
3	5.63±0.01^{b}	5.74±0.04^{ab}	5.92±0.01^{a}	5.96±0.02^{a}
6	7.12±0.03^{b}	8.12±0.00^{ab}	8.84±0.03^{a}	8.90±0.03^{a}
9	7.34±0.03^{b}	8.26±0.03^{ab}	9.13±0.03^{a}	9.20±0.01^{a}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)

Table 11: Effect of fermentation temperature to acidity (g/l) in wine

Fermentation time (days)	Acidity in wine (g/l)			
	28.5°C	29.0°C	29.5°C	30°C
3	1.29±0.01^{b}	1.30±0.02^{ab}	1.32±0.01^{ab}	1.33±0.01^{a}
6	1.74±0.01^{b}	1.78±0.04^{ab}	1.80±0.04^{a}	1.81±0.01^{a}
9	1.85±0.02^{b}	1.87±0.03^{ab}	1.90±0.03^{a}	1.91±0.02^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Table 12: Effect of fermentation temperature to sensory characteristics in wine

Fermentation time (days)	Sensory score of wine (1-5)			
	28.5°C	29.0°C	29.5°C	30°C
3	2.92±0.03^{b}	2.98±0.02^{ab}	3.05±0.03^{a}	3.07±0.00^{a}
6	4.11±0.03^{b}	4.15±0.01^{ab}	4.21±0.03^{a}	4.25±0.00^{a}
9	4.87±0.01^{b}	4.90±0.04^{ab}	4.94±0.01^{a}	4.95±0.02^{a}
Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%)				

Conclusion

Currently, in the context of climate change, increased saltwater intrusion, droughts and floods are extraordinary threat to the coastal plains, especially in the Mekong Delta. Coconut crops were evaluated with the ability to withstand risks, become an object of important crops in farming systems contribute to the development of sustainable agriculture in the future, especially for the low coastal plains. We have successfully utilized coconut juice as substrate for wine fermentation by investigating different parameters such as soluble solid content of juice, fermentation temperature, yeast *Sacchromyces cerevisiae* ratio to wine quality. Coconut wine has great health benefits similar to these of coconut juice from which it's derived.

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