



The Effect of Concentration Areca Seed Extract (*Areca Catechu* L.) on Physicochemical and Sensory Properties of Pineapple Juice (*Ananas comosus* L. Merr) As a Functional Beverages

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Abstract- This study aims to determine the effect of concentration areca seed extract on the physicochemical and sensory properties of pineapple juice as a functional beverages, and to determine the appropriate concentration of areca seed extract to produce pineapple juice that has the best physicochemical and sensory properties. This study used a completely randomized design (CRD) consisting of 4 levels of treatment, namely the concentration of areca seed extract 0%, 1%, 2%, and 3% (v/v). Each treatment was repeated 5 times, so there were 20 experimental units. The results showed that the concentration of areca seed extract had a significant effect on increase the total soluble solids, antioxidant activity, total tannin, vitamin C levels, and had no significant effect or decrease on the acidity (pH), and had a characteristic taste of pineapple chelate until the taste of pineapple is slightly chelate, the color is brown to very brown, it has a pineapple aroma to a strong pineapple aroma, with a weak *aftertaste* to a slightly strong after taste. The best treatment in making pineapple juice with areca seed extract was the concentration of 2% areca seed extract which contained 80.02% antioxidant activity, vitamin C 104.68 mg/100 g, total tannin 99.62 mg TAE/g, total dissolved solids value 20.98^obrix, color degree value L*29.48, a*7.06, b*20.80, acidity value (pH) 3.37, has a slightly brown color, aroma of pineapple (methyl ester and ethyl ester compounds), taste pineapple and not chelate, and has no *aftertaste*.

Keywords: Functional beverages, areca seed extract, pineapple juice.

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I. INTRODUCTION

Functional food is food contain active components which can provide health benefits. The bioactive components found in functional foods are dietary fiber, probiotics, prebiotics, synbiotics, antioxidants, omega-3 fatty acids, omega 6, omega 9, and phytochemical compounds [1]. Areca plant is one of the functional food sources, where areca seed seeds contain 15% condensed tannins (phlobatin, catechins) polyphenols and 0.2-0.5% alkaloids (arecoline, aracidine, guvacine and guvacoline) which act as antioxidants [2]. Areca seed extract can be added to fruit juice beverages as one of the ingredients of functional beverages, but tannins contained in areca seed can cause astringent taste and volatile compounds that can cause unpleasant aromas, so that their application in product form must be controlled [3].

Pineapple is one of the most popular fruits. [4], stated that the high water content of pineapples causes pineapples cannot

be stored for a long time because the fruit is easily damaged and rotten due to the presence of microorganisms. Processing of pineapple fruit into fruit juice can be done to extend the shelf life of pineapple and can be formulated with betel seed extract as a functional food. Pineapple fruit extract has active compounds. Contains: Flavonoids, Saponins, Tannis, Bromelain. This is because extract pineapple fruit has active compounds that the highest was flavonoids (3,82 %) which plays an important role in being an antioxidant and antibacterial [5].

According [6] the antioxidant activity of 1000 grams of areca seeds extracted with 2000 mL of water was higher than that of root, stem, fruit peel and leaf extracts. [6] stated that the antioxidant activity of raw areca seed syrup from 100 grams of areca seed in 300 mL of water produced 53.52% using a temperature of 80°C-100°C for 10-15 minutes. [7], stated that in the manufacture of functional beverages, areca seeds as antioxidants have astringent taste, so further research needs to be done. Therefore, the purpose of this research is toto

determine the effect of the concentration of areca seed extract on the physicochemical and sensory properties of pineapple juice as a functional beverages, and to determine the appropriate concentration of areca seed extract to produce pineapple juice that has the best physicochemical and sensory properties.

II. RESEARCH METHODS

a. Materials and Equipments

The materials used are raw areca seed, pineapple, citric acid, palm sugar, and water. The materials used for analysis were buffer solution, DPPH (*1,1-diphenyl-2-picrylhydrazil*), 70% methanol, FolinCiocalteu, Na₂CO₃, tannic acid and distilled water. The tools used in this research are rotary vacuum evaporator, digital scales. The equipments used for analysis are test tubes, beakers glass, measuring glass, dropper pipettes, micro pipettes, cuvettes, vortexes, analytical scales, *UV-Vis spectrophotometers*, PH-meters, refractometers, color readers and questionnaire sheets.

b. Research Design and Statistical Analysis

This research was conducted using a completely randomized design (CRD) consisting of 4 treatments, the concentration of areca seed extract (v/v)

T1 = 0%

T2 = 1%

T3 = 2%

T4 = 3%

Each treatment was repeated 5 times. The data obtained were analyzed by analysis of variance at the 5% significance level and 1%. If the results of the analysis of variance are different, further testing is carried out with Duncan's multiple range tests at the 5% level.

c. Research Procedure

Processing of Concentrated Areca seed Extract [7]

The areca fruit used is the seed. Then the areca seed is washed and sliced thinly (± 1 mm) as much as 2000 g. Then the areca seed is added to the water as much as 2000 mL with a ratio of one to one. After that, it was heated at 90°C for 15 minutes. Then filtered to obtain areca seed extract, then the filtrate obtained was evaporated using a rotary vacuum evaporator.

Processing of Pineapple Juice [8]

The pineapple used is a pineapple with a characteristic overall yellow skin color, the skin texture is slightly soft and shiny, and has a sweet and fresh aroma. A total of 5000 g of pineapple is weighed, then in a blender until smooth. After that the pineapple pulp is squeezed and filtered, to take the filtrate to produce pineapple juice.

Processing of Functional Beverage [9]

Pineapple juice measured as much as 214,25 mL was put into a sterile bottle then added areca seed extract according to treatment 0 mL, 5 mL, 10 mL, 15 mL. Then each treatment added 14% palm sugar, 0.3% citric acid and added water so that the amount of all ingredients is 500 mL then stirred until homogeneous after that it is filtered. The resulting product is put into a sterile bottle. Then closed and pasteurized at 75°C for 15 minutes. Furthermore, it is removed, cooled to room

temperature, and ready for analysis of properties physicochemical and sensory.

d. Research Parameters

Total Dissolved Solids [10]

Total dissolved solids determined using a refractometer. Samples were taken and one drop was dropped in a refractometer prism that had been calibrated with sterile distilled water, then observed on the refractometer scale reader screen.

Color Analysis, Hunter Method [11]

Color testing is using the Color Reader. The sample to be tested is first put into a transparent bottle, turn on the Color Reader by pressing the power switch button, then attach the optical head to the transparent bottle (sample) and press the measuring button. Color description based on L*, a*, and b* values can be seen in Table 1.

Table 1. Color Description Based on Values L*, a*, and b*

Score	Color Description
Value L	From 0 (black) to 100 (white)
Value (positive)	+a From 0-100 for red color
Value (negative)	-a From 0-(-80) for green color
Value (positive)	+b From 0-70 for yellow color
Value (negative)	-b From 0-(-70) for blue color

Source: [11]

The L*, a*, and b* values obtained from color capture by Color Reader are then searched for the color name (hue) using color-hex on www.colorhexa.com.

Degree of Acidity (pH) [12]

The pH meter electrode was rinsed with distilled water and then dried with a tissue. The electrode is dipped into 10 mL of the sample solution, left for a while until a reading is obtained, then the pH of the sample is recorded.

Antioxidant Activity Test by DPPH Method (2,2-dhenyl-1-picrylhydrazil) [13]

A total of 0,2 mL of functionalbeverages solution was pipetted with a micropipette into the vial, then 3,8 mL of 0,05 μ M DPPH solution was added. The solution mixture was homogenized and left for 30 minutes in the dark. Absorption was measured using a UV-Vis spectrophotometer at a wavelength of 517 nm. The absorbance data obtained or the amount of antioxidant activity for used to determine the % inhibition.

Total antioxidants (%) =

$$\frac{\text{absorbansi DPPH} - \text{absorbansi sampel}}{\text{absorbansi DPPH}} \times 100\%$$

Total Tannin Content [14]

a. Standard Solution Preparation

Tannic acid solutions were made with concentrations of 20, 40, 60, 80, and 100 ppm. From each concentration, 1 mL was added with 0,1 mL of FolinCiocalteu reagent and vortexed, then 2 mL of 20% sodium carbonate was added and vortexed,

the absorbance was read at a length of 760 nm after incubation for 30 minutes at room temperature.

b. Determination of Total Tannin Test

A total of 1 mL of sample solution was added with 0.1 mL of FolinCicalteu reagent and vortexed, then 2 mL of 20% sodium carbonate was added and vortexed, the absorbance was read at a length of 760 nm after incubation for 30 minutes at room temperature.

Vitamin C level[10]

Vitamin C levels were determined by iodine titration. A sample of 5 mL was put into a 50 mL Erlenmeyer and 20 mL of distilled water was added and then 2 mL of 1% starch was added. Next, the titration was carried out with 0.01 N iodine solution until a stable blue-purple color was seen. The determination of ascorbic acid is determined by the formula:

Ascorbic acid (mg/100g ingredient) =

$$\frac{\text{mL iod} \times \text{df} \times 0,88 \times 100}{\text{gram sample}}$$

Note: df = diluent factor

Organoleptic Test Method Quantitative Descriptive Analysis [15]

Testing of organoleptic properties using the method Setyaningsihet al (2010) with a descriptive test, namely the method of Qualitative Descriptive Analysis or Quantitative Descriptive Analysis (QDA). This descriptive test includes 6 semi-trained panelists consisting of students of the Agricultural Product Technology Study Program, Jambi University. In this test, panelists were asked to provide an assessment of the sensory attributes (color, aroma, taste and after taste) of the sample using an unstructured line scale which has a length of 15 cm with a scale value of 0 being the lowest and all samples being tested 3 times repeat. The data obtained is then averaged and plotted into a spider web graph using the Microsoft Excel application.

III. RESULTS AND DISCUSSION

a. Total Dissolved Solid

The total dissolved solid shows the content of the dissolved substances in the solution. The higher the values of total dissolved solids, the better the product, because there is less waste or remaining ingredients that cannot be consumed in

beverages[16]. The results of the total soluble solids of pineapple juice with the concentration of areca seed extract can be seen in **Figure 1**.

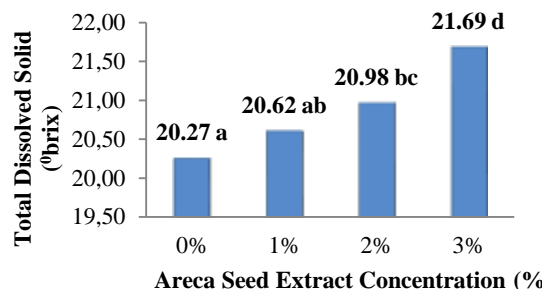


Figure 1. The effect of areca seed extract concentration on the total soluble solids of pineapple juice beverages.

Based on the analysis of variance, it is known that the concentration of areca seed has a very significant effect on the total soluble solids in pineapple juice. The highest total dissolved solids value was found in the treatment with a concentration of 3% areca seed extract, which was 21,69⁰brix, while the lowest total dissolved solids in the treatment with 0% areca seed extract concentration was 20,27⁰brix. The total value of dissolved solids meets the SNI standard for pineapple juice, which is at least 10⁰brix [17].

The components measured as total dissolved solids are sucrose and reducing sugar [18]. Areca seed contain large amounts of polysaccharides[19]. Hydrolysis of polysaccharides can also occur at acidic pH and form monosaccharides, the acidic atmosphere in pineapple juice and the addition of 0,3% citric acid will facilitate the hydrolysis process so that the total value of dissolved solids will increase [3].

b. Color Analysis

Color is the most important factor to determine the acceptance of a product and is the first sensory trait seen by consumers [20]. The results of the measurement of the average values of L*, a* and b* color of pineapple juice beverages with various concentrations of areca seed extract can be seen in **Table 2**

Table 2. Average values of L*, a* and b* color of pineapple juice beverages with areca seed extract

Areca seed Extract Concentration (%)	L*	a*	b*	Color	Color Description of Objectively)*
0	28.12 a	6.50 a	20.23		Very dark desaturated orange
1	29.40 b	6.94 b	20.72		Very dark desaturated orange
2	29.48 b	7.06 bc	20,80		Very dark desaturated orange
3	29.44 b	7.46 d	21.26		Very dark desaturated orange

Note : Values which are followed by the same lowercase alphabet in the same column is not significantly different at level of 5% according to DN MRT

Table 2 shows that the treatment of various concentrations of areca seed extract did not objectively affect the color of pineapple juice with areca seed extract, namely Very dark desaturated orange. The L* value in pineapple juice beverages with areca seed extract stated that it had a significant effect, the brightness value increased from 28,12 to 29,44. The a* (positive) value indicated an increasing reddish color, which was 6,50 to 7,46 and b (positive) shows an increasing yellowish color from 20,23 to 21,26.

The difference in subjective color values for pineapple juice beverages with areca seed extract is because areca seed seeds contain tannins which have physical properties of yellowish white to light brown [21]. In addition, the addition of palm sugar to pineapple juice beverages with areca seed extract gives a brown color. Browning of palm sugar occurs due to the conversion of some of the reducing sugars into brown melanoidin compounds [22].

c. Degree of Acidity (pH)

The acidity value (pH) shows the level or degree of acidity of a product, so the lower the pH value, the higher the acidity of the product [8]. The pH value of pineapple juice beverages with areca seed extract can be seen in **Figure 2**.

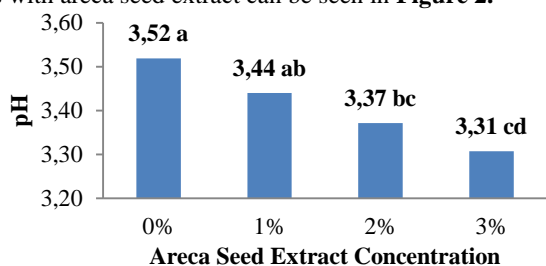


Figure 2. The effect of areca seed extract concentration on the pH value of pineapple juice beverages.

Based on the results of the analysis of variance, it was found that the concentration of areca seed extract had no significant effect on the pH of the pineapple juice beverages with areca seed extract. The highest pH value in pineapple juice beverages with areca seed extract was found in the treatment with 0% areca seed extract concentration which is 3,52 while the lowest pH value is found in the treatment of 3% areca seed extract concentration, which is 3,31. Based on **Figure 2**, it is known that the pH value of the pineapple juice beverages with areca seed extract decreased as the concentration of areca seed extract increased.

According to research by [23] stated the pH value of pineapple juice was 3,71. The decreased pH value in pineapple juice beverages with areca seed extract was caused by the presence of starch or sugar in the areca seed seeds. Areca seeds also have a fairly large total polysaccharide, ranging from 17,5 to 25,7% [19]. The extraction process is thought to have changed the polysaccharide structure in areca seeds but did not remove the starch content. Starch molecules tend to attract negatively charged particles. This property of starch is also shared by sugar because these properties are mainly due to its hydroxyl groups. Withdrawal of OH- ions around sugar molecules will cause the concentration of H+ ions into the solution to increase so that the pH value will decrease [3]. According to [24], ellagitannins in areca seeds will break down into gallic acid when dissolved in water, so that pineapple juice

beverages with betel nut extract are more acidic as the concentration of areca seeds increases.

d. Antioxidant Activity

Antioxidant testing using the DPPH method, where DPPH (1,1-diphenyl-2-picrylhydrazil) acted as a free radical which was then quenched by antioxidants present in the sample with its maximum wavelength on a UV-Vis spectrophotometer. Antioxidants in the material will capture free radicals (DPPH) through the mechanism of hydrogen atom donation. The more DPPH captured, the better the antioxidant in inhibiting oxidation [25]. The antioxidant activity value of pineapple juice beverages with areca seed extract can be seen in **Figure 3**.

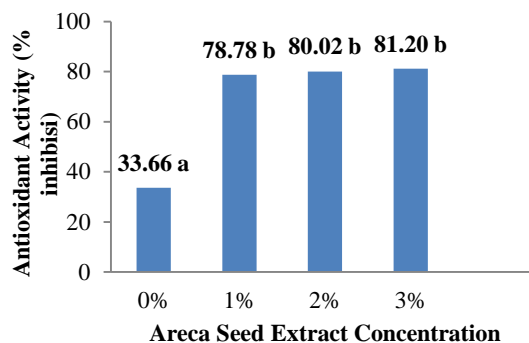


Figure 3. The effect of areca seed extract concentration on the antioxidant activity value of pineapple juice beverages.

Based on **Figure 3**, the concentration of areca seed extract has a significant effect on the antioxidant activity of pineapple juice beverages with areca seed extract. The concentration of 0% areca seed extract was significantly different from the concentration of 1%, 2% and 3% areca seed extract, but the concentration of areca seed extract between 1%, 2% and 3% was not significantly different. The results of the analysis showed highest antioxidant activity was at a concentration of 3% areca seed extract, which was 81.20% and the lowest was at a concentration of 0% areca seed extract, which was 33.66%. According to [3], the antioxidant activity of sweet star fruit juice with the addition of areca seed extract ranged from 12,31% - 17,99%, while the antioxidant activity of young areca seed syrup with the addition of cinnamon powder was 53,52%.

Antioxidants in areca seed are included in the tannin and phenol group which are stable at heating and low pH [26]. The low pH value affects the antioxidant value namely the regeneration of primary antioxidant compounds. Low pH, meaning in the product has a lot of free H+, this H+ can regenerate antioxidant compounds by binding to phenoxy radicals to form antioxidant compounds again [27]. [28] stated that the increase in antioxidant activity at a low pH occurred because at a low pH it could inhibit the enzymatic oxidation of phenolic compounds.

According to [29] the value of different antioxidant activity of areca seed is influenced by the total polyphenols which have the potential to reduce highly reactive hydrogen atoms, causing free radical chain severance, namely by reducing Fe³⁺ to Fe²⁺ by releasing an electron, causing changes in color of the test solution. The amount of antioxidant activity is influenced by chemical compositions contained in areca seed, namely polyphenols including tannins, flavonoids and alkaloids [30].

e. Total Tannin

Tannin are organic compounds belonging to polyphenols, tannins are known to be active compounds of secondary metabolites that have several properties, namely as astringent, anti-diarrhea, anti-bacterial and antioxidant [31]. To determine the content of tannin is measured using a standard tannin curve. The standard tannin used is tannic acid. The choice of tannic acid is because tannic acid is a hydrolyzed tannin group so that it can be used as a comparison in measuring total tannin levels [32]. The average value of total tannins in pineapple juice beverages with areca seed extract can be seen in **Figure 4**.

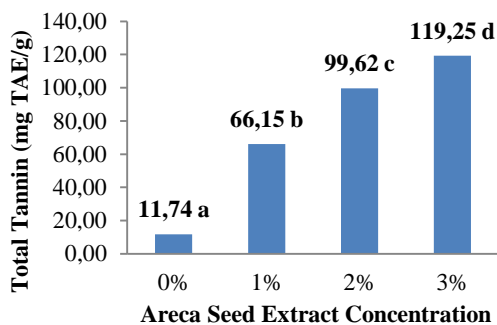


Figure 4. The effect of areca seed extract concentration on total tannins of pineapple juice beverages.

Based on **Figure 4**, the concentration of areca seed extract on the total tannin content of areca seed beverages has a significant effect. The results of the analysis showed that the lowest total tannin content was at 0% areca seed extract concentration, which was 11,74 mg TAE/g and the highest total tannin content was at 3% areca seed extract concentration, which was 119,25 mg TAE/g. Based on research by [33] the total tannin content of aqueous areca seed extract is 95,3 mg TE/g. The tannin content of pineapple juice with areca seed increased with the increase in the concentration of areca seed extract. This is in accordance with the statement of [34], the higher the polarity of the solution, the more phenolic compounds will be dissolved, this is because phenolic compounds have good solubility in water.

Tannins are beneficial for health, acting as antioxidants work by binding to free radicals in the body so that there is a balance between oxidants and antioxidants which can repair damaged cells due to oxidative stress and produce stable radicals [35]. However, consuming tannins should not be excessive because it can cause the process of absorption of seedrients in the body to be hampered, such as inhibiting the absorption of minerals such as iron. This is due to the nature of tannins as metal ion chelateors [21]. [36] stated that the consumption of tannins should not exceed 750 mg/day.

f. Vitamin C level

Vitamin C is a vitamin that have chemical structure of $C_6H_8O_6$ [37]. Vitamin C is easily degraded by enzymes and dissolved oxygen so that it is included in labile compounds. The presence of heat, light, alkali, enzymes, oxidizing agents and catalysts in the form of copper and iron can accelerate the oxidation process of vitamin C which causes damage to vitamin C [26]. The levels of vitamin C content of pineapple juice beverages with areca seed extract can be seen in **Figure 5**.

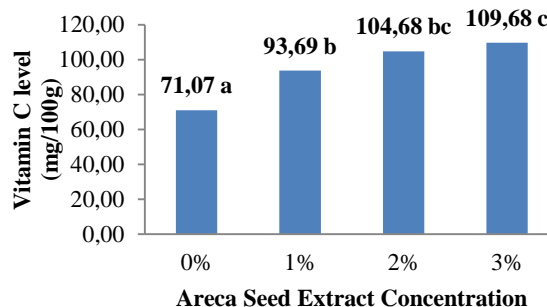


Figure 5. The effect of areca seed extract concentration on vitamin C level in pineapple juice beverages.

Based on the results of analysis of variance showed that the concentration of areca seed extract had a significant effect on vitamin C levels of pineapple juice beverages with areca seed extract. It can be seen in **Figure 5**, based on the figure, the results of the analysis of the vitamin C content in pineapple juice beverages with areca seed extract increased with the increase in the concentration of areca seed extract. The lowest level of vitamin C was shown at the concentration of 0% areca seed extract, which was 71,07 mg/100 g, while the highest vitamin C level was shown at the concentration of areca seed extract 109.68 mg/100 g. The results of [38], stated that pineapple juice has a lower vitamin C content of 65,12 mg/100 g. The vitamin C content of pineapple juice is lower than that of guava juice. Guava juice contains 114 mg/100 g of vitamin C [39]. The heating process during the processing of pineapple juice is thought to cause damage to some of the vitamin C. The use of clear translucent bottles is thought to also cause the acceleration of the oxidation of vitamin C so that its levels decrease [37].

According to [40], vitamin C contained in areca seed is ascorbic acid which is an excellent free radical scavenger. In addition, acidic conditions in beverages can increase the stability of vitamin C so as to protect vitamin C from metal oxidation catalysts (27). Citric acid has a synergistic relationship with pH where citric acid can condition the pH of the solution to be low. The synergism that occurs is because vitamin C is more resistant to acidic conditions and the yellowish color complex formed due to the reaction of citric acid and areca seed extract will make the pH decrease so that vitamin C levels increase [3].

g. Organoleptic Test Qualitative Descriptive Analysis (QDA) Method

According to [15], the data obtained from the QDA test is presented in the form of a spider web graph, with a value of zero at the center point of each attribute. The color characteristics of pineapple juice beverages with areca seed extract based on descriptive test results obtained from brown to more brown. Aroma characteristics obtained from slightly pineapple aroma to strong pineapple aroma. The taste characteristics obtained the taste of pineapple was not chelate to the taste of pineapple and slightly chelate. Aftertaste characteristics on descriptive test results obtained weak to moderately strong aftertaste. The results of the panelists' assessment of color, aroma, taste and aftertaste can be seen in **Figure 6**.

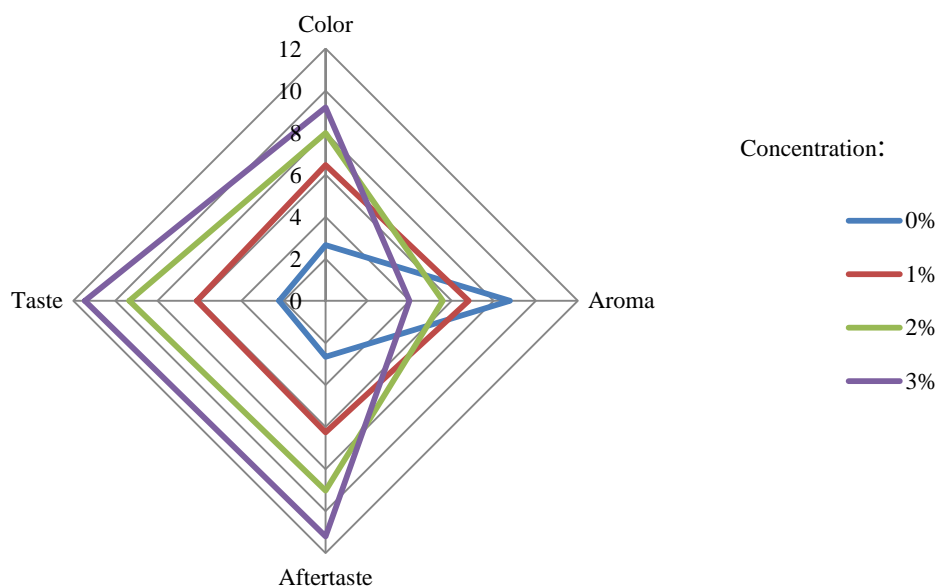


Figure 6. Graph of QDA test results of color, aroma, taste and after taste of pineapple beverages with areca seed extract.

Color

According to Setyaningsih (2010), the data obtained from the QDA test is presented in the form of a spider web graph, with a value of zero at the center point of each attribute. One of the main factors that determine consumer acceptance of a product is color. The results of panelists' assessment of color can be seen in **Figure 6**.

The color characteristics of pineapple juice beverages with areca seed extract based on descriptive test results obtained from brown to very brown due to the influence of the concentration of areca seed extract and the addition of palm sugar. Based on the average color value of the line scale measurement results, the lowest value was found in the treatment of 0% areca seed extract concentration, namely 2,65 and the highest value was found in the 3% treatment, namely 9,19. Based on **Figure 6**, in the treatment of 0% areca seed extract concentration, spider web describes the closest point to the center point and this shows that the 0% concentration has a dark color. While in the treatment of 3% areca seed extract concentration, spider web describes the farthest point from the center and this shows that the 3% concentration has a very dark color.

The color of the pineapple juice beverages with areca seed extract is brown this is caused by the addition of palm sugar which functions as a sweetener. Browning of palm sugar occurs due to the conversion of some of the reducing sugars into brown melanodin compounds [22]. According to [21], the difference in subjective assessment of the color of the areca seed beverages is thought to be caused by the areca seed seeds themselves which contain tannins which will produce a yellowish white to light brown color and will darken when exposed to direct light and in the open air. The higher the concentration of areca seed extract, the color becomes brown.

Aroma

Testing of aroma in food industry is important role because it can quickly provide an assessment of the product regarding whether the product is accepted or not. Aroma

perception is an interpretation of the stimulus generated by the aroma component molecules that interact with the olfactory nerve [26]. The results of the panelists' assessment of the aroma can be seen in **Figure 6**.

Aroma characteristics of pineapple juice beverages with areca seed extract based on descriptive test results obtained from slightly pineapple aroma to strong pineapple aroma. Based on the average aroma value of the line scale measurement, the lowest value was found in the 3% areca seed extract concentration treatment, which was 3,99 and the highest value was found in the 0% treatment, namely 8,77. Based on **Figure 6**, in the treatment of 3% areca seed extract concentration, spider web describes the closest point to the center point and this shows that the 3% concentration has a weak pineapple aroma. While in the treatment of 0% areca seed extract concentration, spider web describes the farthest point from the center point and this shows that the 0% concentration has a strong pineapple aroma.

The more concentration of areca seed extract added, the lower the pineapple aroma. The volatile compounds found in pineapple are methyl ester and ethyl ester group compounds. The compounds carrying the aroma of pineapple are methyl-3-hydroxybutyrate, methyl-3-hydroxyhexanoate, dimethyl malonate and acetochiacetone [37]. The decrease in the aroma of pineapple juice with the addition of areca seed extract, this is due to the ester compounds in areca seed extract having a distinctive aroma which can reduce the aroma of pineapple in pineapple juice beverages with areca seed extract. According to [20], the components that give aroma to food are organic acids in the form of esters and volatiles.

Taste

Taste has an important role in determining the acceptance of a product. Flavor compounds in the product can provide stimulation to the sense of reception at the time of tasting. Taste is one of the important sensory properties in the acceptance of food products [15]. [26], states that taste perception is strongly influenced by the sensitivity of the papillae of the tongue, besides that it is also influenced by several other factors such as chemical compounds, temperature, concentration, and the

interaction of other flavor components. The results of the panelists' assessment of taste can be seen in **Figure 6**.

The taste characteristics of the pineapple juice beverages with areca seed extract based on the results of the descriptive test, it was obtained that the taste of pineapple was moderately acid, enough sweet and not chelate to slightly chelate. Based on the average value of the taste results from the line scale measurement, the lowest value is found in the treatment of 0% areca seed extract concentration, which is 2.20 and the highest value is found in the 3% treatment, which is 11.45. Based on **Figure 6**, in the treatment with a concentration of 3% areca seed extract, spider web describes the closest point to the center point and this shows that the concentration of 0% has a strong pineapple taste and is not chelate and this shows that the concentration of 3% has a weak pineapple taste and is slightly chelate.

The taste is slightly chelate in the treatment of 3% areca seed extract concentration in pineapple juice beverages with areca seed extract because there is a tannin content in areca seed extract. According to [41], the bitter taste in food is usually caused by tannins. Tannins are one of the members of polyphenolic compounds, namely compounds with a phenol group in their chemical structure found in plants, so they are often referred to as plant polyphenols.

Aftertaste

Aftertaste is the impression that is felt or arises after enjoying a food or drink. Aftertaste is one of the important attributes in sensory testing [42]. The results of the panelists' assessment of the aftertaste can be seen in **Figure 6**.

Aftertaste characteristics of pineapple juice beverages with areca seed extract based on descriptive test results obtained weak to enough strong aftertaste. Based on average aftertaste value of the line scale measurement results obtained that the lowest value was found in the 0% areca seed extract concentration treatment, which was 2.65 and the highest value was found in the 3% treatment, which was 11.21. Based on **Figure 6**, in the treatment of areca seed extract concentration of 3% spider web describes center point and this shows that the 0% concentration reflects a weak aftertaste. While in the treatment of areca seed extract concentration of 3% spider web describes the farthest point from the center point and this shows that the 3% concentration shows a enough strong aftertaste.

IV. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusion

Based on the results of this research, it can be concluded that:

1. The concentration of areca seed extract has a significant effect on total soluble solids, color degrees L* and a*, antioxidant activity, total tannins, vitamin C levels, and had no significant effect on the degree of acidity (pH), as well effect on organoleptic tests of taste, color, aroma and aftertaste.
2. The best treatment in formulation pineapple juice with areca seed extract was the concentration of 2% areca seed extract containing 80,02% antioxidant activity, vitamin C 104.68 mg/100 g, total tannin 99,62 mg TAE/g, total value dissolved solids 20,98⁰brix, color degree value L*29,48, a*7,06, b*20,80, acidity value (pH) 3,37, has a slightly brown color, has a pineapple aroma (methyl ester and ethyl ester compounds), pineapple taste and no chelate, and has no aftertaste.

b. Recommendations

The best pineapple juice beverages with areca seed extract, it is recommended to use a concentration of 2% areca seed extract.

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