

# Characteristics of Functional Drinks Based on Variations in the Composition of Binahong Leaf Extract (*Anredera cordifolia*) and Pineapple Juice (*Ananas comosus* (L.) Merr.).

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Functional drinks are a type of drink that is beneficial for the health of the human body, because generally they contain nutrients not only needed for metabolic purposes, but can act as a preventive and cure for certain diseases. So functional drinks besides being fresh consumption drinks are also useful for supporting health. In this research, a functional drink was made using the raw material of Binahong leaves (*Anredera cordifolia* (Ten) Steenis) mixed with pineapple juice (*Ananas comosus* (L.) Merr.). The purpose of this study was to determine the method of extracting nutrients from binahong leaves and determining the composition of the best formula from a mixture of binahong extract and pineapple juice through variable response to vitamin C content, antioxidant activity, and sensory/organoleptic tests. The results of this study can be used as a reference if industrial scale production will be carried out. The methodology in this research is carried out in two stages, namely the first stage research and the second/main stage research. The first phase of research intends to determine / select the binahong leaf extract method through 3 methods, namely maceration, dissolving by heating, and pulping followed by filtration, the selection is based on the highest vitamin C content and the most active antioxidant activity.. The second / main stage of the research was carried out by formulating the composition of binahong leaf extract and pineapple juice with a variation of 9 formulas also mixed with sugar (sucrose) and Carboxy Methyl Cellulose (CMC) stabilizer, then functional drinks were analyzed for variance analysis to determine the significance of the response to vitamin C content, antioxidant activity, and sensory/organoleptic tests, as well as determining the relatively best formulation. The results of this

study showed that the response to the variable content of vitamin C and antioxidant activity showed significant differences, while the results of the sensory/organoleptic test showed significantly different responses to taste and aroma, but not significantly different in response to color. Based on the consideration of the results of experiments and analyzes or tests on the response of these variables, it can be concluded that the composition of binahong leaf extract and 4:1 pineapple juice is the best to be used as a reference in industrial scale production.

**Key Words:** *Functional Drinks, Binahong, Pineapple, Vitamin C, and Antioxidants.*

## INTRODUCTION

### Functional Drinks

Soft drinks are food products that are often consumed by people from all walks of life, including children, adolescents and adults. Increasing consumption of soft drinks needs to be followed by efforts to use these drinks into functional drinks. As functional food, functional drinks are drinks that contain one or more active ingredients that have physiological and biochemical benefits, as well as cellular, and their healthy functional effects have been tested. Functional drinks can be consumed every day in a certain amount and give optimal healthy effects. Based on the provisions of the BPOM (2005), functional food is processed food containing one or more functional components based on scientific studies that have certain physiological functions, proven to be harmless and beneficial to health. According to Goldberg (2004), in Japan functional food has criteria, namely food (not in the form of capsules, tablets, or powders) that comes from natural ingredients.

- Functional food can be consumed as part of the daily diet.
- These functional foods have certain functions when consumed, smoothen, and help the body's metabolism, such as increasing immunity, freshness of the body and others.

### **Binahong (*Anredera cordifolia* (Ten.) Stennis)**

Binahong (*Anredera cordifolia*) is a potential medicinal plant that can treat various types of diseases. This plant comes from China with its original name is Dheng Shan Chi. In Indonesia this plant is not widely known. This plant actually originated from China and spread to Southeast Asia. In Indonesia, this plant is often used as a decoration for a circular gate above the garden path. However, this plant has not been widely known by the people of Indonesia (Towaha, 2011). The shape and characteristics of the binahong plant are creeper, long-lived, can reach a length of more than 6 m. The stems are soft, cylindrical, twisted together, red, solid inside, smooth surface, sometimes forming a kind of tuber that sticks to the axilla with irregular shape and coarse texture. Single leaf, very short stem, arranged alternately, green, heart shape, 5-10 cm long, 3-7 cm wide, thin limp leaves, pointed tip, grooved base, flat edge, smooth, edible.

Compound flowers in the form of bunches, long-stemmed, appearing in the axillary of the leaves, the crown is creamy-whitish, five non-sticky, crown length 0.5-1 cm, smells good Rhizome-shaped roots, soft flesh (Towaha, 2011).

Binahong leaves contain high phenolic compounds, ascorbic acid and antioxidants. These compounds can also be used as antibacterial. The oleanolic acid found in binahong leaves can function as anti-inflammatory. Binahong rhizome contains ancordin protein which can stimulate nitric oxide so that the circulation of the blood flow is better and can also stimulate the body to produce growth hormone and stimulate the replacement of damaged cells with new cells. Saponins can be found in the leaves, stems and roots of the binahong plant. Saponin levels in leaves were 28.14 mg / g, stems were 3.65 mg / g, and in the rhizome was 43.15 mg / g. Saponins can be classified into triterpenoids, steroids, and alkaloids. Saponins can function as antibacterial, antiviral, anti-tumor, cholesterol-lowering and can stimulate the formation of collagen which has an important role in the wound healing process. Saponins also act as steroid hormones which act as analgesic and anti-inflammatory substances. Saponins can be potential as "hydrocarbon ointments" for the formation of type 1 collagen (Qurrotu, 2014). Binahong leaves also contain other active substances, namely flavonoids. The types of flavonoids contained in Binahong extract are flavonols. Flavonoids act as antioxidants and antimicrobials. Flavonoids have hydroxyl groups that can neutralize free radicals. Flavonoids can also inhibit enzymes that help free radical formation and increase the protection of other antioxidants. Lipid peroxidation process can cause free radicals. Flavonoids protect lipids from being damaged by oxidative stress and will prevent free radicals from forming. Flavonoids can inhibit the DNA gyrase enzyme so that bacterial growth will be inhibited. Flavonoids can also act as anti-inflammatory. Flavonoids can interfere with signal transduction and activation of immune cells by inhibiting the kinase and phosphodiesterase enzymes.

### **Pineapple (*Ananas comosus* (L.) Merr.)**

Pineapple (*Ananas comosus* (L.) Merr.) Is a fruit plant in the form of a shrub which has the scientific name *Ananas comosus*. In botanical science, pineapples are formed from two main spirals that are linked together. One of the spirals contains 8 spirals and 13 in the other. This number is called the Fibonacci number. The leaves of the "Smooth Cayenne" variety are generally not spiny except at the tips of the leaves. But the "Spamish / Spanish" and "Queen" varieties are prickly along the edges of the leaves. Pineapple (*Ananas comocus* (L.) Merr.) Is a tropical fruit with yellow flesh which is rich in vitamin C. In addition, it contains potassium, calcium, iodine, sulfur, chlorine, acid, biotin, vitamin B12, vitamin A and Bromelain enzyme (Bartholomew, 2003). Pineapple is beneficial for body health and makes the body's defense system stronger. Every 100 grams of pineapple contains vitamin C (36.2 mg), calcium (13 mg), phosphorus (8 mg), magnesium (12 mg), iron (0.28 mg), sucrose (9.26 mg), and the bromelain enzyme stored in pineapple is very effective in killing serious diseases such as tumors, atherosclerosis (narrowing of blood vessels), beriberi, urinary tract disorders, nausea, flu, hemorrhoids, anemia, and as a medicine for constipation. Pineapple has a good combination of taste, namely sweet, sour, and fresh and has a relatively complete nutritional content.

## **Purpose of this Research**

This research is intended to mix binahong leaf extract with pineapple juice with certain composition variations to produce functional drinks. Meanwhile, the aim of this research is to create functional drinks that taste delicious and have beneficial properties to support the health of the human body.

## **METHODOLOGY**

### **Material and Method**

#### **Materials**

The material used is the leaves of binahong (*Anredera cordifolia*) of the Basella Alba variety taken from the fourth to the seventh shoots with less than 3 months of age. Full ripe pineapples Smooth Cayenne variety with a maturity of six - seven months purchased from pineapple plantations in Subang and sucrose (sugar) brand Gulaku purchased from supermarkets (Alfa Mart) Bandung. The material (reagent) used for the analysis of vitamin C using the Iodometric method and analysis of antioxidant activity by the DPPH (*Diphenyl picrilhydrazin*) spectrophotometric method.

#### **Method**

The research has been carried out consisting of two stages, namely the First Stage Research and the Second Stage Research.

#### **1) First Stage Research**

The implementation of the first stage of research was carried out as follows:

- Analysis / test of vitamin C content was carried out using the Iodometric method and analysis of antioxidant activity using the DPPH spectrophotometric method on raw materials for fresh binahong leaves and pineapple fruit.
- The binahong leaf extract method was selected / determined by the maceration extraction method, extraction by boiling fresh binahong leaves which were compressed to ½ the volume, and the method of pulverizing using a blender that extracted the extract, then each binahong extract was analyzed for vitamin C content and analysis. antioxidant activity. The selection / determination of this extraction method is determined based on the highest vitamin C content and the most active antioxidant activity.

#### **2) Second Stage Research**

This second study was conducted consisting of a treatment design, experimental design, analysis design and response design.

##### **a. Treatment Design**

The second stage of research was conducted to determine the best composition of binahong leaf extract and pineapple juice with variations in the composition of binahong leaf extract with pineapple juice, namely  $f_1$  (1:0),  $f_2$  (0:1),  $f_3$  (1:1),  $f_4$  (2:1),  $f_5$  (3:1),  $f_6$  (4:1),  $f_7$  (1:2),  $f_8$  (1:3), and  $f_9$  (1:4). Each was mixed with 10 % cane sugar (sucrose) and 0.2 % *Carboxy Methyl Cellulose* (CMC), stirring until homogeneous. Furthermore, for

each formula an analysis / test was carried out on the content of vitamin C, antioxidant activity, and sensory tests with attributes of color, aroma and taste.

**b. Experimental Design**

The experimental design used in this study was a randomized block design (RBD) with a 1 x 9 factorial pattern with 4 repetitions for each treatment combination in order to obtain 36 experimental plots, with the following equation:  $Y_{ij} = \mu + T_i + B_j + \epsilon_{ij}$ .

**c. Analysis Design**

Based on the experimental design above, a one-way analysis of variance (ANOVA) can be made to get conclusions about the effect of treatment where the analysis of variance can determine the significance of the response to the variable used as a parameter.

**d. Response Design**

The second stage research response design was carried out to determine the significance of the response to vitamin C content, antioxidant activity, and sensory tests (color, taste, and aroma) due to the treatment of variations in the composition of the binahong extract with pineapple extract.

**e. Experimental Procedure**

- Mixing and stirring the binahong leaf extract, pineapple juice, cane sugar (sucrose) and CMC according to the formula / ratio while continuing to stir for 5 minutes or until homogeneous.
- Filling and packaging into sterile glass bottles, followed by pasteurization at 80 °C for 10 minutes, followed by cooling shock, and a functional drink is obtained. All processes from start to bottling are carried out aseptically.
- Analysis / testing of vitamin C content, antioxidant activity, and sensory tests (color, taste and aroma).

## RESULTS AND DISCUSSION

Based on the results of the research in the first and second stages that have been carried out sequentially and tested on the predetermined variable responses, the following results are obtained.

### First Stage Research

Based on the test results of binahong leaves and pineapple fruit, the vitamin C content of binahong leaves is 84.13 mg/100g and antioxidant activity of 48.85 ppm, while the vitamin C content of pineapples is 68.05 mg/100g and antioxidant activity is 52.65 ppm. The test results show that the vitamin C content of binahong leaves is higher than pineapples, as well as the antioxidant activity of binahong leaves is more active than pineapples. Based on the test results of binahong leaves and pineapple fruit, it was found that the vitamin C content of binahong leaves was higher than pineapples, as well as binahong leaves showed more active antioxidant activity than pineapples. The selection or determination of the binahong extract method with the criteria for the highest vitamin C content and the most active antioxidant activity, is obtained as shown in the table below. Based on the test results of vitamin C content and antioxidant activity

on the binahong leaf extraction method, the pulping and filtration (m<sub>3</sub>) extraction methods showed the highest vitamin C content and the most active antioxidant activity.

**Table 1.** Results of Analysis of Vitamin C and Antioxidant Activity of Several Extraction Methods on Binahong Leaves.

No	Extraction Method (M)	Vitamin C (mg/100ml)	Antioxidant Activity (ppm)
1.	Maceration (m <sub>1</sub> )	38.85	196.44
2.	Boil fresh leaves and shrink to half the volume (m <sub>2</sub> )	45.31	652.65
3.	Pulping and filtration (m <sub>3</sub> )	49.96	74.35

This situation is because the heat in the maceration and boiling methods affects the content of vitamin C, so there is a decrease, as well as the heat affects the decrease in antioxidant activity, because vitamin C is part of the antioxidant. Basically, vitamin C and antioxidants (compounds from flavonoids, phenols, etc.) are reducing agents or easily oxidized, so that the heat during the extraction process can degrade some of the vitamin C and antioxidants. Therefore, extraction of binahong leaves without using heat is confirmed to be more effective in maintaining the content of vitamin C and antioxidants. Thus the binahong leaf extraction method by means of "Pulping and filtration (m<sub>3</sub>)" was selected and continued in the second / main stage of research.

### Second stage research

The main or second stage research is a continuation of the first stage research. The main or second stage research has been carried out to determine:

- The significance of the response of functional drinks due to the treatment of the binahong leaf extract composition formula with pineapple juice.
- Determination of the best composition formulation of functional drinks due to variations in the composition of binahong leaf extract and pineapple juice.

The criteria for determining the significance and the best functional drink are based on variable responses, namely vitamin C content, antioxidant activity, and sensory tests on color, taste and aroma.

### Response to Vitamin C Content

Based on the test results on the vitamin C content of the functional drinks from each treatment, it was shown that the more portion of the binahong leaf extract composition, the higher the vitamin C content. This condition is linear with the test results of the vitamin C content of binahong leaves showing that the vitamin C content is higher than pineapple juice, so that when it is mixed it gives an effect that the composition of the binahong ekstrak portion is large, so the vitamin C content is also more. The results of the variance analysis showed that in general, there were significant differences (significant effect) on the response to vitamin C content, but the ratio of binahong leaf extract with pineapple extract 0:1, 1:2, and 1:3 showed that the vitamin C content was not significantly different.. Also for the ratio of binahong leaf extract with pineapple juice

1:1, 1:2,1:3, and 1:4 it shows that the vitamin C content is not significantly different, then the ratio of binahong leaf extract and pineapple juice 2:1 and 3:1 show the vitamin C content was not significantly different, and the ratio of binahong leaf extract with pineapple juice 1:0, 3:1, and 4:1 showed that the vitamin C content was not significantly different. However, the highest content of vitamin C is the formula of binahong leaf extract with pineapple juice 1:0 and the second highest is the ratio of binahong leaf extract with pineapple juice 4:1, while the ratio of binahong leaf extract and pineapple juice 1:0 and 4:1 shows that the position is not significantly different.

Vitamin C is the most easily damaged vitamin. besides being easily soluble in water, vitamin C is easily oxidized and the process is accelerated by heat, light, alkalis, enzymes, oxidizing agents, as well as by copper and iron catalysts. Sources of vitamin C mostly come from vegetables and fruits, especially fresh fruit. The content of vitamin C can also be reduced due to treatments such as excessive slicing and crushing (Winarno, 2002). The production of functional drinks by mixing binahong leaf extract with pineapple juice, in order to obtain functional values for health, efforts must be made to avoid excessive heat use, due to the chemical properties of vitamin C mentioned above. So the quality functional beverage processing process is strongly influenced by the production process activities, including the effect of heat use.

**Table 2.** Effect of Composition Variations (Binahong Leaf Extract and Pineapple Juice) on Vitamin C Levels (mg/100 ml) and Antioxidant Activity in Binahong Functional Drinks.

Variations in the composition of Binahong leaf extract and pineapple juice	Average Value of Vit C (mg/100ml)	Average Value Antioxidant Activity at IC50 (ppm)
f <sub>1</sub> (1:0)	38.45 <sup>d</sup>	64.35 <sup>a</sup>
f <sub>2</sub> (0:1)	26.32 <sup>a</sup>	71.54 <sup>c</sup>
f <sub>3</sub> (1:1)	30.60 <sup>b</sup>	68.37 <sup>b</sup>
f <sub>4</sub> (2:1)	34.46 <sup>c</sup>	67.86 <sup>ab</sup>
f <sub>5</sub> (3:1)	35.87 <sup>cd</sup>	66.27 <sup>ab</sup>
f <sub>6</sub> (4:1)	37.19 <sup>d</sup>	65.80 <sup>a</sup>
f <sub>7</sub> (1:2)	28.50 <sup>ab</sup>	70.08 <sup>c</sup>
f <sub>8</sub> (1:3)	29.68 <sup>ab</sup>	70.75 <sup>c</sup>
f <sub>9</sub> (1:4)	31.40 <sup>b</sup>	71.08 <sup>c</sup>

Note: The mean value followed by different letters shows a real difference at the 5% real level.

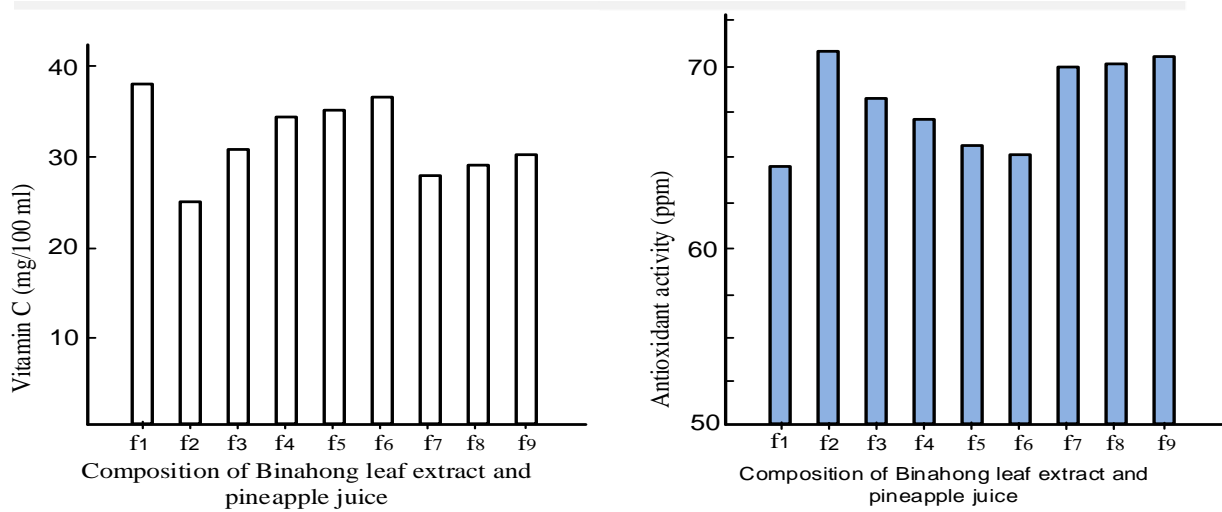
### Response to Antioxidant Activity

The analysis / test of antioxidant activity was carried out in order to determine the antioxidant content of the various compositions of binahong leaf extract and pineapple juice using the IC50 (Inhibitor Concentration 50%) spectrophotometric method of DPPH solution. The results of the analysis of variance (ANAVA) showed a significant difference (significant effect) on the

response to antioxidant activity, but showed no significant difference for the ratio of binahong leaf extract with pineapple juice 1:0, 2:1, 3:1, and 4:1. Also, it shows no significant difference for the ratio of binahong leaf extract with pineapple juice 1:1, 2:1, and 3:1. Likewise, it shows no significant difference for the ratio of binahong leaf extract with pineapple juice 0:1, 1:2, 1:3, and 1:4. Meanwhile, the response of the most active antioxidants was the ratio of binahong leaf extract with pineapple juice 1:0 and 4:1, and based on the analysis of variance it was not significantly different. Based on table 4, the ratio of binahong leaf extract with pineapple juice 1:0 and 4:1 shows the value of antioxidant activity is lower than the other composition variations, which means that the smaller the value, the better the ability of the antioxidant activity. Analysis of antioxidant activity IC<sub>50</sub> (DPPH) carried out on variations in the composition of binahong leaf extract and pineapple juice 1:0 and 4:1 can be categorized as "strong", because the IC<sub>50</sub> value of 50-100 ppm is considered strong. IC<sub>50</sub> (Inhibitor Concentration 50%) is a concentration of antioxidants that can reduce or inhibit 50% of free radicals. According to Taroreh (2015), the level of antioxidant power of test compounds using the DPPH method can be classified according to the IC<sub>50</sub> value, that the smaller the value, the stronger the ability to ward off free radicals.

Antioxidants in principle can be grouped into primary, secondary, and tertiary antioxidants. Primary antioxidants include superoxide dismutase, catalase, and glutathione dismutase which play a role in preventing the formation of new free radicals by breaking chain reactions and turning them into more stable products. Secondary antioxidants, for example vitamin E, vitamin C,  $\beta$ -carotene, Phenolic, and flavonoids, which function to capture free radical compounds and prevent chain reactions. Whereas those included in tertiary antioxidants include enzymes that repair DNA in the cell nucleus, namely methionine sulfoxide reductase which functions to repair cell and tissue damage caused by free radicals. Primary, secondary, or tertiary antioxidants are generally sensitive to oxidation or heating, based on the results of this study, binahong leaf extraction which uses relatively little heat has a fairly strong antioxidant activity, as well as in the manufacture of functional drinks with minimal heat utilization processes that have relatively relatively antioxidant activity. strong enough. As a result of mixing the composition of the binahong leaf extract with pineapple juice, the composition of the binahong extract has a stronger antioxidant activity. So based on the results of this research, it is recommended that functional beverage processing use minimal heat, so that functional drinks have strong antioxidant activity, so that they can function to support health.





**Figure 1.** Illustration of vitamin C response and antioxidant activity in functional drinks due to variations in the binahong leaf extract with pineapple juice.

### Response to Sensoric / Organoleptic

Sensory / organoleptic response is part of the quality parameters of a food or beverage product, because it is related to consumer interest in the food or beverage product. Following are the results of sensory / organoleptic tests on response to color, taste, and aroma.

**Table 3.** The effect of composition variations (Binahong Leaf Extract and Pineapple Extract) on the attributes of color, taste, and aroma of the Binahong Leaf Extract Functional Drink.

Variations in the composition of Binahong leaf extract and pineapple juice	The average value of preference for the color of the functional drink Binahong leaf extract	The average value of preference for the taste of functional drinks of Binahong leaf extract	The average value of preference for the aroma of functional drinks of Binahong leaf extract
f <sub>1</sub> (1:0)	4.86 <sup>a</sup>	2.90 <sup>a</sup>	2.68 <sup>a</sup>
f <sub>2</sub> (0:1)	4.34 <sup>a</sup>	4.98 <sup>cd</sup>	5.61 <sup>d</sup>
f <sub>3</sub> (1:1)	4.56 <sup>a</sup>	4.81 <sup>cd</sup>	5.25 <sup>d</sup>
f <sub>4</sub> (2:1)	4.62 <sup>a</sup>	4.60 <sup>c</sup>	4.28 <sup>c</sup>
f <sub>5</sub> (3:1)	4.54 <sup>a</sup>	4.45 <sup>c</sup>	3.80 <sup>b</sup>
f <sub>6</sub> (4:1)	4.39 <sup>a</sup>	3.48 <sup>b</sup>	3.64 <sup>b</sup>
f <sub>7</sub> (1:2)	4.70 <sup>a</sup>	5.00 <sup>d</sup>	5.20 <sup>d</sup>
f <sub>8</sub> (1:3)	4.78 <sup>a</sup>	5.22 <sup>d</sup>	5.55 <sup>d</sup>
f <sub>9</sub> (1:4)	4.66 <sup>a</sup>	5.15 <sup>d</sup>	5.62 <sup>d</sup>

Based on the results of the sensory / organoleptic test, the color of functional drinks with variations in the composition of the binahong extract with pineapple juice shows no significant

difference (no significant effect) or non-significant, because the green binahong leaf extract color (containing chlorophyll) and yellow pineapple juice orange (containing  $\beta$ -carotene) when mixed, the colors blend into yellowish green. Meanwhile, the sensory / organoleptic test results on the taste and aroma parameters showed significantly different results (significantly). The sensory / organoleptic test results of functional drinks from a mixture of binahong extract with pineapple juice on taste and aroma parameters showed no significant differences, namely the composition of 1:2, 1:3, and 1:4, that the pineapple juice is more likely to be preferred.. This situation can be understood because pineapple juice naturally tastes and smells attractive to consumers, while binahong leaf extract, both flavor and aroma, are relatively unattractive to consumers.

## CONCLUSION

Based on the results of research carried out through the first stage and the second / main stage, the following conclusions can be drawn:

- The results of the first phase of research can determine that the binahong leaf extraction method best produces the highest vitamin C content and the most active antioxidant activity is the "pulping and filtration" method, so the next stage of research (main research) uses extraction. this way.
- The results of the main stage of research, in general, variations in the composition of binahong leaf extract with pineapple juice show a significant (significant) difference in response to vitamin C content and antioxidant activity. Determination of the variation in the composition of the binahong extract with pineapple juice, that the 4:1 composition shows the highest vitamin C content and antioxidant activity after the 1:0 composition. Sensory testing of taste and aroma is relatively preferred by consumers. In addition, the results of this main study gave no significant response to the color of functional drinks, while the response to taste and aroma showed a significant difference, but the most preferred was the composition of binahong leaf extract with pineapple juice 1:2, 1:3, and 1:4, the composition is statistically not significantly different.

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