The effect of citric acid and sodium bicarbonate concentration on the quality of effervescent of red ginger extract

Giyatmi and D K Lingga
Study Program of Food Technology, Sahid University Jakarta, Jl. Prof. Supomo 84 Tebet, Jakarta, Indonesia
E-mail giyatmi@hotmail.com

Abstract. The effervescent product of red ginger extract was made from a mixture of red ginger extract, citric acid, sodium bicarbonate, dextrose, mannitol, sucralose and polyethylene glycol. This study used a single factor randomized complete design method with the ratio of different concentrations of citric acid and sodium bicarbonate (50:50, 51:49, 52:48, 53:47, 55:45) in three replication. Analysis of Variance (ANOVA) was used to see the effect of each treatment, if there was an effect of each treatment then continued with DMRT (Duncan Multiple Range Test) to see which levels produced differences in quality. The results showed that the addition of different concentrations of citric acid and sodium bicarbonate had significant effect (sig < α =0.01) on the value of soluble and effervescent pH of red ginger extract and significantly affected the level of color preference, taste and effervescent solubility of red ginger extract. The best effervescent product of red ginger extract was selected based on the hedonic test with the ratio of citric acid and sodium bicarbonate 52:48 with the following quality test results: 0.00% ethanol residue; levels of active red ginger 0.65%; and the level of effervescent red ginger extract 0.52%.

1. Introduction
Red ginger (Zingiber officinale var. Rubrum) is widely used as a spice, traditional medicine ingredients, sweets and refreshing drinks. People use red ginger more often as medicines because it has the highest volatile oil content, consisting of, among others, turpentine oil, zingiberene, and curcumin. Ginger also contains camphene, farnesene, sesquiphellandrene, linalool, nerolidol, neutral geranial and 1,8-cineol [1]. According to Hapsoh and Julianti [2], the spicy taste in ginger is produced by gingerol and shogaol which are widely found in ginger oleoresin. Red ginger extract is also used to stimulate appetite, alleviate coughs, colds, inflammation, facilitate digestion, reduce nausea and vomiting [3]. Processed ginger is usually enjoyed as a warm drink in cold weather.

Many red ginger preparations on the market have been made in traditional beverage preparations such as wedang jahe, instant ginger drinks and bandrek. The use of traditional drinks in the form of effervescent is still rare, only limited to products of supplements and vitamins. Whereas this has several advantages such as time efficient and producing a fresh taste because of the presence of carbonates which help improve the taste of the preparation[4].

Effervescent is a product made by mixing active ingredients in the form of acidic sources and alkaline sources such as citric acid or tartrate acid and sodium bicarbonate. When this product is put into the water, a chemical reaction begins between citric acid and sodium bicarbonate forming sodium salt from acid and produces CO₂ [5]. The reaction is quite fast and usually completed in a minute or less. Effervescent produce clear solutions and produce a good taste because of the presence of carbonates that help improve certain flavors [3].

Acid sources and alkaline sources have an important role in making effervescent. Sources of acid commonly used are citric acid, malic acid and fumaric acid and the alkaline source commonly used is
sodium bicarbonate. This research refers to previous research [6] regarding the manufacture of effervescent granules. In this study we used only citric acid. Citric acid and sodium bicarbonate have an important role in formulating an effervescent preparation because it is the main source of carbon dioxide that determines the effervescent system produced [7]. Thus, drinks given in the form of effervescent granules will provide a refreshing sensation caused by the release of carbon dioxide [8].

The aim of this study was to determine the quality of effervescent granules of red ginger extract with a ratio of citric acid and sodium bicarbonate 50:50, 51:49, 52:48, 53:47 and 55:45. The parameters tested were flow test, stationary angle, bulk density, dissolution time, moisture content, pH, organoleptic, levels of active ingredients of red ginger extract, ethanol residue, and test of purchase decision.

2. Materials and Methods

2.1. Effervescent ingredients

The ingredients used in making effervescent red ginger extract were citric acid, sodium bicarbonate, dextrose, red ginger extract, sucralose, ethanol, water and PEG 6000, while the chemicals used for analyzing samples were H₃PO₄, acetonitrile and methanol.

2.2. Effervescent granule preparation

The process of making effervescent in this study was by using a wet granulation method [9], which included several stages: weighing raw material, mixing I, wet granulation process, sieving I, drying, sieving II, mixing II, so that wet granule mass was formed. Dextrose, red ginger extract, mannitol, citric acid, sodium bicarbonate and sucralose are mixed and shaken in the plastic until the mixture was homogeneous. After the mixture of homogeneous ingredients, the material was put into a stainless steel basin container for wet granulation process by adding an ethanol binder solution, then the moist granule was sieved with a 6 mesh sieve in order to made granule homogeneous. Then the granules were dried using an oven at 50 °C for 1 hour to obtain a moisture content of 0.4-0.7%. The dried granules were sieved again with a 20 mesh sieve to form a granule mass. The mass of the formed granules was mixed with PEG 6000 lubricating material to help increase the flow of effervescent granules. The process of making effervescent granules with a ratio of citric acid and sodium bicarbonate with 50:50, 51:49, 52:48, 53:47 and 55:45 can be seen in figure 1.

2.3. Methods

2.3.1. Flow time

The time needed to flow a number of granules or powder on the tool was measured. The flowing granules or powders is influenced by the shape, surface area, density and humidity of the granules. The inequality and the smaller size of the granule will increase the power of cohesion so that the granules clot and not easily flow. Usually the flow rate ≤ 10g / sec is considered good [9].

2.3.2. Angle of repose

Fixed angles that occur between heaps of cone-shaped particles with horizontal fields, if a number of powders or granules were poured into a measuring device. The size of the stationary angle is influenced by the shape, particle size and humidity of the granule. Granules will flow well if they have a stationary angle between 25° to 45° [10]. Angel of repose can be calculated by the formula:

\[ Tg \beta = \frac{h}{R} \]  

Note:

- Tg \( \beta \) = angle of repose (°)
- h = cone height (cm)
- R = radius (cm)
2.3.3. Bulk Density
Decrease in the volume of a number of powder granules due to shock with vibration. The smaller the tapping index (in percent), the better the flow properties. The tapping test was carried out by a volumenometer device which consists of a measuring cup that can move regularly up and down with the help of a driving motor. Granules or powders that have a determination index of less than 20% have good flow properties. This determination process can also be calculated the value of its bulk density with the formula [10]:

\[ \rho_b = \frac{M}{V_b} \]  

Note:
- \( M \) = particle mass
- \( V_b \) = final volume after being pressed
- \( \rho_b \) = bulk density after being pressed

2.3.4. Solubility time
200 ml of cold water at a temperature of 15°C - 25°C were poured in a 200 ml glass. After that, 6 grams of effervescent granules were added to the water. The requirements for dissolving time are less than 5 minutes, when the effervescent was completely diluted and had an ideal dissolving time ranging from 1-2 minutes. If the effervescent is well dispersed in water and completes the reaction in less than 5 minutes, it shows that the preparation meets the standards of dissolution and the requirements of dissolution time [11].
2.3.5. Moisture content [12]
Determination of water content began with drying of aluminum plates at a temperature of 105°C for 15 minutes in oven, then cooled in a desiccator and weighed. A total of 1-2 grams of sample was put into the aluminum dish and dried in an oven at 105°C for five hours then cooled in a desiccator, and weighed until the dry sample weight was relatively constant.

The moisture content of the granule can affect the flow rate of the granule. Conversely, high moisture content can cause instability of granules which can be seen from changes in physical appearance, color, smell, taste, and texture of the granule [8]. In this study the author used a moisture analyzer to test the water content analysis.

\[
\text{Moisture content (\% b/b)} = \left( \frac{a - b}{b} \right) \times 100\% 
\]

Note:
\[a = \text{initial weight}\]
\[b = \text{final weight}\]

2.3.6. pH
According to Juita [13], the pH test needs to be done because if an effervescent solution formed too acidic, it might irritate the stomach while if it is too alkaline it might causes a bitter and unpleasant taste. In addition, according to Lestari [4], effervescent has good solubility at pH between 5-7 because effervescent is not stable at pH> 8. While according to Estiasih and Ahmadi [14], effervescent need a pH <6 as a quality standard. Balance of acid base body tissue and human blood must be at pH 7.3 - 7.5 means that the condition of the body is somewhat alkaline or alkaline, in order to stay healthy and function optimally. Above pH 7.8 or below pH 6.8 will cause metabolic disorders, which in turn is also a disruption to health [15].

2.3.7. Organoleptic test
The organoleptic test of taste, smell, color and solubility were carried out by a preference / hedonic test and hedonic quality test. The parameters observed were the taste, smell, color, and solubility of the effervescent granules of red ginger extract produced.

2.3.8. Active compound [16]
Measuring the concentration of gingerol content was carried out using a chromatographic method, the sample was ultrasonically heated by sonication using methanol at room temperature. The extract was then analyzed by HPLC. Oven column temperature 40°C. 280 nm wavelength. and the mobile phase flow rate of 1 ml / minute. The solvent used in the column is acetonitrile (mobile phase).

2.3.9. Ethanol residue
Alcohol / ethanol residues were examined by the method of GC (Gas Chromatography) or HPLC (High Performance Liquid Chromatography). Analysis of ethanol residues using GC with a detection limit of at least 20 ppm. Analysis of alcohol / ethanol levels can be done using GC equipped with flame ionization (FID) detectors and software integrated with computers. The temperature of the FID detector was set at 150°C and the injection port temperature is set at 250°C. Helium was used as a carrier gas and was used with a flow rate of 3°C / minute. The capillary column used is SGE ID-BP20, 30 mm, and a diameter of 0.25 mm. The oven temperature was set at 60°C at the start, up to 80°C and programmed 20°C / minute.

In food products, the limits for receiving ethanol residues are differ by countries and organizations. In general, ethanol residues of 0.5% are allowed in food products. However, the Islamic Food and Nutrition Council of America sets the permissible alcohol level at 0.1% [17].

2.3.10. Purchase decision test
The decision test to buy effervescent products of red ginger extract was done by determining whether the panelist will buy the product or not based on general price and acceptance ratings.
2.4. Data analysis
The data displayed was in the form of mean ± standard deviation. The analysis technique used was Variant Analysis (ANOVA) with five levels with three repetitions using Statistical Package for The Social Science (SPSS) version 20. If there was an influence of the ratio of citric acid and sodium bicarbonate to the quality of red ginger extract effervescent products, then proceed with Test DMRT (Duncan's Multiple Range Test) to find out which treatment level is different. The variable in this study was the ratio of citric acid and sodium bicarbonate (A) which consists of 5 levels, namely A1 (50:50), A2 (51:49), A3 (52:48), A4 (53:47), and A5 (55:45).

3. Results and Discussion
3.1 Physical properties
The quality of effervescent granules of red ginger extract was assessed in the form of physical quality, i.e. flow time, angle of repose, bulk density, and dissolution time. The effervescent value of red ginger extract treated with physical tests can be seen in Table 1.

| Physical Test    | A1 (50:50) | A2 (51:49) | A3 (52:48) | A4 (53:47) | A5 (55:45) |
|------------------|------------|------------|------------|------------|------------|
| Flow time        | 9.35 ± 0.05| 9.40 ± 0.00| 9.40 ± 0.10| 9.4 ± 0.10 | 9.45 ± 0.05|
| Angle of repose  | 42.30 ± 0.00| 42.34 ± 0.00| 42.36 ± 0.03| 42.34 ± 0.04| 42.34 ± 0.04|
| Bulk density     | 13.33 ± 0.58| 13.66 ± 1.15| 13.33 ± 0.58| 13.00 ± 0.00| 13.66 ± 0.58|
| Solubility time  | 2.25 ± 0.05a| 2.13 ± 0.03b| 2.07 ± 0.04b| 1.60 ± 0.00c| 1.56 ± 0.02c|

Note: same codes mean that they are not significantly different between treatment and different codes mean that they are significantly different between treatments.

Flow time is the time needed to drain a number of granules or powder on the tool used. The ease of flowing granules or powders is influenced by the shape, surface area, density and humidity of the granules. The inequality and the smaller size of the granule will increase the power of cohesion so that the granules clot and not easily flow. The value of flow time ranging from 9.35 to 9.45 (s) is in accordance with the quality requirements for effervescent flow time provided that the flow velocity ≤10g/sec is considered good [9]. Based on the results of variance, the ratio of citric acid and sodium bicarbonate did not affect the quality of the effervescent flow time of red ginger extract (α> 0.01 and 0.05).

Angle of repose is a fixed angle that occurs between a pile of cone-shaped particles and a horizontal plane, if a number of powders or granules are poured into a measuring device. The size of this angle is influenced by the shape, particle size and humidity of the granule. Based on the results of variance, the ratio of citric acid and sodium bicarbonate did not affect the quality of the stationary angle (α> 0.01 and 0.05). The value of the stationary angle ranges from 42.30º to 42.36º according to the requirements for the quality of the angle of repose of the effervescent granule provided that the granule will flow well if it has a stationary angle between 25º to 45º [10].

Based on the results of variance, the different ratio of citric acid and sodium bicarbonate did not affect the bulk density value (α> 0.01 and 0.05). Bulk density values ranging from 13.00% to 13.66% according to the requirements of bulk density of effervescent granules with granules or powders that have a bulk density index of less than 20% means having good flow properties [10].

Dissolution time test was carried out by 200 ml of granules put into beaker glass containing aquaest. When it dissolved, it was determined that the granule was inserted into the glass until all the granules were dissolved in the distilled water. Good effervescent has a dissolving time of less than 5 minutes [11]. Soluble time testing was done using a stopwatch. Based on the results of variance, the ratio of citric acid and sodium bicarbonate added influenced effervescent dissolution time (α> 0.01 and 0.05). Based on Duncan’s test to find out on which comparison affected the quality of dissolved time in the product, it is known that the higher the ratio of citric acid is added, the faster the solubility time, this is because citric acid has a high solubility in water and very hygroscopic [18].
3.2 Chemical properties
The chemical quality of effervescent granules of red ginger extract was assessed based on water content and pH. Effervescent value of red ginger extract chemical test treatment can be seen in Table 2.

| Chemical Test          | A1 (50:50) | A2 (51:49) | A3 (52:48) | A4 (53:47) | A5 (55:45) |
|------------------------|------------|------------|------------|------------|------------|
| Moisture content       | 0.41 ± 0.02| 0.43 ± 0.05| 0.43 ± 0.02| 0.45 ± 0.05| 0.47 ± 0.06|
| pH                     | 5.45 ± 0.02| 5.37 ± 0.02| 5.31 ± 0.02| 5.23 ± 0.04| 5.15 ± 0.02|

Note: same codes mean that they are not significantly different between treatment and different codes mean that they are significantly different between treatments.

Water content was tested using a moisture content analyzer by weighing 2.5 grams of granules and inserted into a moisture meter. The device was run by setting the temperature to 60°C. The water content value ranged from 0.41% to 0.47%. In accordance with the effervescent granule water quality requirements with the condition that standard granules with moisture content of ≤ 5%, the effervescent moisture content of red ginger extract met the requirements. Based on the results of variance, the comparison of different citric acid and sodium bicarbonate did not affect the effervescent water quality of red ginger extract (α> 0.01 and 0.05).

Effervescent granule pH measurements were carried out by 6 grams dissolved in 200 ml of beaker glass. The pH meter used previously was calibrated first using a pH 7 buffer. Then the electrode is cleaned with distilled water and dried with a tissue. Effervescent pH quality according to ranges from ≤ 6 [14]. Based on the results of variance, the comparison of citric acid and sodium bicarbonate added affects the effervescent pH level of red ginger extract (< α = 0.01 and 0.05). Duncan test results α = 0.01 indicate the average value of effervescent pH of red ginger extract differed very significantly at the level of α = 0.01 for each treatment. Based on the results of these observations, the higher the citric acid, the effervescent pH value of red ginger extract will lower the pH. The decrease in pH is caused by an increase in the amount of citric acid added and when reacting with carbonate and water sources can increase the activity of H⁺ ions in organic acids in food products [19].

3.3 Organoleptic result
The quality of effervescent granules of red ginger extract was assessed as a hedonic test for the color, smell, taste and effervescent solubility of red ginger extract. The quality test of hedonic effervescent red ginger extract can be seen in Table 3.

| Hedonic Test | A1 (50:50) | A2 (51:49) | A3 (52:48) | A4 (53:47) | A5 (55:45) |
|--------------|------------|------------|------------|------------|------------|
| Color        | 68.00⁶c    | 80.00⁶     | 82.67⁶     | 79.33⁶     | 78.00⁶     |
| Smell        | 68.00⁶     | 71.00⁶     | 74.00      | 71.33      | 70.00      |
| Taste        | 67.00⁶a    | 71.00⁶b    | 79.33⁶b    | 67.33⁶     | 63.00⁶     |
| Solubility   | 67.33      | 68.00      | 74.00      | 75.00      | 77.67      |

Note: same codes mean that they are not significantly different between treatment and different codes mean that they are significantly different between treatments.

The average results of the panelists' favorite values for the effervescent color of red ginger extract ranged from 68.00% - 82.67%, from dislike to very like. 82.67% of panelists liked the A3 sample with the addition of citric acid and sodium bicarbonate 52:48. Based on the results of variance, the comparison of citric acid and sodium bicarbonate added influenced the hedonic test of the effervescent color of red ginger extract (< α = 0.01 and 0.05). The Duncan test results showed a hedonic test of the effervescent color of red ginger extract with a ratio of citric acid and 50:50 sodium bicarbonate was significantly different from the ratio of citric acid and sodium bicarbonate 51:49, 52:48, 53:47 and 55:45. Winarno [20] states that color is influenced by raw materials and processes. Color changes occur in the effervescent dough of red ginger extract after the mixture has undergone a wet granulation process.
Citric acid is added because it affects the solubility of effervescent powder to be faster, so the color looks brighter [18].

The average value of the panelists' preference for the effervescent smell of red ginger extract ranged from 68.00% to 74.00%, from dislike to very like. 74.00% of panelists liked the A3 sample with the ratio of citric acid and sodium bicarbonate 52:48. Based on the results of variance, the ratio of citric acid and sodium bicarbonate added did not affect the hedonic test of the effervescent smell of red ginger extract ($\alpha > 0.01$ and 0.05).

The average results of panelists' preference for the effervescent taste of red ginger extract ranged from 63.00% - 79.33%, from dislike to very like. 79.33% of panelists liked the A3 sample with the ratio of citric acid and sodium bicarbonate 52:48. Based on the results of variance, the comparison of citric acid and sodium bicarbonate added influences the hedonic test of the effervescent taste of red ginger extract ($<\alpha = 0.01$ and 0.05). The Duncan test results showed a hedonic test of red ginger taste in effervescent with a ratio of citric acid and sodium 52:48 not significantly different from a ratio of 51:49 that it would be different from the citric acid ratio of 55:45, 50:50 and 53:47. This shows the ratio of citric acid and sodium bicarbonate to affect the taste of the panel effervescent red ginger extract liking the ratio of citric acid and sodium bicarbonate 52:48.

The average value of panelists' preference for effervescent solubility of red ginger extract ranged from 67.33% - 77.67%, from very insoluble to very soluble. 77.67% of panelists like the P5 sample, which is the ratio of citric acid and sodium bicarbonate 55:45. Based on the results of variance, the comparison of citric acid and sodium bicarbonate added affects the hedonic test of the effervescent solubility of red ginger extract ($<\alpha = 0.01$ and 0.05). The Duncan test results showed a hedonic test of red ginger extract with a ratio of citric acid and sodium bicarbonate 55:45 not significantly different from the ratio of citric and sodium bicarbonate 52:48 and 53:47 but significantly different from the ratio of citric acid and sodium bicarbonate 50:50 and 51:49. Based on observations the higher the ratio of citric acid added, the faster the solubility will be, this is because citric acid has a high solubility in water and is very hygroscopic [18].

3.4 Hedonic quality result

The quality of effervescent granules of red ginger extract was assessed in the form of hedonic quality tests on the color, smell, taste and effervescent solubility of red ginger extract. The quality test of hedonic effervescent red ginger extract can be seen in Table 4.

| Hedonic Quality Test | A1 (50:50) | A2 (51:49) | A3 (52:48) | A4 (53:47) | A5 (55:45) |
|----------------------|------------|------------|------------|------------|------------|
| Color                | 73.11c     | 80.00p     | 81.44a     | 79.78c     | 77.00p     |
|                      | Slightly bright | Bright     | Bright     | Bright     | Bright     |
| Smell                | 71.44c     | 72.33c     | 72.33c     | 71.89c     | 68.83c     |
|                      | Slightly ginger smell | Slightly ginger smell | Slightly ginger smell | Slightly ginger smell | Slightly ginger smell |
| Taste                | 67.44c     | 74.44c     | 78.89c     | 63.89c     | 63.66c     |
|                      | Slightly spicy | Spicy      | Spicy      | Slightly spicy | Slightly spicy |
| Solubility           | 66.89c     | 71.11c     | 74.56c     | 74.44c     | 76.82c     |
|                      | Slightly soluble | Slightly soluble | Soluble | Soluble | Very soluble |

Note: same codes mean that they are not significantly different between treatment and different codes mean that they are significantly different between treatments.

Color is the most important quality attribute. The color of the product is considered as a factor that determines quality, also can be used as an indicator of whether or not the standard method of mixing or processing can be characterized by the presence of color [20]. Based on the results of variance, the comparison of the concentration of citric acid and sodium bicarbonate affects the hedonic quality test.
on the brightness of the effervescent color of red ginger extract (α<0.05). The Duncan test results show that the ratio of citric acid and natrium bicarbonate affects the hedonic quality test. Panelists liked the ratio of citric acid and sodium bicarbonate 52:48.

The smell caused by chemical stimulation which is smelled by olfactory nerves in the nasal cavity [20]. Based on the results of variance, the comparison of citric acid and sodium bicarbonate did not affect the hedonic quality test on the smell of effervescent ginger red ginger extract.

Taste is judged by the presence of chemical stimulation responses by the senses and trigeminal nerves located in the mouth of the tasting mouth, namely the tongue and nose. Sensitivity to taste varies depending on the substance being tested, as well as the panelist and temperature conditions. Based on the results of variance, the comparison of the concentration of citric acid and sodium bicarbonate affects the hedonic quality test of the effervescent taste of red ginger extract (<α = 0.01). The Duncan test results showed a hedonic test of effervescent spicy flavor of red ginger extract with a ratio of citric acid and sodium bicarbonate 52:48 not significantly different from a ratio of 51:49 but was markedly different from the concentration ratio of citric acid and sodium bicarbonate 50:50, 53:47 and 55:45.

Standard effervescent preparations have a solubility time of less than 5 minutes [11]. Based on the results of variance, the comparison of the concentration of citric acid and sodium bicarbonate affects the hedonic quality test of the effervescent solubility of red ginger extract (<α = 0.01 and 0.05). The Duncan test results showed that the comparison of citric acid and sodium bicarbonate in the making of effervescent red ginger extract can affect the effervescent solubility of the resulting red ginger extract, where the higher the concentration of citric acid is added, the faster the solubility of the product [18].

3.5 Supporting analysis

Effervescent products of red ginger extract with the best treatment were carried out supporting tests in the form of red ginger active ingredient test, red ginger extract extract test, ethanol residue and purchase decision based on product prices and general product acceptance. The best product was obtained based on the highest value hedonic test results, the product made using the ratio of citric acid and sodium bicarbonate 52:48 (A3). It is known that the test for the level of active ingredients of red ginger is 0.65%, while the active ingredient in effervescent red ginger extract is 0.52%. Testing of ethanol residue on effervescent red ginger extract is known to be 0.00%.

Supporting analysis was also carried out on the decision to buy effervescent red ginger extract products. The decision to buy a product is the action of the consumer to buy or not buy the product. Of the various factors that influence consumers in purchasing a product or service, usually consumers always consider the quality, price, and products that have been known by the community. The buying decision factor used in this study is the organoleptic quality and product selling price. The price of effervescent products from the research is Rp. 2,000 / 6 gram packaging. The diagram of the test results for the decision to buy effervescent red ginger extract products can be seen in figure 2.

The results of the buying decision test based on product acceptance in general as many as 60% of panelists liked and intended to buy products with a concentration of citric acid and sodium bicarbonate 52:48 and based on the price of products sold Rp.2,000/6 gram packaging as much as 40% panelists liked and intended to buy the product.

4. Conclusion

Based on the physical properties, the difference in the ratio of the concentration of citric acid and sodium bicarbonate to the effervescent red ginger extract only affected the dissolution time, but did not affect the flow time, angle of repose and bulk density. All levels of comparison of the concentration of citric acid and sodium bicarbonate could still be categorized as conformed with the physical requirements of effervescent products.

Based on chemical properties, the difference in the ratio of concentrations of citric acid and sodium bicarbonate to effervescent red ginger extract affected pH, but did not affect water content. All levels of comparison of concentrations of citric acid and sodium bicarbonate could still be categorized as conformed with the chemical requirements of effervescent products.
Figure 2. The results of the test diagram for the purchase of red ginger extract effervescent products.

Based on the hedonic test, the difference in the ratio of the concentration of citric acid and sodium bicarbonate to the effervescent red ginger extract only affected color and taste, but did not affect smell and solubility. Comparison of the concentration of citric acid and sodium bicarbonate which had the best level of preference is 52:48. Based on the hedonic quality test of the best effervescent product of red ginger extract had a bright color, the smell of the slightly ginger smells, tastes spicy, and a good solubility.

The effervescent product of red ginger extract with the best ratio of citric acid and sodium bicarbonate (52:48), the raw material (red ginger) had characteristics of red ginger active content of 0.65%; the level of effervescent red ginger extract 0.52%; 0.00% ethanol residue. In addition, the results of the test of buying decisions were also obtained based on product acceptance, 60% panelist liked and intended to buy and based on product selling prices of 40% panelist liked and intended to buy too.

5. References
[1] Harwati C H T 2009 Khasiat jahe bagi kesehatan tubuh manusia Jurnal Inovasi Pertanian 8(1) 54-61
[2] Hapsoh H Y and Julianti E 2008 Budidaya dan Teknologi Pascapanen Jahe. USU Press Medan 1,3
[3] Ervina A T 2010 Formulasi Tablet Effervescent Ekstrak Jahe Merah (Zingiber officinale Rosc) Dengan Kombinasi Asam Sitrat dan Asam Malat sebagai sumber asam dan natrium karbonat sebagai sumber basa. Fakultas Farmasi Universitas Muhammadiyah Surakarta
[4] Lestari P M, Radjab N S and Octaviani A 2014 Formulasi dan evaluasi fisik granul effervescent sari buah naga (Hylocereus undatus).
[5] Imanuela M, Sulisyawati, Ansori M 2012 Penggunaan asam sitrat dan natrium bikarbonat dalam minuman jeruk nipis berkarbonasi. J Food and Culinary Education Univ Negeri Semarang
[6] Rantiasih M D 2007 Optimasi natrium bikarbonat dan campuran asam tartrat-asam fumarat sebagai ekspion dalam pembuatan granul effervescent ekstrak rimpang temulawak [Curcuma xanthorrhiza Roxb.] secara granulasi basah dengan metode desain faktorial. Skripsi Sanata Dharma
[7] Kumullah I R 2016 Optimalisasi Formulasi Bahan Pengikat Dan Bahan Penghancur Terhadap Karakteristik Effervescent Ampas Stroberi (Fragaria Chiloensis L.) Program Studi Teknologi Pangan fakultas Teknik Universitas Pasundan. Bandung
[8] Ansel H C 2008 Pengantar Buku Sediaan Farmasi UI-Press Jakarta
[9] Siregar C J P and Wikarsa S 2010 Teknologi Farmasi Sediaan Tablet :Dasar-Dasar Praktis EGC Jakarta
[10] Lachman L, Lieberman H A and Kanig J L 2008 Teori dan Praktek Farmasi Industri Universitas Indonesia Press Jakarta
[11] Anshory, Syukri, and Malasari 2007 Formulasi Tablet Effervescent dari Ekstrak Ginseng Jawa (Tlinum paniculatum) dengan Variasi Kadar Pemanis Aspartam. Jurnal Ilmiah Farmasi
[12] AOAC 2012 Official Method of Analysis of the Association Analytical Chemistry Inc. Washington D.C.
[13] Juita Y 2008 Formulasi Tablet Effervescent Tepung Daging Lidah Buaya. Skripsi FMIPA UI Depok
[14] Estiasih T and Ahmadi K 2009 Teknologi Pengolahan Pangan PT Bumi Aksara Jakarta
[15] Misbah D 2014 Pengaruh Asam Basa dalam Makanan terhadap Kesehatan https://klinikpengobatanalami.wordpress.com/(accessed 21 March 2018)
[16] Lee S, Choo C, Halstead C W, Huynh T, and Bensoussan 2007 Liquid chromatographic determination of 6-, 8-, 10-gingerol, and 6-shogaol in ginger (Zingiber officinale) as the raw herb and dried aqueous extract Journal of AOAC International 90(5) pp 1219-1226
[17] Husni P, Norisca A P, and Imam A W 2017 Metode Deteksi Kandungan Babi dan Alkohol dalam Eksipien Farmasi dan Produk Obat untuk Menjamin Kehalalan Sediaan Obat Majalah Farmasetika 2 1 pp 1-7
[18] Fung K Y and King K M 2003 Product Centered Processing: Pharmaceutical and Capsules J AIChE. 49: 5 pp 1193-1218
[19] Dede Y 2005 Studi Kasus Fisika Pangan Pembuatan Tablet Effervescent Sari Buah Tomat Skripsi IPB Bogor
[20] Winarno F G 2004 Kimia Pangan dan Gizi Gamedia Pustaka Utama Jakarta