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RESEARCH ARTICLE

THE EFFECT OF DRAGON FRUIT (*Hylocereus polyrhizus*) PEEL JUICE ADDITION TOWARD QUALITY OF AMBARELLA FRUIT (*Spondias dulcis*, Forst) SYRUP.

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Abstract

This research was aimed to know the effect of dragon fruit peel juice addition toward quality of ambarella fruit syrup. This research used Completely Randomized Design (CRD) with 5 treatments and 3 replications. The treatment in this study was the quantity of dragon fruit peel juice added in making of ambarella fruit syrup as A (15%), B (20%), C (25%), D (30%) and E (35%). The data were analyzed statistically by ANOVA (Analysis of Variance) and continued with DNMRT (Duncan's New Multiple Range Test) at the 5% significance level. The analysis on raw materials were pH, total acid, vitamin C, total soluble solids, antioxidant activity, betacyanin and the analysis on syrup include viscosity, total soluble solids, pH, total sugar, total acid, vitamin C, antioxidant activity and betacyanin. The results showed that the addition of dragon fruit peel juice gave significant effect on each analysis.

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Introduction:-

The syrup is defined as a beverage product made from a mixture of water and sugar with a minimum sugar content of 65% with or without other foodstuffs and/or food additives permitted in accordance with applicable provisions (SNI 01-3544: 2013). Ambarella syrup is one of the utilization of ambarella fruit as a beverage. In this way can be served fresh beverages with a distinctive aroma of ambarella fruit.

Ambarella fruit (*Spondias dulcis*) has a high water and fiber content that can help the digestive process and relieve dehydration. Vitamin C content in ambarella fruit of 30 mg, therefore vitamin C is often called Fresh Food vitamin. Raw fruit still contains more vitamin C, the riper the fruit the decreases its vitamin C content (Inayati, 2007).

According to Bachtiar (2004), ambarella fruit has a sweet sour taste. The ambarella fruit can be eaten directly in fresh or processed usually for sweets, besides ambarella fruit can also be processed into syrup. Utilization of ambarella fruit as the syrup is expected to increase the economic value of the ambarella fruit. Ambarella fruit syrup has a white color, to be more interesting then added the dragon fruit peel. The addition of dragon fruit peel is also expected to increase the nutritional value of syrup.

Dragon fruit (*Hylocereus polyrhizus*) contains anthocyanin which has a function as the prevention of premature aging, prevention of intestinal cancer. In addition, the protein content in ambarella fruit can also increase metabolism in the body and keep the heart healthy (Idawati, 2012). The peel color was red and yellow. Red dragon

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fruit peel extract is efficacious in improving the flexibility of blood vessels and red dragon fruit peel extract can be used in the making of syrup (Amalya, 2013).

In the making of ambarella syrup added kiamboy, because it can increase and maintain the flavor of ambarella syrup. Kiamboy is a kind of candied dried fruit from plum that is dried with a mixture of sweet, sour and salty flavors. Kiamboy has three types: white kiamboy taste sweet slightly sour and not too salty. Red kiamboy taste slightly more sour and salty than gray-black kiamboy (Fatah., et al, 2004). In this study kiamboy that used is white kiamboy.

Based on preliminary research that has been done the making of ambarella syrup with the addition of red dragon fruit peel juice with various concentrations of 15%, 20%, 25%, 30%, and 35% known in terms of color of red dragon fruit peel juice has an influence on the ambarella syrup, but the effect on physical and chemical properties of syrup still unknown.

Methodology:-

Materials and Tools:-

The raw materials used in this study were the ripe green ambarella fruit, red dragon fruit peel, sugar (sucrose), CMC (Carboxy Methyl Cellulose), kiamboy and water.

The chemicals used in the analysis were: aquades, filter paper, Luff Schoorl solution, buffer solution, H₂SO₄ Na₂S₂O₃ solution, starch indicator, 1% acetic acid, and other chemicals required for analysis.

The tools used in this research were scales, stainless steel spoon, stainless steel knife, juicer, blender, plastic basin, pot, stirrer.. While the tools used for analysis are an aluminum bowl, filter paper, and other tools needed for research.

Research Design:-

The research design used in this study was Completely Randomized Design (CRD) with 5 treatments and 3 replications. The analysis result from each parameter was statistically analyzed by ANOVA test and continued with Duncan's New Multiple Range Test (DNMRT) at 5% level.

The treatment in this study was the quantity of dragon fruit peel juice added in the manufacture of syrup, as follows:

A = Addition of dragon fruit peel 15%

B = Addition of dragon fruit peel 20%

C = Addition of dragon fruit peel 25%

D = Addition of dragon fruit peel 30%

E = Addition of dragon fruit peel 35%

Research Implementation:-

Making Ambarella Fruit Juice (Manoi, 2006) methods with Modification:-

Ripe ambarella fruits with green color, sorted, washed, then separated between the flesh of the fruit with the seeds and weighed 250 grams. Flesh of ambarella then added with 250 ml of water and blended by a blender. Filtered use a gauze to obtained the ambarella fruit juice.

Making of Dragon Fruit peel juice (Fadillah, 2015) methods with Modification:-

Red dragon fruit peel sorted then washed with clean water. The cleaned dragon fruit peel weighed according to the treatment and then added 50 ml of water and blended by a blender. Filtered use a gauze to get dragon fruit peel juice.

Making Ambarella Syrup (Ayuningsih, 2015) methods with Modification:-

250 ml ambarella fruit juice and 50 ml dragon fruit peel juice containing (15%, 20%, 25%, 30%, and 35% by weight of fruit juice). Added 300 g of sugar, 2 g of CMC and 3 g of kiamboy while stirring. After homogen, the syrup heated at temperature of 80°C until thickened for 5 minutes. The ambarella syrup put in a bottle and ready for further analysis.

Observation:-

Observations were done on raw material and syrup products produced. Observations of ambarella fruit juice include pH, total acid, vitamin C, total soluble solids (Yenrina, et al., 2011) and antioxidant activity (Huang, et al., 2005). Observation on dragon fruit peel were pH, vitamin C, antioxidant activity (Huang, et al., 2005), betacyanin (Eder,1996) total soluble solids and total acid (Yenrina, et al., 2011). While observations of syrup include as viscosity, total soluble solids, pH, total sugar, total acid, vitamin C (Yenrina., et al., 2011), antioxidant activity (Huang, et al., 2005) and betacyanin (Eder,1996).

Results And Discussion:-**Raw Material Analysis:-**

Data from raw material analysis can be seen in Table 1. Based on the analysis of the raw material of ambarella fruit juice obtained pH of 3.04. The pH value of ambarella is classified as high acid food. The pH of dragon fruit peel juice was 5.57, and higher than the pH of the peel of dragon fruit 5.06 (Jamillah, et al., 2011). The content of vitamin C obtained in ambarella fruit juice of 0.18 mg / 100g and the dragon fruit juice of 0,05 mg / 100g. Total acid content in ambarella fruit juice was 2.42% and the dragon fruit peel juice of 0.95%. Total acid content in ambarella juice was higher than the total acid content in dragon fruit peel juice. This happened because the sour sweet taste of ambarella fruit and the pH classified as a high acid. In the total soluble solids, the analysis found that the ambarella juice had a total soluble solid of 4.00 ° Brix, whereas in the dragon fruit peel juice of 1.00 ° Brix. The antioxidant activity analysis result showed the antioxidant activity in ambarella juice of 0.75% and dragon fruit peel juice of 5.92%. Betacyanin analysis only conducted on the dragon fruit peel, because the dragon fruit peel contains betacyanin pigment and the result obtained was 1.05 mg / 100 ml. The result of betacyanin obtained was lower than analysis done by Khumairoh (2016) which stated that the result of betacyanin of raw material dragon fruit peel obtained was 11.37 mg / 100 ml. This can happen because of many factors that affect the betacyanin content of species and agronomic factors. Differences in chemical content levels can be caused by differences in soil conditions where it grows (Khoiriyah, 2015).

Table 1:-Result of Raw Materials Analysis

Component	Ambarella Fruit Juice ± SD	Dragon Fruit Peel Juice ± SD
pH	3.04 ± 0.03	5.57 ± 0.01
Vitamin C (mg/100g)	0.18 ± 0.01	0.05 ± 0.01
Total Acid (%)	2.42 ± 0.00	0.95 ± 0.00
Total Soluble Solids (°Brix)	4.00 ± 0.00	1.00 ± 0.00
Antioxidant Activity (%)	0.75 ± 0.21	5.92 ± 2.28
Betacyanin (mg / 100 ml)	-	1.05 ± 0.07

Note: (-) not analyze

Table 2:-Viscosity of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Viscosity (cP) ± SD
A (dragon fruit peel 15%)	3.64 ± 1.00 a
B (dragon fruit peel 20%)	4.91 ± 1.00 b
C (dragon fruit peel 25%)	5.03 ± 0.58 c
D (dragon fruit peel 30%)	5.33 ± 1.53 d
E (dragon fruit peel 35%)	5.63 ± 0.58 e

CV = 0.20%

Table 3:-Total Soluble Solids Content of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Total Soluble Solids (°Brix) ± SD
A (dragon fruit peel 15%)	49.50 ± 4.50 a
B (dragon fruit peel 20%)	54.00 ± 4.50 ab
C (dragon fruit peel 25%)	58.63 ± 4.51 bc
D (dragon fruit peel 30%)	64.50 ± 2.60 c
E (dragon fruit peel 35%)	73.50 ± 2.60 d

CV = 6.42%

Table 4:- pH Value of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	pH \pm SD
A (dragon fruit peel 15%)	2.75 \pm 0.35 a
B (dragon fruit peel 20%)	3.06 \pm 0.06 a
C (dragon fruit peel 25%)	3.60 \pm 0.12 ab
D (dragon fruit peel 30%)	3.60 \pm 0.06 ab
E (dragon fruit peel 35%)	4.11 \pm 0.06 b

CV = 13.27%

Table 5:-Total Sugar Content of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Total Sugar (%) \pm SD
A (dragon fruit peel 15%)	41.26 \pm 1.00 a
B (dragon fruit peel 20%)	40.09 \pm 0.62 b
C (dragon fruit peel 25%)	39.59 \pm 0.22 c
D (dragon fruit peel 30%)	32.64 \pm 0.86 c
E (dragon fruit peel 35%)	30.10 \pm 0.16 c

CV = 1.27%

Table 6:- Total Acid Content of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Total Acid (%) \pm SD
A (dragon fruit peel 15%)	0.47 \pm 0.01 a
B (dragon fruit peel 20%)	0.63 \pm 0.00 b
C (dragon fruit peel 25%)	0.95 \pm 0.01 c
D (dragon fruit peel 30%)	1.10 \pm 0.00 d
E (dragon fruit peel 35%)	1.58 \pm 0.01 e

CV = 10.54%

Table 7:-Vitamin C Content of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Vitamin C (mg/100g) \pm SD
A (dragon fruit peel 15%)	0.08 \pm 0.01 a
B (dragon fruit peel 20%)	0.09 \pm 0.00 b
C (dragon fruit peel 25%)	0.10 \pm 0.01 c
D (dragon fruit peel 30%)	0.11 \pm 0.00 d
E (dragon fruit peel 35%)	0.12 \pm 0.01 e

CV = 4.03%

Table 8:-Antioxidant Activity of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Antioxidant Activity (%) \pm SD
A (dragon fruit peel 15%)	20.47 \pm 0.35 a
B (dragon fruit peel 20%)	25.03 \pm 0.06 b
C (dragon fruit peel 25%)	31.13 \pm 0.12 c
D (dragon fruit peel 30%)	36.77 \pm 0.06 d
E (dragon fruit peel 35%)	38.97 \pm 0.06 e

CV= 0.56%

Table 9:- Betacyanin Content of Ambarella Fruit Syrup with Addition of Dragon Fruit Peel Juice

Treatments	Betacyanin (mg/100g) \pm SD
A (dragon fruit peel 15%)	0.20 \pm 0.00 a
B (dragon fruit peel 20%)	0.30 \pm 0.00 b
C (dragon fruit peel 25%)	0.45 \pm 0.05 c
D (dragon fruit peel 30%)	0.65 \pm 0.05 d
E (dragon fruit peel 35%)	0.75 \pm 0.05 e

CV = 1.65%

Note: The numbers on the same lane followed by unequal letters are significantly different according to DNMR at a real 5%

Physical Properties of Ambarella Fruit Syrup with Dragon Fruit Peel Juice Addition:-

Viscosity Test:-

The result of the statistical analysis showed that the addition of dragon fruit peel juice gave a significantly different effect on the viscosity of ambarella fruit syrup at $\alpha = 5\%$. The average viscosity value of the syrup can be seen in Table 2.

The viscosity of ambarella fruit syrup with the addition of dragon fruit peel juice ranged between 3.64 cP - 5.63 cP. According to Bird (1987), the viscosity of syrup is due to a large number of hydrogen bonds between the hydroxyl (OH) groups in the dissolved sugar molecules and the water molecules that dissolve them. In this ambarella fruit syrup, it was suspected that the consistency of the syrup was the dissolution of sugar into the water during heating process, the addition of CMC, with the addition of dragon fruit peel juice with different concentrations, and the pectin content in dragon fruit peel (Jamillah et al. , 2011). So the higher the addition of dragon fruit peel juice then the viscosity of the syrup was increased. The viscosity value of the syrup was higher than the viscosity of another syrup that has been tested, *Marjan* syrup had a viscosity of 1.64 cP. This showed that the fruit syrup is more viscous than *Marjan* syrup that sold in the market.

Total Soluble Solids:-

The result of the statistical analysis showed that the addition of dragon fruit peel juice gave a significantly different effect on the total soluble solids of ambarella fruit syrup at $\alpha = 5\%$. The average value of total soluble solids of ambarella fruit syrup with the addition of dragon fruit peel juice can be seen in Table 3.

The analysis result of total soluble solids of ambarella fruit syrup with an addition of dragon fruit peel juice with highest value found in treatment E (addition of dragon fruit peel 35%) of 73,50 ° Brix and the lowest total soluble solid found in treatment A (addition of dragon fruit peel 15%) of 49.50 ° Brix. Increased total soluble solids due to decreased moisture content and increased insoluble components during the process (Herawati, et al., 2005). The components measured as total soluble solids are sucrose, reducing sugar, organic acids, and protein (Muafi, 2004). According to Setyowati (2004), the value of total soluble solids is closely related to viscosity. The higher the value of total soluble solids the higher the viscosity.

Chemical Characteristics of Ambarella Fruit Syrup with Dragon Fruit Peel Juice Addition

pH:-

Based on a statistical test of acidity of ambarella fruit syrup with dragon fruit peel juice addition showed a significant difference at level ($\alpha = 5\%$). From the data in table 4. the more the addition of dragon fruit peel juice then the resulting pH was increased. Foodstuffs based on the pH value are grouped into 3, namely low acid food (pH above 5.3), medium acid food (pH 4.5-5.3) and high acid foodstuff (pH less than 4.5) (Fardiaz, 1993),. In this case, the pH of ambarella fruit syrup is classified as a high acid food.

Total Sugar:-

The average value of the analysis of total sugar of ambarella syrup with the addition of dragon fruit peel juice can be seen in Table 5. Based on the statistical test the ambarella syrup with the treatment of dragon fruit peel juice addition showed a significant difference at the level ($\alpha = 5\%$). The more the addition of dragon fruit peel juice the lower the total sugar content in the syrup produced. Decreased in total sugar content can be caused by the amount of water contained in the syrup also increased with the addition of dragon fruit peel juice. The amount of sugar was same in each treatment, while the water content derived from the addition of the dragon fruit peel juice continued to grow so that the proportion of sugar to the syrup became lower with the more dragon fruit peel juice added. Therefore, the total sugar content of the ambarella fruit syrup decreased as the amount of dragon fruit peel juice added.

Based on the SNI 01-3544-2013, the total sugar content of syrup is at least 65%, the sugar content of the fruit syrup with the addition of dragon fruit peel juice obtained with the highest value of 41.26%, it indicates that the ambarella fruit syrup does not meet the SNI.

Total Acid:-

The average total acid can be seen in Table 6. Based on a statistical test of total acid of ambarella syrup with dragon fruit peel juice treatment showed a significant difference at level ($\alpha = 5\%$). The more the addition of dragon fruit peel juice the higher the total acid. Based on the analysis of dragon fruit peel raw material contains total acid 0.95%. The total acid is inversely proportional to the pH, the higher the total acid the lower the pH and vice versa. The total acid content is high in line with the decrease in pH (Alakali et al., 2008). The pH value of ambarella fruit syrup with the addition of dragon fruit peel juice caused by the presence of organic acids in the ambarella fruit and dragon fruit peel juice.

Vitamin C:-

The results of variance showed that the addition of dragon fruit peel juice gave a significant effect on vitamin C content in ambarella syrup. The content of vitamin C in ambarella fruit was high, but in this case, the processing of syrups through the heating process that can lead to decreased levels of vitamin C contained in the syrup. The average vitamin C content obtained from the analysis can be seen in Table 7.

According to Winarno (1991), vitamin C is the most easily damaged vitamin compared with other types of vitamins. Besides being highly soluble in water, vitamin C is easily oxidized and the process is accelerated by heat, rays, alkalis, enzymes and other oxidizers. Therefore, the vitamin C content contained in ambarella fruit syrup possibility decreased when it processed into syrup ambarella fruit, vitamin C damaged by processing. The more a foodstuff through the process of processing, it will be reduced the nutritional value or vitamins contained in the material.

Antioxidant Activity:-

Based on analysis of variance showed that the addition of dragon fruit peel juice gave a significant effect ($\alpha = 5\%$) on antioxidant activity of ambarella syrup. Analysis results of antioxidant activity can be seen in Table 8. The antioxidant activity was higher along with the increased of dragon fruit peel juice addition. Table 9. in the betacyanin analysis showed that the higher the dragon fruit peel juice added, the higher the betacyanin content found in ambarella fruit syrup, thus affecting the antioxidant activity obtained.

Betacyanin:-

Based on the analysis of variance showed that the addition of dragon fruit peel juice gave a significant effect ($\alpha = 5\%$) on the content of betacyanin on ambarella syrup. The results of this analysis can be seen in Table 9.

In the analysis of dragon fruit peel raw material betacyanin pigment found around 1.05%, but on ambarella syrup obtained the average value of betacyanin ranged from 0.20% to 0.75%. This was because of betacyanin susceptible to pH. Thus, the content of betacyanin was lower than the raw material of dragon fruit peel. As stated by Fadillah (2015), citric acid can affect betacyanin content in dragon fruit peel. This is because the stability of betacyanin is strongly influenced by pH (Azeredo, 2009)

Conclusions And Suggestions:-**Conclusion:-**

Based on the research result that has been done it can be concluded that the level of dragon fruit peel juice in ambarella fruit syrup gives significant effect on pH, viscosity, vitamin C, total acid, total soluble solids, total sugar, antioxidant activity and betacyanin.

Suggestions:-

Based on the research that has been done, the authors suggest the next researcher conduct further research on:

1. Need to do an organoleptic test and microbiological analysis on ambarella syrup with dragon fruit peel juice addition.
2. Need to observe the proper addition of sugar in the making of syrup, so as to meet the SNI syrup

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