

**INFLUENCE OF STABILIZER TYPE AND THE CONCENTRATION  
OF SUCROSE AGAINST CHARACTERISTICS OF  
THE BLACK MULBERRY JAM  
(*Morus Nigra Sp.*)**

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**ARTICLE**

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THE BLACK MULBERRY JAM  
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**ABSTRACT**

*The purpose of this research was to study the influence of a kind of stabilizer and concentration sucrose to Black Mulberry jam characteristic. The benefit of research is would add knowledge and skill on extracting black mulberry fruit as a jam, viewed from the perspective of economy would help the farmers and traders in process of black mulberry to improve his life and could become information about black mulberry jam to public contain many healthy nutritional value.*

*The design that used in this research was 3 x 3 factorial in Randomized Block Design (RAK) with 3 time replication. First factor were type stabilizer (P) consist of Pectin ( $p_1$  0,2%), Gelatine ( $p_2$  0,6%) and Gom Arab Powder ( $p_3$  0,10%). Second factor were concentration sucrose (S) consist of  $s_1$  (25%),  $s_2$  (30%) dan  $s_3$  (35%).*

*There was used the parameter including chemical analysis, which were conducted for vitamin c content, the water level content, and total sugar content, physical test to viscosity, also organoleptic test based on the pleasure test concerning colour, taste, texture and the visibility.*

*Result of this research showed that product with treatment  $p_3s_3$  (0,6% gelatine and 3% concentration sucrose) was the best sample with 59,26% water content, 395% texture and 3308,30 antioxidant activity. Of these results can be seen that characteristic of jam elected not comply with contained in SNI because this is not based on figures applied by SNI.*

*Keyword : Jam, Black Mulberry, Stabilizer, Sucrose.*

**INTRODUCTION**

Indonesia has a lot of variety of fruits, ranging from fruits that can be obtained throughout the year e.g. banana, pineapple, soursop and other seasonal fruits, such as mango, durian, and others, or fruits that emanate from the colder regions such as strawberries and apples.

The fruit is a commodity that is easily damaged. Nature easy damaged or rotten this often resulted in losses for farmers or fruits. Losses that arise vary for each type of fruit that can occur at the time of harvesting, storage, transport, or to heating.

Fruits can be used for many kinds of processed foods so that it can be consumed in other forms that are more nutritious and can be consumed in the future without reducing the value of its nutrition value, one of which, namely the black mulberry fruit.

Black Mulberry is an annual plant that originated in China. This plant is cultivated because its leaves are the main food of silkworms is. Currently there are 45,085.5 Ha land Black Mulberry in Indonesia and about 9,000 hectares of which are contained in Bandung, West Java. Until 2005 the vast acreage of crops Black Mulberry in East Java reaching 540 ha and is expected to

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always increase every year (Director General of Forestry, 2005).

Judging from the fact, the plant is able to contribute a considerable production but in terms of its utility in the country is still very minimal.

Black Mulberry (*Morus Nigra* Sp.) is a plant that can bear fruit throughout the year. However, the utilization of Black Mulberry leaves only as alone as silkworms feed, while the unfortunate especially since it's not silk textile-producing regions then the Black Mulberry only utilized as garden plants. Therefore Black Mulberry is very potential for food products with high selling price. Judging from his physical character, Black Mulberry is a fresh sweet taste fruit are red to blackish, and the Black Mulberry has relationships with levels of up to 1993mg/100 g the relationships which acts as a source of antioxidants (Astawan, 2008).

Black Mulberry contains essential nutrients that can improve health. Nutrients in the Black Mulberry include protein, carbohydrates and vitamins and minerals such as calcium, phosphorus, potassium, magnesium, potassium, and fiber. High water content on Black Mulberry fruit as well as low in calories. One cup of Black Mulberry equals 60 calories.

Black Mulberry contains anthocyanin, which is a kind of high antioxidant that can help maintain the immune system, prevent cancer, and diabetes. High levels of vitamin C and flavonoids is a good supplement to cope with flu and immunity of the body.

Black Mulberry can be used for many kinds of processed foods so that it can be consumed in other forms that are more nutritious and can be consumed in the future without reducing the value of its nutrition value, for example by way of mengawetkannya. One way to preserve fruit Black Mulberry by means of the creation of "jam" or commonly known as jams.

Jam or often called "fruit jams" is a semi solid food which made from pureed fruits mixed with 35 to 45 part sugar and heated until the sugar content ranges from 30 to 65%. Basically all types of ripe fruits can be processed into jams. But commercially noteworthy consumer tastes before processing the fruit into jams for commercial purposes, because not all the fruit, once processed, have favored taste.

Jam is a food product in the shape of a half solid and made of a mixture of sugar and fruit. Young fruit cannot be used for the manufacture of jams due to low pectin content. Fruit maturity criteria that can be used to make Marmalade is a fruit which is ripe, there are no signs of spoilage, contains pectin and acid enough to produce a good jam.

According to Desrosier (1988) in the research of Yulistiani (2013) on "the role of the Pectin in the manufacture of Purple sweet potato Jam", a mechanism that occurs in the formation of the gel in the manufacture of jams is a mixture of pectin, sugar, acid and water. Where is the addition of sugar will affect the balance of pectin-air and negate the appearance of pectin. Pectin will be lumpy and form a delicate fibers. The structure is able to withstand fluid. Continuity and density of fibers that are formed is determined by a multiplicity of levels of pectin, if increasingly high levels of pectin is added to the solid structure of the fibers anyway.

The stubbornness of the fiber network is affected by the sugar levels. The higher levels of sugar are added then reduced the water held back by the structure. The fiber density is determined by the asiditas substrate is added. High Asiditas will form a dense gel structure but it can also damage the structure of the network due to hydrolysis of the pectin, but if asiditasnya is too low then the wire will be weak in its formation. The optimum condition of formation of

the gel pH 3.2, 1% content of pectin and sugar levels 30%.

The formation of the gel on the jam-influenced by the concentration of pectin, and the concentration of sugar. The addition of sugar will affect the balance of pectin. Sugar is commonly used for a food preservative because the sugar is hygroscopic in nature or absorb water so that the bacterial cells will dehydrate and eventually die.

The concentration of sugar used in the manufacture of jams in addition are giving sweet flavor also affects the texture, appearance and flavor.

stabilizer is a function of maintaining the stability of the emulsion. The workings of the stabilizer material is lowering the surface tension by means of forming a protective layer surrounding the dispersed phase globula so insoluble compounds will more easily dispersed in the system and is stable (Fennema, 1985).

There are two types of stabilizer type i.e. gelatin and stabilization of plants. Stabilizer is a type of gelatin derived from animal, whereas the stabiliser of a plant that is commonly used is pectin, sodium alginate, gelatin, gum, CMC and other such tragakan, karaya, guar, and others

Gelatine is a food additive with the value the market ranges from 60,000 to 70,000 rupiah. In Indonesia, a food additive used to affect the nature or form of the food so that it is in its use adjusted according to his needs. The industry's most widely utilizing the gelatin is the food industry. In the food industry, according to Poppe (1992) in Setiawati (2009) gelatine used as whipping agent, binder agent, stabilizer, gelling agent, adhesives, viscosity agent, emulsifiers, finning agent, crystalmodifier, and thickener.

Pectin is a natural ingredient contained in the fruits. Content of pectin in the fruit are all generally higher at the

time of half-cooked fruit, and decreased at the time of the full ripe fruits and cooked through. The formation of the gel during processing in the manufacture of jam or hours depending on the content of pectin in the fruit pulp. Some types of fruit contains pectin which is high, so there is no need to add pectin into fruit pulp on the process of formation of the gel.

According to research by Meliala dkk (2014) stated the results of research on "the effect of the addition of red beans and Gum Arabic Stabilizer Against the quality of the corn Milk" gum Arabic is produced from the SAP of Acasia trees assortment SP. in the Sudan and Senegal. Gum Arabic is essentially a series of units of D-galactose, L-arabinosa, D-galakturonat acid and L-ramnosa. Molecular weight of between 250,000 up to 1.000.000. Gum Arabic is far more easily soluble in water than other hidrokoloid. On processed food that contains a lot of sugar, gum Arabic was used to encourage the formation of an emulsion of fat steadily and prevent crystallization of sugar. Gum Arabic can improve stability with increased viscosity. The type of thickener is also heat resistant on a process that uses heat but it is better if the heat is controlled to shorten the warm-up time, given the gum Arabic can be degraded slowly and lack of efficiency of the emulsifikasi and viscosity.

The intent of the research was to study the influence of different types of stabilizers and concentration of sucrose so obtained types of stabilizers and concentration of sucrose and effect on the characteristics of the black mulberry jam.

The purpose of this research is to know the influence of sucrose concentration and stabilizer type against a black mulberry jam characteristics.

## MATERIALS AND METHODS OF RESEARCH

### Materials and Tools

The materials used for the manufacture of jam is the fruit of the mulberry (black mulberry), which in may from Cibodas, Lembang, water, sucrose (sugar) and citric acid obtained from traditional markets, as well as a stabilizer in the form of pectin, gum Arabic, and the gelatin obtained from Chemical Bratacho Stores and pastry shops. The materials that are used for chemical analysis is aquadest, amylum, toluen, KI, H<sub>2</sub>SO<sub>4</sub>, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, I<sub>2</sub>, a solution of Luff Schoorl, KI, HCl, Indicator PP, NaOH, DPPH (2,2-Diphenyl-1-picrylhydrazyl) of 0, 1 m phosphate buffer, enzyme termamyl 0.1 M, ethanol 95%, acetone.

The tools used for making jam, namely, weights, prevents the blade destroyers, containers, pots, stoves, spatula, spoon, and jar. The tools used for chemical analysis, namely an Erlenmeyer flask 100 ml flask, measuring condenser flask, pipette pipette drops, volumetri, filter paper, beaker, distillation, onto a stand, clamps, bure, stove, bath, digital scales, viscometer, UV spektrofotometer.

### Research Methods

The method of research conducted consisted of two stages, namely the preliminary research and primary research.

The purpose of this preliminary study is to know the content of antioxidants found in fruit pulp of Black Mulberry. So at the time of testing the antioxidants on the finished product can be known antioxidants in products are declining or not

Primary research on researchers conducting experiments to determine the concentration of sucrose that is 25%, 30%, 35% and type of stabilizer that is 0.2% pectin, gum Arabic 0.10%, and 0.6% gelatin.

The design of treatment on this research consisted of two factors, namely: the stabilizer type consists of 3 levels and concentration of sucrose that consists of 3 levels.

Factors of the treatment:

- a. type of stabilizer (P), consists of three levels, namely:

Pectin (p1) = 0.2%

Gelatin (p2) = 0.6%

Gum Arabic (p3) = 0.10%

- b. concentration of sucrose (S), consists of three levels, namely:

S1 = 25%

S2 = 30%

S3 = 35%

The design of the experiments conducted in this study was a Randomized Block Design (RAK) factorial pattern 3 x 3 with 3 repetitions. Model experiment for this research are as follows:

$$Y_{ijk} = \mu + K_j + S_i + P_j + (SP)_{ij} + \sum_{ijk}$$

Where:

Y<sub>ijk</sub> = observations to factor P levels i, factor S extent to j to k group

μ = the Middle Value (the actual average) of the value of the observation

K<sub>j</sub> = k to group Influence

The influence of sucrose concentration factor = on to level j

P<sub>j</sub> = influence of type of stabilizer on extent to the i

SP<sub>ij</sub> = influence of interactions of PS on level i (from the P factor), and the extent to j (from the S-factor)

∑<sub>ijk</sub> = random Influences (experimental error) on the extent to-i, (L factor, to the extent the j, S), the interaction of the PS to the i and the j (Gasperz, 1995).

The chemical response of Mulberry fruit Marmalade products are: Analisis Vitamin C Iodometri method, analysis of water content Analisis method of Distillation, sugar levels Luff

School method, antioxidant (selected products).

Physical response does is to test the level of viscosity .

Organoleptik response done to know the level of fondness from panelists against the product. This is done by organoleptic method of reception quality scale, i.e. hedonik, where the assessment criteria based on the level of fondness panelists against characteristics of the Black Mulberry jam.

Research Procedure

Research Introduction

1. Sorting

Sorting was carried out to separate the Black Mulberry fruit of good quality, and that's no good, rotten fruit, like for example not too ripe, and disabled.

2. Leaching

Laundering aims to remove dirt that clings to the Black Mulberry fruit good soil, residual insecticide and fungicide, and gained a good appearance. Black Mulberry fruit-washing can be done by using the hands.

3. The destruction of

Black Mulberry fruit after washing done, next is the process of destruction. Input the mulberry fruit into a blender and then do the destruction of Black Mulberry fruit until completely smooth.

**The Main Research**

1. Sorting

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4. Mixing

Black Mulberry fruit already smooth then added, sugar and stabilizers such aspectin, gum Arabic, gelatin. Then do the mixing back manually to a homogeneous dough.

5. Cooking

Black Mulberry fruit pulp that was done mixing, cooking was done next with the goal of keeping at the time of ripening process takes place then it will happen hot process, where the process of the heat can help the Black Mulberry fruit pulp in the formation of a gel.

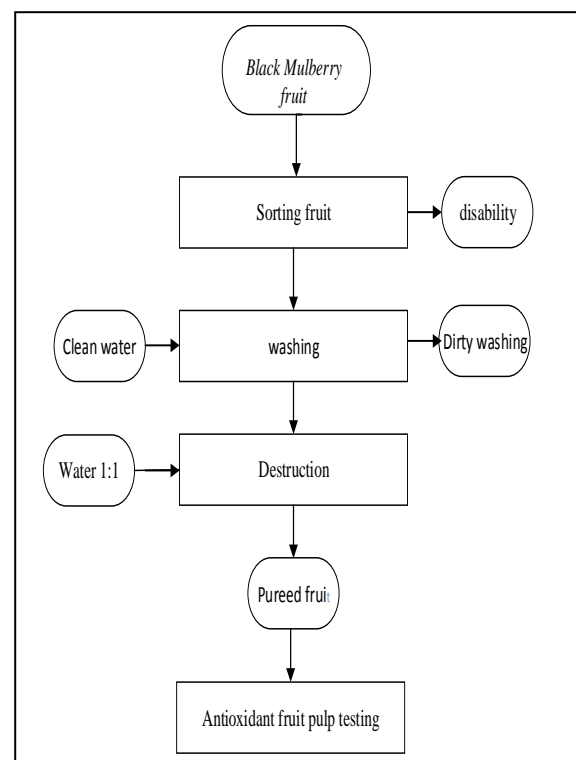


Figure 1. Preliminary Research Flowchart

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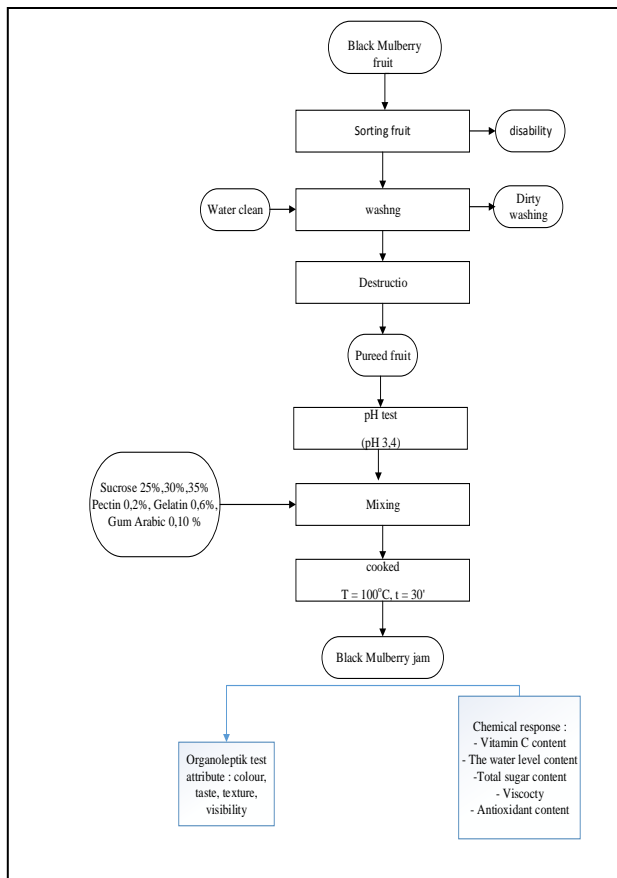


Figure 2. Major ResearchFlowchart

## RESULTS AND DISCUSSION

### Preliminary Research Results

Preliminary research was conducted to find out the antioxidant content in the pulp of the fruit of the Black Mulberry. Preliminary study on conducted tests using the DPPH antioxidant activity against Black Mulberry fruit which had been destroyed be pureed fruit, fruit pulp that will be further processed into jam Black Mulberry.

Determination of antioxidant activity in fruit pulp of Black Mulberry is calculated by finding the results as IC50. IC50 is the value that shows the ability of inhibition of the oxidation process by 50% of a sample concentration (ppm) (Maliandri, 2012).

Based on the above analysis of the results obtained on the IC50 value of pureed fruit Black Mulberry of 283.35907 ppm. IC50 is the concentration of the substrate solution or

sample that is able to reduce the activity of the DPPH by 50% or IC50 arguably number which indicates the concentration of extract (ppm) which is capable of inhibiting the oxidation process by 50%. The IC50 value of the smaller shows are getting the high antioxidant activity. A compound is said to have antioxidant activity sangan IC50 values are stronger if less than 50 ppm, a powerful antioxidant for IC50 value 51 to 100 ppm, IC50 values are antoksidan 101 to 150 ppm, and antioxidants is weak if worth 151 to 200 ppm (Maliandari, 2012). The results of the analysis of the Black Mulberry fruit pulp has a 238.35907 results, which indicate that the antioxidant activity in fruit pulp contains the category is weak.

The underlying strong case or whether the values of IC50 against antioxidant activity can be affected by the nature and composition of the fruit of the womb. As for the underlying factor is the plant, composed of three factors, namely a factor in, out, and degree of ripeness. Factor in genetic matters covering, this is an inherited trait parent plants, such as taste, smell, chemical composition, and bio-production capabilities. Plant varieties or types of cause also differences properties, such as taste, smell, chemical production and the amount of content that is produced. Next is the outside factors that also affect the nature, composition, appearance (morphology), as well as the production of bio-era of the crop much influenced by factors of cultivation, care, and the environment such as light, temperature, season, and nutrient elements which are available. The last is a different level of ripeness that result in a difference in the nature of the results, such as physical, chemical, or biological plant itself. The difference is especially noticeable in the constituent substances content, texture, and colour (Siswanto, 2004).

### The Main Research Results

Primary research is the research of preliminary research begins by destroying the Black Mulberry fruit into pulp the fruit will then be made into jams and conducted chemical analysis and physical analysis.

The manufacture of jams made from the fruit of the Black Mulberry was performed according to the formulation that was made based on the pattern of factorial. As for the formulation used to jam Black Mulberry are kind of stabiliser of pectin (i.e. 0,2%), Gum Arabic (0.10%) and Gelatin (0.6%), then there is also concentration of sucrose that is used that is 25%, 30% and 35%.

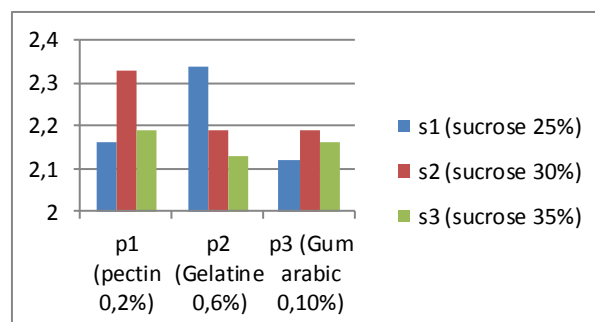
The analysis performed for this Black Mulberry jam i.e. chemical analysis includes testing the levels of vitamin C, test the moisture content using the method of Distillation, and test your sugar levels using the Luff School method. Analysis of physics include the Viscosity test, and organoleptic response against the color, texture, taste, and visibility. As well as the analysis of antioxidant activity of product selected.

#### 4.2.1. Organoleptic Results

##### 4.2.1.1. attribute Color

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the type of stabilizer, and sucrose concentration factor, as well as the interaction between the types of stabilizers and concentration of sucrose has no effect against the organoleptic attributes of the real color of Black Mulberry jam products generated, so no further testing done Duncan. The absence of a real difference on the treatment because the types of stabilizers and concentration of sucrose added to product jams have no influence on color change, so there is no noticeable difference against the color of Marmalade.

Figure 3. Graph Of Organoleptic Color Against The Jam



Based on the graph above it can be seen that the results of the biggest influence of types of stabilizers and concentration of sucrose sucrose concentrations are present in 25% of stabilizers gelatin. In addition the results of the next largest concentrations of sucrose 30% pectin stabilizer type. From the results of the graph shows the difference in the range of values between types of stabilizers and concentration of sucrose that far enough so the lack of any real influence against organoleptic at jams. The addition of stabilizers do not affect real against the color Black Mulberry jam due to the use of the stabilizers is relatively low and there is no discoloration caused by levels of anthocyanin of Black Mulberry are big enough that is 147.68 to 2725.16 mg/100 g. According to Fachruddin (1997) stabilizer needed to establish consistency in the product jams. The ideal amount of stabilizer for the formation of a gel range 0.75 to 1,5%. The greater the concentration of stabiliser, hard gel is formed. Soluble stabilizer be lumpy if plus water and sugar and acid in the circumstances given the treatment of warming.

The concentration of sucrose added to Black Mulberry jam has no effect against the real color of Black Mulberry jam. It is because sucrose is added to the jam gives only sweetness can not change the color. Sucrose can undergo caramelization reaction when heated in a high temperature and in quite a long time. But if sucrose on jam experience caramelization discoloration



that occurs not too significant, caused because of the color of the Black Mulberry itself can cover the sucrose terkaramelisasi color, the color of the Black Mulberry itself has a very thick purple color.

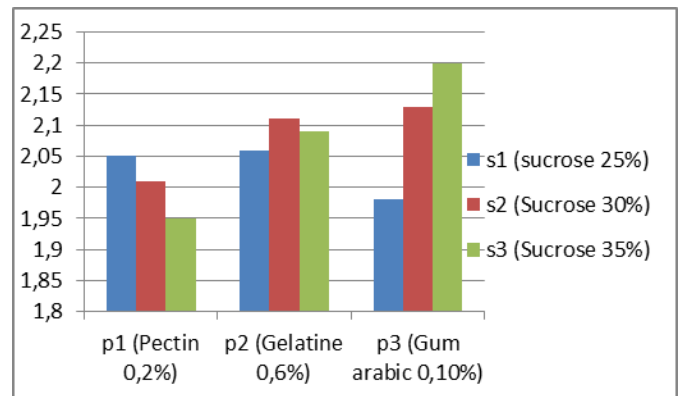
Another thing that causes no effect organoleptic coloration is on testing against the panelists themselves. The color resulting from the Black Mulberry jam itself has a dark color that is purple. Of all samples no one delivers a pretty color look striking though with the addition of stabilizer type and the concentration of sucrose, it is causing panelists argued that all the colors in the sample have the same color capacity. Any Panelist factor effect, because the panelists used in this test are somewhat trained panelists, so the panelists have yet to understand very well how to distinguish the color from a sample of the product.

Color is one of the factors that determine the quality of the appearance of food ingredients, along with other factors such as the shape and size. The color of the food depends on the appearance of these food ingredients, food ingredients and the ability to reflect, absorb, distribute, or forward the rays looked (Desrosier, 1988).

#### 4.2.1.2. The flavor Attribute

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the type of stabilizer, and sucrose concentration factor, as well as the interaction between the types of stabilizers and concentration of sucrose has no effect against the organoleptic attributes of a real sense of the Black Mulberry jam products generated, so no further testing done Duncan.

Figure 4. Graph Of Organoleptic Flavor



Based on the graph of organoleptic flavor of Black Mulberry jam retrieved the highest value 2.20 with criteria of "strong" and it means the flavors of jam is pretty sweet and the taste of the Black Mulberry itself still feels, while the lowest average value obtained 1.95 criteria "somewhat weak" and that means the sweetness of the jam itself less and taste of Black Mulberry itself is not too strong.

The addition of stabilizers with different concentrations of no effect against a real sense of Black Mulberry jam. Stabilizer does not have a sharp taste and it only as a shaper of the gel. According to Sakidja (1989) in addition to the ability to form a gel, the nature of the second stabilizer that is very important is the stabilizer acts as an emulsifier. Therefore, the stabilizer can not affect the taste and serve only as the formation of the gel on the Black Mulberry jam.

The addition of sucrose has no effect against the real flavor of the jam Black Mulberry jam-making process because the materials used not only sucrose and yet there is the addition of other ingredients. In addition to every addition of sucrose treatment between treatments with each other the amount of sucrose was not the same. However, in the manufacture of jam sugar not only as a sweetener but can also be used as a preservative, to obtain the texture, appearance and flavor of the ideal (Fachruddin, 1997).

Influence of addition of sucrose and stabilizer against the Black Mulberry jam flavors shows that the addition of stabilizers and sugar do not affect the real flavor of the Black Mulberry jam, because in the process of making jam, sugar and stabilizers used are not the same between the treatment of one to nine treatment. So the results obtained vary in accordance with the addition of sugar and stabilizers respectively of each treatment. John m. deMan (1997) States the sweetness of sugar and compound nature is like. While the gel acts as a stabilizer or thickener. Thus the sucrose and stabilizer does not interact with one another on a Black Mulberry jam.

4.2.1.3. Power Brush Attributes

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the type of stabilizer, the concentration of sucrose, and the interaction between the types of stabilizers and concentration of sucrose effect on power brush Black Mulberry jam products produced, so further testing done Duncan.

Table 1. Influence of Stabilizer Type Interactions (P) and the concentration of Sucrose (S) against the texture of the Black Mulberry Jam.

Stabilizer Type (P)	Concentration Of Sucrose (S)		
	25% (s <sub>1</sub> )	30% (s <sub>2</sub> )	35% (s <sub>3</sub> )
Pectin 0,2% (p <sub>1</sub> )	4,60 A a	5,25 A b	5,25 A b
Gelatine 0,6% (p <sub>2</sub> )	4,85 B a	4,38 A a	5,17 A b
Gum arabic 0,10% (p <sub>3</sub> )	4,42 B b	4,40 A a	3,95 A b

Description: \* Each different letters shows the real difference for each treatment on Test Duncan real standard of 5%.

\* Capital letters on a line is read vertically and lower case letters in a column is read horizontally.

Based on a test of ANAVA, the value F calculate the addition of stabilizer against the texture of the Black

Mulberry jam influential real power against oles jam Black Mulberry. According to Winarno (1997) one of the purposes of the giving of the stabilizer material is to increase the thickness of the material or product so that it serves as a thickener and stabilizer Shaper-power brush on jam. Based on above, the addition of stabilizer against the organoleptic results against the power brush is in line with the results obtained on the organoleptic.

Based ANAVA, the value F count on adding sucrose against powerbrush jams Black Mulberry real power against the influential oles Black Mulberry jam. The addition of sucrose effect real power against of texture Black Mulberry jam because sucrose on making jam are able to draw water in the jam so that water contained in a jam will decrease causing the texture from the Jam will turn lumpy. It also serves as a giver of sucrose taste at once natural preservative. Sucrose added to foodstuff with a high concentration (at least 30% of dissolved solids) will bind to the water so that the water activity becomes diminished. The reduced water activity will affect the growth of microorganisms, the less water activity then the less likely microorganisms to live.

The influence of interaction of sucrose and stabilizer against the texture of the Black Mulberry jam shows that there is an interaction of these two factors. This occurs because the granting of material stabilizers is to increase the thickness of the material or the processed products so that it serves as a thickener and stabilizer Shaper texture in jams. Whereas sucrose has the nature of reaction can cause Browning caramelization and the Maillard.

4.2.1.4. Appearance Attributes

The average value of the Black Mulberry jam appearance obtained value of 2.24 to 2.45. The highest median value obtained of 2.45 criteria "Very

powerful", while for the lowest average value obtained 2.24 criteria "rather weak".

Table 2. Influence Of Stabilizer Type (P) Against The Appearance Of The Black Mulberry Jam.

Stabilizer Type	Average
p <sub>1</sub>	2,24 a
p <sub>2</sub>	2,31 b
p <sub>3</sub>	2,45 c

Description: the average value of the different letters followed shows the real difference at test level with Duncan advanced 5.

Based on a test of ANAVA, the value F calculate the addition of stabilizer against the Black Mulberry jam favorite level obtained the results of the effect is real. The addition of a stabilizer in the manufacture of Black Mulberry jam is to acquire texture, appearance and smell of the ideal.

The main factors affecting the power received to food stimuli is the flavor of the food. The addition of sucrose in the manufacture of jams is to acquire the appearance and flavor. However, in this study the addition of sucrose on the making of the Black Mulberry jam is more so his number level of fondness panelists tend to like it because the flavor of the jam was too sweet and reduce the taste typical of the Black Mulberry itself.

The influence of interaction of the addition of stabilizers and sucrose on the horizon against the Black Mulberry jam shows the result of the interaction of the addition of stabilizers and sucrose have no effect against the real level of fondness of Black Mulberry jam. It basically gives the sweetness of sucrose on jams and stabilizer helps in thickening process. The main factors that ultimately affect power received against the Black Mulberry jam flavors of stimulation is evoked by the Black Mulberry jam. Resulting in a flavor that fits on a Black Mulberry jam so much liked by the

panelists if the given proportion of sugar is not too high.

4.2.2. The results of the chemical analysis

4.2.2.1. The levels of Vitamin C

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the stabiliser (P), and the concentration of sucrose (S) influence on the levels of vitamin C from the resulting products until further testing is done Duncan. While the interaction between factors in the type of stabilizer and concentration of sucrose did not affect levels of vitamin C products that are produced, so as not to further test done Duncan.

Table 3. Influence Of Stabilizer Type (P) Against The Levels Of Vitamin C Black Mulberry Jam

Stabilizer Type (P)	Average
p <sub>1</sub>	3,69 a
p <sub>2</sub>	3,17 a
p <sub>3</sub>	2,75 b

Description: the average value of the different letters followed shows the real difference at test level 5 Duncan details.

Table 4. The Influence Of Sucrose Concentration (S) Of The Levels Of Vitamin C Black Mulberry Jam

Stabilizer Type (P)	Average
s <sub>1</sub>	3,49 a
s <sub>2</sub>	3,19 a
s <sub>3</sub>	2,93 b

Description: the average value of the different letters followed shows the real difference at test level 5 Duncan details.

Table 3. indicates that the type of different stabilizers have a different influence against the levels of vitamin C than Black Mulberry jam. The greatest vitamin C levels in the p<sub>1</sub> (pectin stabilizer 0.2%) with an average value of 3.69% and lowest in the stabilizer (gum Arabic p<sub>3</sub> 0.10%) with an average value of 2.75%. Stabilizer is extra raw materials usually used in making jam because it has properties which can be kind of stabilizer, and

agglomerate also can maintain the levels of vitamin C in the jam. So that the addition of a different type of stabilizer will increasingly affect the levels of vitamin C Black Mulberry jam.

Jam has a paste-like consistency is mainly influenced by three factors, namely, sugar, pectin and acid. One pectin stabilizer can be obtained from berries by means of warming, but excessive warming would damage its ability to form gels especially in fruit is very sour due to the occurrence of hidrolisa pektat acid pectin (Muchtadi, 1980).

From table 3 Note that the use of different types of stabilizers and different sucrose concentrations affect the levels of vitamin C than Black Mulberry jam. At low pH then the stabilizer capable of interaction with vitamin C.

In table 4 it can be seen that the concentration of sucrose gives real influence against the levels of vitamin C, where the levels of vitamin C tend to decrease with more concentration of sugar is added. This is because the comparison of vitamin C in fruit juice against the lower with increasing concentration of sucrose added. The concentration of sugar is added then dissolved elements in products will increase as well as an increase in the temperature of the heating water content lead to many who undergo evaporation and increasing pH. According to Desrosier (1988), sugar can reduce water in ripening product, because sugar can decrease the water held in the structure of the material.

The interaction between the types of stabilizers and concentration of sucrose that are added to the Black Mulberry jam delivers real has no effect. It happened because of stabilizer and sucrose are not able to unite to maintain levels of vitamin c. the nature of the stabilizer itself is neutral sehigga does not have any response against vitamin

C, or more stabilizer tends to be negative so it does not interact with vitamin c. Whereas sucrose to make the levels of vitamin C in the lower jam this is because sucrose is added to the higher concentration.

In addition, leading to increasingly low levels of vitamin C in black Mulberry jam because sucrose has a high boiling point IE 160°C, so the more sucrose added to cooking with high temperature will raise the temperature and long warming causing more vitamin C are damaged due to the nature of vitamin C itself is easily oxidized and easily damaged by light and high temperatures causing the levels of vitamin C decreases (Winarno, 1997).

The higher the concentration of the sucrose concentration resulted in added a mixture of pureed fruit is added, so the fewer sources of vitamin C in raw materials is also getting a little bit. Therefore, the levels of vitamin C in the smaller Black Mulberry jam.

The greatest vitamin C from this analysis are caused due to the concentration of stabiliser which can help maintain the content of vitamin C in a jam, this is because vitamin C is easy soluble in water so that the presence of this vitamin C stabilizer can be handled properly. Besides it is very soluble in water, vitamin C is easily oxidized and the oxidation process can be accelerated by heat, rays, alkali oxidizing enzymes, as well as by the catalyst of copper and iron. Because vitamin C is easily soluble in water, whereas the stabiliser has to absorb water and regular components therein, including vitamin C, so that vitamin C will be more stable because the pectin would bind the metals that are the catalysts for the occurrence of oxidation of vitamin C (Pemburuan, 2008).

#### 4.2.2.2. Moisture content

Based on the results of the analysis of the variansi ANAVA, on a

significant level of 5%, indicating that the type of stabilizer (P) and sucrose concentration factor (S) provide real influence against the Black Mulberry jam, and the interaction between the factors type of stabilizer and concentration of sucrose effect on moisture content of the product is produced, so that further tests be done Duncan.

Table 5. Influence of Stabilizer Type Interactions (P) and the concentration of Sucrose (S) against the water content (%) Black Mulberry Jam.

Stabilizer Type (P)	Concentration of Sucrose (S)		
	25% (s <sub>1</sub> )	30% (s <sub>2</sub> )	35% (s <sub>3</sub> )
Pectin 0,2% (p <sub>1</sub> )	83,87 C c	79,62 C b	72,36 C a
Gelatine 0,6% (p <sub>2</sub> )	77,42 B c	73,99 B b	66,96 B a
Gum arabic 0,10% (p <sub>3</sub> )	70,67 A c	64,72 A b	59,26 A a

Description: \* Each different letters shows the real difference for each treatment on Test Duncan real standard of 5%.

\* Capital letters on a line is read vertically and lower case letters in a column is read horizontally.

From those results showed that the addition of a different type of stabilizer can give a real influence towards water levels between treatment of the Black Mulberry jam. This is because this type of stabilizer is added to have the properties of water soluble and will coagulate when interacting with the acid and sugar (sucrose). In this case the stabilizer was added to the Black Mulberry jam interact with sugar (sucrose). Stabilizer can form a gel and has a capacity of holding water. Stabilizer will rotate and form smooth fibers and trapping air (Winarno, 1997).

The addition of different sugar concentrations shows real influence towards water levels between treatment of the Black Mulberry jam. This is due to the higher levels of sugar (sucrose) are

added, then the lower the moisture content also in the Black Mulberry jam. This situation was brought about because of the sugar (sucrose) are able to bind to the water from the material so that the amount of water will become increasingly tied to increased with increasing concentration of sugar. According to Maesaroh (1998), has the nature of sugar dissolves easily in water and has the ability to absorb water, the higher the concentration of sugar then the lower solvency and absorbance against water, as well as the lower concentration of sugar then high solvency and ability absorption becomes low.

In this experiment the interaction between type of stabilizer with the concentration of sucrose showed the influence of different real against moisture. This happens because in the formation of a gel stabilizers and sucrose are able to interact. Stabilizer can interact because of the help of sucrose in the jam, so the stabiliser can act as an additional material that can absorb water and agglomerate. Likewise with sucrose, the sucrose is able to absorb the water with the help of the stabilizer is able to agglomerate. In addition, according to Aryani (2003) the sugar has the properties of hygroscopic that can pull water in a jam. Water levels on the materials preserved fruit withdrawn from the cell, so that the moisture content in the jam. The longer the heating process is done then more water will be evaporated.

Water levels in the Black Mulberry jam crucial age length of storage and durability of the product against the growth of microbial decay. Moisture content too high will lead to jams easily damaged and have a short shelf life. When sugar is added to the Black Mulberry jam on the high levels of some existing water become unavailable for the growth of microorganisms and water activity (aw) of product jams be

reduced. However, the influence of the concentration of sugar in the aw is not the only factor that controls the growth of a variety of microbes because the basic materials that contain different components but with the same value of aw showed resilience against different microbial cell damage (Hendritomo, 2013).

Moisture content in a food need to be set, the higher the moisture content is contained in a food then the greater the likelihood of the fast food also damaged or not durable (Winarno, 1997).

#### 4.2.2.3. Sugar levels

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the type of stabilizer and sucrose concentration affect sugar levels total Black Mulberry jam products produced, so further testing done Duncan.

Table 6. Influence Of Stabilizer Type (P) Against The Black Mulberry Jam Sugar Levels.

Stabilizer Type	Average
p1	5,24 a
p2	7,05 b
p3	7,01 b

Description: the average value of the different letters followed shows the real difference at an advanced level test Duncan 5%

Table 7. The Influence Of Sucrose Concentration (S) Of The Black Mulberry Jam Sugar Levels.

Contrentation of Sucrose	Average
s1	6,31 A
s2	6,49 A
s3	6,50 A

Description: the average value of the different letters followed shows the real difference at test level 5 Duncan details

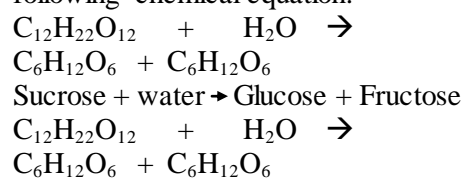
Tables 6 and 7. indicates that the type of stabilizer and different sucrose concentrations have different real influence against the sugar levels of

Black Mulberry jam. The smallest sugar levels on p1 (pectin stabilizer 0.2%) with an average value of 5.24% and the highest on the stabilizers gelatin p2 (0.6%) with an average value of 7.05%.

This is caused because the stabiliser can interact with materials and neutral or can interact with the acid. The role of stabiliser in this also may be due in part to thicken the water contained in the jams are bound, so with the help of the addition of stabilizer then sugar would not dissolve along the water contained in the Black Mulberry jam.

The concentration of sucrose on Black Mulberry jam shows different result against real jam, this happens because of several factors, in addition to that also the higher the concentration of sucrose that are added to the Black Mulberry Jam then the total sugar tends to increase. This is because the growing number of sugar (sucrose) which is hydrolyzed into sugars by the reduction of the influence of acid and heating so that the average of the total sugar in jams Black Mulberry tends to increase. Sucrose has easily hydrolyzed, disaccharides are experiencing the process of hydrolysis produces Monosaccharides. The hydrolysis of sucrose is also known as an inversion of sucrose and the result is a mixture of glucose and fructose is called "invert sugar".

Sucrose is a disaccharide composed of glucose and fructose. Whereas maltose is a disaccharide formed from two molecules of glucose. Hydrolysis can be said to be a contrast to the process of the formation of compounds. Sucrose and maltose will be hydrolyzed into the monosaccharides. The hydrolysis process can be expressed with the following chemical equation:



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Maltose + water → Glucose + Glukose

4.2.3. Analysis results of physics

4.2.3.1. The viscosity of the

Based on the results of the analysis of the variansi ANAVA, on a significant level of 5%, indicating that the only factor in the type of stabilizer, and sucrose concentration factors that influence on the viscosity of the product Black Mulberry jam but the interaction kinds of stabilizers and concentration of sucrose has no effect.

Table 8. Influence Of Stabilizer Type (P) Against The Black Mulberry Jam Viscosity.

Stabilizer Type	Average
p <sub>1</sub>	334,44 a
p <sub>2</sub>	411,11 b
p <sub>3</sub>	496,66 c

Description: the average value of the different letters followed shows the real difference at an advanced level test Duncan 5%.

Table 9. The Influence Of Sucrose Concentration (S) Of The Black Mulberry Jam Viscosity.

Concentration of Sucrose	Average
s <sub>1</sub>	388,89 a
s <sub>2</sub>	414,44 b
s <sub>3</sub>	438,88 c

Description: the average value of the different letters followed shows the real difference at an advanced level test Duncan 5%.

The data table above shows that the treatment of all kinds of different stabilizers and different concentrations of sucrose concentrations with a noticeable influence against the Black Mulberry jam viscosity as more and more types of stabilizers and concentration of sucrose in fruit jams then viscosity a the higher value or increasingly thick jam. Most likely this is due to some content of the water is absorbed by the gel, citric acid which are contributing to the formation of the gel on the stabilizer. So the more stabilizers

and added sucrose will cause more and more water also bonded with gels and jams became progressively thicker.

The greater the concentration of sugar then the higher viscosity of the Black Mulberry jam this is because the sugar has the ability to bind water, the higher the concentration of sugar then more sugar binds water where water will decrease and the solubility of the sugars increase viscosity resulting in increased Black Mulberry jam. The magnitude of viscosity is directly proportional to the number of sucrose is added, the greater the sucrose is added then the viskositasnya greater because is directly proportional to the concentration of the solution (Dahniar, 2010).

Things that can affect the viscosity of the other is the content of pectin contained in the fruit. The increase in viscosity is also caused due to the addition of stabilizers are closely related to the density of the fiber structure that is formed. Gel formation occurred at a time of warming up and by the time the viscosity or viscosity increases. This happens because the development of molecular and liquid stabilizer that previously was free flowing will be trapped inside the structure so the viscosity increases (Dahniar, 2010).

Viscosity jam only seen from the receipt of the panelists against the power of his brush only. Viscosity parameter is one of the factors that can affect the quality of jam that is texture. Jam is too thick is not a quality of a good jam, because when the jam is too thick will be difficult is applied. But when the jam is too dilute it will make jam too hard is because it is too liquid. Therefore dilute the jam is not a quality of a good Jam (Hasibuan, 2010).

4.3. Results Selected Products

Based on the determination of the selected product is done, there are samples of 9 selected samples. The selected sample was viewed from an

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overall analysis that took place namely organoleptik, physical and chemical analysis.

Table 10. Organoleptik Response Analysis Results Of Product

Code	Colour	Taste	Taste	Visibility
p <sub>1</sub> s <sub>1</sub>	4,07 (a)	4,17 (a)	4,60 (a)	4,30 (a)
p <sub>1</sub> s <sub>2</sub>	4,97 (a)	5,15 (a)	5,25 (b)	4,60 (a)
p <sub>1</sub> s <sub>3</sub>	4,38 (a)	4,75 (a)	5,25 (b)	4,80 (a)
p <sub>2</sub> s <sub>1</sub>	3, 55 (a)	5,07 (a)	4,85 (a)	4,87 (a)
p <sub>2</sub> s <sub>2</sub>	4,37 (a)	4,62 (a)	4,38 (a)	4,75 (a)
p <sub>2</sub> s <sub>3</sub>	4,07 (a)	5,18 (a)	5,17 (b)	4,88 (a)
p <sub>3</sub> s <sub>1</sub>	4,00 (a)	5,18 (a)	4,42 (b)	5,82 (a)
p <sub>3</sub> s <sub>2</sub>	4,37 (a)	5,03 (a)	4,40 (a)	5,12 (a)
p <sub>3</sub> s <sub>3</sub>	4,20 (a)	4,88 (a)	3,95 (b)	5,58 (a)

Description: the same Level at the treatment showed no real different in level 5%

Based on the table above, it can be seen that the determination of the selected products based on organoleptic features levels did not differ markedly for the entire sample, ranging from color, taste, and appearance. That is because the stabilizer and sucrose does not provide any real influence against characteristics of the Black Mulberry jam. Against color, stabilizers don't provide real influence because of the color of the Black Mulberry jam itself has concentrated, i.e. the color purple. For flavor, stabilizer does not give the impression of flavors because the stabilizer has a taste bland and sucrose added also have little influence. For appearance, this is a pretty difficult assessment because if only seen on the horizon at a glance then seen only the color purple pekatnya only. As for organoleptic power against oles, the influence of stabilizers and concentration of sucrose gives real influence with the value of the real extent of different shows.

Based on the analysis of the physics that is by testing the viscosity can be seen as follows in the table 11.

Table 11. The Results Of The Analysis Of The Physical Response Of Product

Code	Viscosity
p <sub>1</sub> s <sub>1</sub>	316,67 (a)
p <sub>1</sub> s <sub>2</sub>	336,67 (a)
p <sub>1</sub> s <sub>3</sub>	350,00 (a)
p <sub>2</sub> s <sub>1</sub>	383, 33 (a)
p <sub>2</sub> s <sub>2</sub>	406,67 (a)
p <sub>2</sub> s <sub>3</sub>	443,33 (a)
p <sub>3</sub> s <sub>1</sub>	466,67 (a)
p <sub>3</sub> s <sub>2</sub>	500,00 (a)
p <sub>3</sub> s <sub>3</sub>	523,33 (a)

Description: the same Level at the treatment showed no real different in level 5%.

Based on the table above, it can be seen that the determination of the selected products based on the analysis of physics has not adequate for real different for the whole sample. That is because the interaction of the stabilizer and sucrose did not give the real influence of viscosity against Black Mulberry jam.

Table 12. The Results Of The Chemical Analysis Of The Response Of Product

Code	Vitamin C	Water content	Sugar content
p <sub>1</sub> s <sub>1</sub>	3,84 (a)	83,87 (c)	3,68 (a)
p <sub>1</sub> s <sub>2</sub>	3,89 (a)	79,62 (b)	5,47 (a)
p <sub>1</sub> s <sub>3</sub>	3,36 (a)	72,36 (a)	6,59 (a)
p <sub>2</sub> s <sub>1</sub>	3,54 (a)	77,42 (c)	8,23 (a)
p <sub>2</sub> s <sub>2</sub>	3,23 (a)	73,99 (b)	7,05 (a)
p <sub>2</sub> s <sub>3</sub>	2,75 (a)	66,96 (a)	5,87 (a)
p <sub>3</sub> s <sub>1</sub>	3,10 (a)	70,67 (c)	7,02 (a)
p <sub>3</sub> s <sub>2</sub>	2,47 (a)	64,72 (b)	6,97 (a)
p <sub>3</sub> s <sub>3</sub>	2,68 (a)	59,26 (a)	7,04 (a)

Description: different Levels shows real different treatment on levels 5%.

Based on the table above, it can be seen that the determination of the selected products based on chemical analysis have the extent no different for real the whole sample is based on the analysis of vitamin C and sugar levels. But for the moisture content, the influence of stabilizers and concentration of sucrose gives a real influence. It can be seen that the level on moisture content shows different letters.



The analysis of the three, then the selected products can be determined i.e. p3s3 products (Gum Arabic, sucrose 0.10% 35%). The products were selected because the product is almost close to a set value of SNI. Based on SNI specified moisture content that is 35 to 40% (maximum), from the data above the water levels almost approaching SNI i.e. sample p3s3 (Gum Arabic 0.10%, sucrose 35%) with a value of 59,26%. With water levels low enough then the effect also on power brush power brush value, from a sample of Arabic Gum (p3s3 0.10%, sucrose 35%) the most value and is 3.95 low. Thus the sample into the sample selected

The selected samples are then conducted further analysis i.e. analysis of antioxidant activity. The intent of this antioxidant activity of testing is where on a sample selected with kinds of stabilizers and different sucrose concentrations can be seen how large the content of antioxidants in it. The addition of stabilizers and sucrose into product can affect the activity of antioxidants in it. With this antioxidant testing against the Black Mulberry Jam then it can be known to be the result of content of antioxidant activity.

Table 13. The Results Of The Antioxidant Activity Against Selected Samples

Sample	IC <sub>50</sub> (ppm)
P <sub>3</sub> S <sub>3</sub> (Gum arab 0,10% ; sukrosa 35%)	3308,30

Determination of antioxidant activity in fruit pulp of Black Mulberry is calculated by finding the results as IC<sub>50</sub>. IC<sub>50</sub> is the value that shows the ability of inhibition of the oxidation process by 50% of a sample concentration (ppm) (Maliandri, 2012).

Based on the above analysis of the results obtained on a sample IC<sub>50</sub> value of Black Mulberry jam in sample p3s3 (Gum Arabic 0.10% sucrose, 35%) 3308.30 ppm From the results it can be

seen that the Black Mulberry jam samples have antioxidant activity in a category is weak. A compound is said to have antioxidant activity sangan IC<sub>50</sub> values are stronger if less than 50 ppm. Antioxidant activity of those samples belong to weak because the range of the value is above 200 ppm. The best antioxidant activity if under 200 ppm. As with the results of the antioxidant activity of Black Mulberry fruit pulp has a 238.35907 results, which indicate that the antioxidant activity in fruit pulp contains the category is weak.

The other thing that underlies the samples that have antioxidant activity is weak due to the addition of a substance in the product, besides the warming process also causes the antioxidant levels go down. On the number of a substance which is mixed so that it allows the content of antioxidant activity resulting in the product not optimal. In addition with the process of heating then the antioxidant activity will be damaged and degraded causing the antioxidant activity down and have a little bit of concentration.

## CONCLUSIONS AND SUGGESTIONS

### Conclusion

1. The addition of stabilizer type effect on power brush, appearance, Vitamin C, water content, viscosity and sugar levels
2. The addition of sucrose concentration effect on power brush, vitamin C, water content, viscosity and sugar levels.
3. The interaction of the addition of stabilizer type and the concentration of sucrose effect on power brush and moisture content.
4. Black Mulberry jam products are selected based on the determination of a sample obtained at p3s3 (Gum Arabic 0.10% Sucrose and 35%), with the highest levels of vitamin C 2.68%, moisture 59,26%, 7.04%, sugar levels 523.33 viscosity, color, sense of 4.20 4.88, texture, and appearance of 3.95

5.58, as well as the results of the antioxidant activity of 3308.30 ppm.

#### **Suggestions**

1. Need to do a repair of the product of the flavor, and it seems so produced products more acceptable to all consumers.

2. Need to do studies on the way of storage of materials used and the products, as well as the kind and packaging materials that are either so that the resulting product is not too liquid and quickly turn moldy if stored for a long time.

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