

PROCEEDING



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**INTERNATIONAL
SEMINAR**

**Resources, Environment, And Marine
In The Global Challenge**

**“The Role Of Science and Technology
In The Basis Of Environment
To Support Sustainable
Resource Development”**

DITERBITKAN OLEH:
Pusat Pengkajian Hukum dan Pembangunan (PPHP)
Fakultas Hukum Universitas Wijaya Kusuma Surabaya
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SIWALAN SUGAR PROCESSING WITH TEA EXTRACT ADDITION TO REDUCE GLYCEMIC INDEX VALUE

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Abstract: Application of siwalan sugar as a sweeteners in society requires testing in terms of health. It is necessary for the testing of siwalan sugar Glycemic Index value. Glycemic Index (GI) value of siwalan sugar is lower than cane sugar but higher than diet sugar. However, GI value of siwalan sugar is still relatively high. One of the process engineering that can be done to reduce GI value is the addition of tea extract. Therefore, it is necessary to process engineering of siwalan sugar processing with the addition of tea extract to reduce GI value of siwalan sugar. This study aims to: (1) determine the process engineering to reduce GI value of siwalan sugar through the process of adding tea extract, and (2) determine tannins content and GI value of siwalan sugar process engineered. Study design is Randomized Block Design with two factors, namely: First Factor is tea type, with 2 levels are Green Tea and Black Tea, as well as the Second Factor is concentration of tea extract with three levels are 1%, 2%, and 3%. For comparison used siwalan sugar without tea extract addition. Based on the study revealed that the tannin content of siwalan sugar given green tea extract higher when compared with black tea extract. The tannin content is expected to affect the GI value of siwalan sugar. Glycemic Index measurement used glucose as a standard with GI value is 100. The measurement result showed that the higher tannin content affect GI value tends to lower.

Keywords: Siwalan Sugar, Tea Extract, Tannin, Glycemic Index

1. Introduction

Siwalan sap have potential as a source of sweetener other than cane, because it has a relatively high sugar content of around 10-15% (Lutony, 1993), which can be either liquid sugar (Wedowati, Rejeki, & Puspitasari, 2012), solid sugar (Rejeki, Wedowati, & Puspitasari 2010), and crystal sugar (Wedowati & Puspitasari, 2008; Wedowati & Rahayuningsih, 2006). The use of siwalan sugar as a sweetener in society requires a test in terms of health. It is necessary for testing on glycemic index of siwalan sugar.

Glycemic Index (GI) is one of the parameters in the food sector which is closely related to the metabolism of carbohydrates. Glycemic index of food is a food index according to their effect on blood glucose level. Determining of food glycemic index using the glycemic index of pure glucose as the comparison, which glycemic index of pure glucose is 100 (Rimbawan & Siagian, 2004).

Glycemic index value of siwalan sugar are generally still lower than sugar cane but above diet sugar glycemic index. Among three types of siwalan sugar, solid siwalan sugar has a lowest glycemic index value. However, the the types of siwalan sugar glycemic index value is still relatively high (Wedowati, Puspitasari, & Kadir, 2014). It is based on the classification of GI values, foods with low GI (GI<55), moderate GI (GI: 55-70), and high GI (GI>70). It is necessary for efforts to reduce the siwalan sugar glycemic index value in order to become a sweetener which has low GI. One of the engineering process that can be done to reduce GI value is by adding tea extracts. Therefore, it is necessary to process engineering processing of siwalan sugar with the addition of tea extract to reduce the GI value.

This research aims to: (1) Determine the engineering process to reduce siwalan sugar glycemic index value through a process of adding tea extracts, (2) Determine the tannin content of siwalan sugar process engineered, and (3) Determine the glycemic index value of siwalan sugar process engineered.

2. Literature Review

Theoretical Review

Siwalan plant (*Borassus flabellifer* Linn) is a palmeae species plant in Indonesia were not handled addressed optimally. Utilization of siwalan plant is still very limited, views of parts of the plant used, the type of product produced, and the technology applied. Various studies indicate that there is still quite a lot of possibilities to develop the parts of the plant palm as industrial raw materials both for domestic needs and for export. Siwalan sap potential as a source of sweetener other than cane, because it has a relatively high sugar content is about 10-15% (Lutony, 1993). The use of siwalan sugar

as a **sweetener** in **society** requires a test in terms of health. It is **necessary** for testing on the siwalan **sugar** glycemic index.

Glycemic **index** is first developed in 1981 by Dr. David Jenkins (Professor of Nutrition at Toronto **University**, Canada) to help determine the best food for diabetics. **This concept assumes that all** carbohydrates food with the same **quantity** will yield the same influence on blood **glucose** levels (Rimbawan & Siagian, 2004).

Based on **glycemic** index response, foods are **classified into three** groups, namely **foods** with low GI (GI < 55), **moderate** GI (GI: 55-70), and high GI (GI >70). The foods that have high GI when **consumed** will increased blood glucose levels **quickly** and high. Conversely, people **who consume** low GI food **then** an increase in blood glucose levels **has been slow** and glucose content peak is low.

Food with a low GI are digested and changed **gradually** and slowly, so that blood **glucose levels** peak will also be low, **so fluctuations** in sugar **levels** will also be low. It is very important for diabetes to control blood **glucose** levels. Conversely, athletes who **want** to compete **require** a high GI food **that** food **consumed** immediately **converted** into **energy** (Anonymous, 2014).

Information about IG various types of siwalan **sugar** can help people with the disease **Diabetes Mellitus (DM)** in **choosing** a sweetener that does not increase blood glucose levels **dramatically**, **so that** blood glucose levels can be controlled **at** a safe **level**. Food with a low GI helping people to control **hunger**, **appetite** and blood glucose levels, then food with low GI **can help** reduce excess weight.

One treatment to reduce the GI value is with the addition of tea extract. Leaves of tea plant contains **flavonoids** which is **polyphenol compounds**. The type of tea consists of **black tea (perfect fermented tea)**, **green tea (unfermented tea)** and **oolong** (semi-fermented tea). **But** in general there are **two types of tea** based on the presence or absence of fermentation in the processing process, namely **black tea and green tea (Wijaya, Wardani, Meutia, Hermawan, & Begum, 2012).**

The **main compounds contained** in tea are catechism, which is a **derivative of condensed tannins**, also known as **polyphenol compounds**. **Polyphenol** compounds is **often** referred to as **tannin**, **Antigenic substances** can reduce the **protein and starch digestibility** so that the **glycemic response is decreases**. Therefore, in this study will be used tea leaf extract to reduce the GI value of siwalan sugar.

Several studies have **linked** GI has been done, including the Glycemic Index of **rice with high and low amylose (Widowati, Santosa, & Budiyanto, 2007)**, where the results can be used as a reference for determining the **appropriate rice varieties for** diabetics and **obese**. Glycemic Index value of **some types of sweet corn processing has also been reviewed** by **Amalia, Rimbawan & Dewi (2011)**, the research concluded that **the roasted** sweet corn has a medium GI value, **while** the boiled sweet corn that has a low GI value. **Rakhmawati, Rimbawan & Amalia (2011)**, has **conducted** a study on the GI value of **variety of processed breadfruit** and **concluded** that of the various refined **breadfruit (fried, steamed, boiled)** have high GI value. **Arif, Budiyanto, & Hoerudin (2013)** has **conducted** research on the factors that **influence** the glycemic index of food products. Research results states that **factors that affect the GI value** include the **fiber content of food, amylose and amylopectin content, fat and protein content, digestibility of starch, and the way of processing.**

Hypotheses

The addition of tea extracts on the processing of **siwalan sugar** can reduce **the** glycemic index value of siwalan **sugar**.

The higher the **concentration of tea extract** were added can **produce siwalan sugar with GI value that is lower.**

3. Research Method

This research was conducted in the laboratory of Analysis Product Industry, Department of Agriculture Industrial Technology, Faculty of Engineering UWKS and Laboratory of Hewan Coba, Faculty of Medical, UWKS. Manufacture of siwalan sugar products carried in the palm sugar artisans in the Sumur Gayam Village, Lamongan District.

Stages of research Engineering Process to Reduce Glycemic Index Value of Siwalan Sugar Through the Adding Tea Extracts Process are as follows: (1) **Engineering processing** of siwalan sugar with **the** addition of tea **extract**, (2)

Determination of tannin content of siwalan sugar process engineered, and (3) Measurement glycemix index of siwalan sugar process engineered in experimental animals (mice).

Engineering processing of siwalan sugar with the addition of tea extracts using a randomized block design with two (2) factors, namely: Factor 1 (Type of Tea), with 2 levels are Green Tea (T1) and Black Tea (T2), while Factor 2 (Concentration of Tea Extract), with 3 levels are 1% (K1), 2% (K2), and 3% (K3). Thus there are six combinations of treatments, where each treatment was repeated 3 times, so there are 18 attempts. For comparison is used siwalan sugar without the addition tea extract.

Data processing was performed by descriptive analysis and analysis of variance, if there is a difference followed Duncan test with 95% confidence level.

4. Discussion

Tannin Content

Based on the results of the chemical tests for parameters tannin content in the product of siwalan sugar process engineered, average results of tannin content obtained for each treatment is shown in Figure 1.

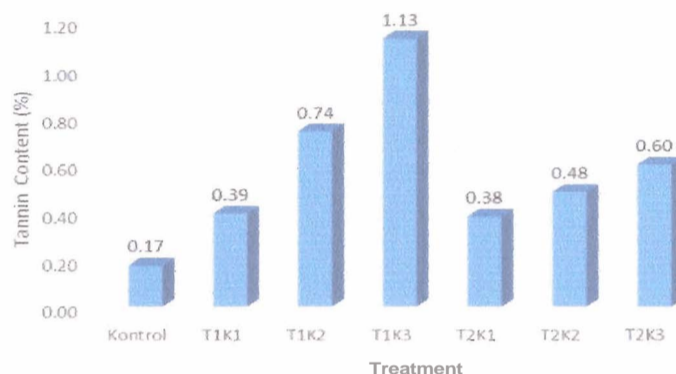


Figure 1. Tannin Content of Siwalan Sugar in Each Treatment

Based on Figure 1 can be seen that the higher the concentration of the tea extract is added to the processing of siwalan sugar, the tannin content of sugar products also be higher as well. Tannin content of siwalan sugar with the addition of green tea extract tends to be higher when compared with black tea. The highest content of tannins found in siwalan sugar products with T1K3 treatment, i.e. at 1.13%.

Based on the results of analysis of variance is known that there is interaction between the factor treatment of siwalan sugar tannin content, is based on the value of $F = 17.898 > F \text{ table} = 3,885$ with $\text{sig} = 0.00 < \alpha = 0:05$. Therefore, continued with Duncan test and the results are as shown in Table 1. The tannin content of siwalan sugar with the addition of green tea extract higher when compared with black tea at a concentration of 2% and 3% (tannin content $T1K2 > T2K2$; and $T1K3 > T2K3$). However, the addition of tea extract at a concentration of 1%, siwalan sugar tannin content not different significantly. This shows that the addition of green tea extract would produce siwalan sugar products with higher tannin content when compared to black tea

Table 1. Average Content of Tannin (%)

Treatment	Tannin Content	Notation
Control	0.1733	e
T1K1	0.3933	d
T1K2	0.7367	b
T1K3	1.1267	a
T2K1	0.3800	d
T2K2	0.4833	cd
T2K3	0.5967	c

Glycemic Index Value

Calculation of the glycemic index (GI) value is based on an increase in blood glucose of experimental animals for observation. Observation of blood glucose content is done in minutes 0, 15, 30, 45, 60, 90, and 120 after the product samples given at experimental animals. The observation of an increase in blood glucose for each treatment of sugar is shown in Figure 2.

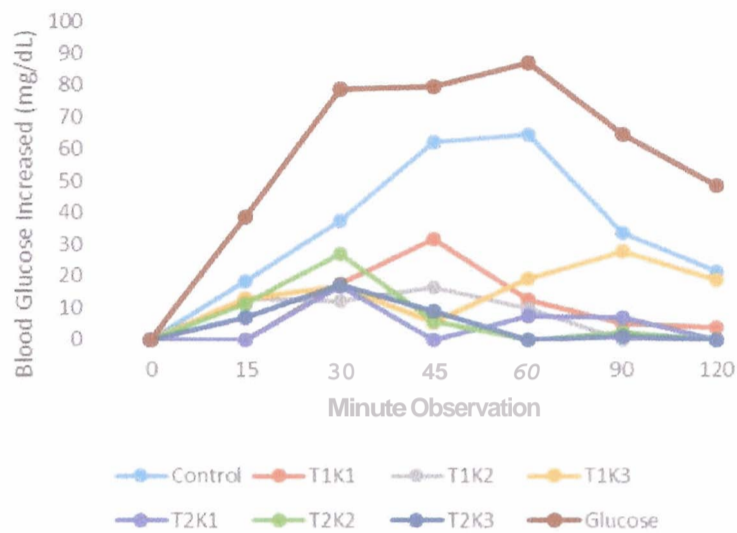


Figure 2. Blood Glucose Increased of Experimental Animal

Based on the observations of an increase in the blood glucose content in minutes 0, 15, 30, 45, 60, 90, and 120 made quadratic regression curve. Quadratic regression equation is then made integral to explore the extent of the area under the curve. To calculate the value of the GI, the extent of area under the curve of each treatment of sugar compared with the extent of the area under the curve for glucose as a standard. Glycemic Index due of glucose is 100. The curve equations for each treatment of sugar is shown in Table 2. The curves for each treatment of sugar shown in Figure 3.

Table 2. Siwalan Sugar Curve Equations for Each Treatment

Treatment	Curve Equation
Control	$Y1 = -1,171 + 1,814 X - 0,014 X^2$
T1K1	$Y2 = -0,452 + 0,647 X - 0,005 X^2$
T1K2	$Y3 = 4,822 + 0,293 X - 0,003 X^2$
T1K3	$Y4 = 2,537 + 0,388 X - 0,002 X^2$
T2K1	$Y5 = 0,442 + 0,246 X - 0,002 X^2$
T2K2	$Y6 = 7,542 + 0,125 X - 0,002 X^2$
T2K3	$Y7 = 4,661 + 0,126 X - 0,002 X^2$
Glucose	$Y6 = 7,601 + 2,375 X - 0,017 X^2$

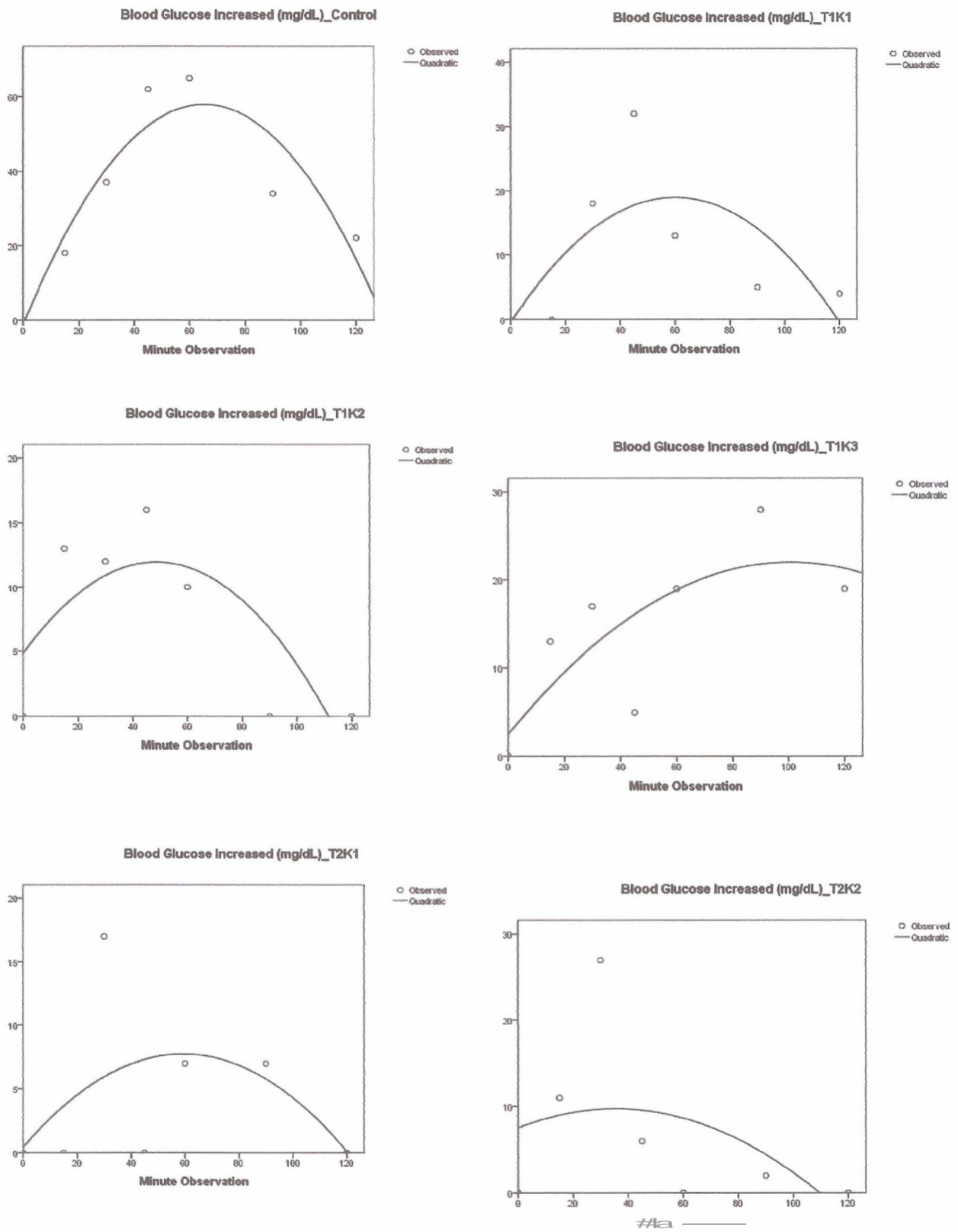


Figure 3. Blood Glucose Increased Curve in Each Treatment

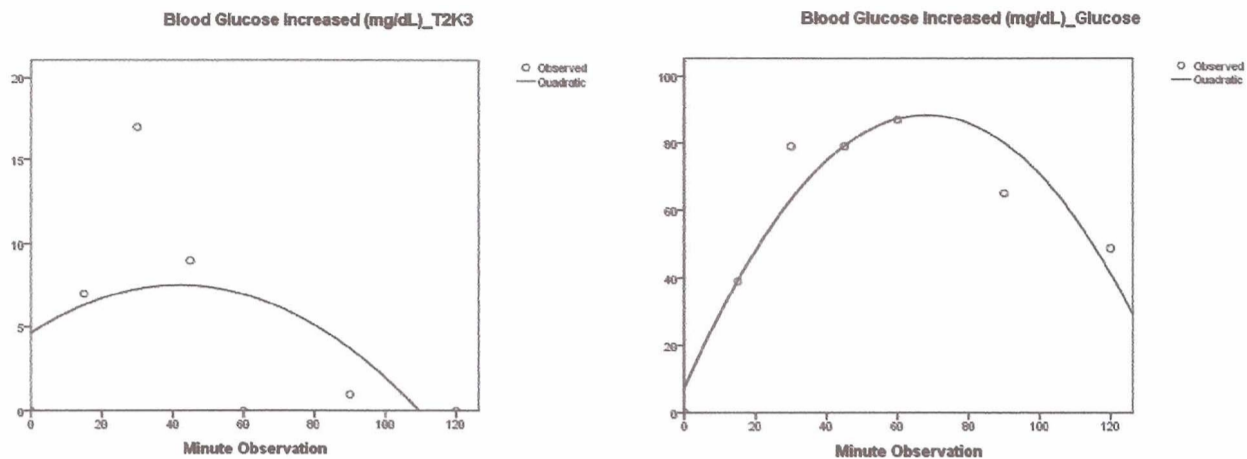


Figure 3. Blood Glucose Increased Curve in Each Treatment (Continued)

Calculation results of area under the curve and glycemic index values for each treatment of sugar can be seen in Table

Table 3. Curves Area and Glycemic Index Value in Each Treatment

No.	Treatment	Curve Area	GI Value
1	Control	20984,28	75,47
2	T1K1	7484,16	26,92
3	T1K2	4416,24	15,88
4	T1K3	4250,04	15,29
5	T2K1	2976,24	10,70
6	T2K2	2957,04	10,64
7	T2K3	2690,52	9,68
8	Glucose	28617,24	100,00

Based on the calculation results of the glycemic index (GI) value, then the GI value of siwalan sugar process engineered is included in the low GI group (IG < 55). Between of the various treatments available, treatment produce siwalan sugar with the lowest IG is T2K3 treatment with IG value is 9.68. The use of black tea extract is able to lower the siwalan sugar GI value than green tea extract. And the higher the concentration of tea extract were added, then the resulting siwalan sugar has a GI value that the lower too. Therefore it can be concluded that the use of tea extracts on the processing of siwalan sugar can decrease the GI value of siwalan sugar products.

5. Conclusion

Based on the results of this study concluded that:

- The tannin content of siwalan sugar with the addition of green tea extract tends to be higher when compared with black tea.
- There was an interaction between treatment factors for siwalan sugar tannin content
- The siwalan sugar glycemic index (GI) value with the addition of black tea extract is lower when compared with green tea
- The lowest siwalan sugar GI value obtained at T2K3 treatment with GI value is 9.68.

Suggestions

Further research is needed to determine the GI value with human respondent, so that siwalan sugar can be used as a natural sweetener and healthy.

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