The Effect of Natural Preservatives from Jackfruit Wood Percentage Addition on Palm Oil Sap (*Elaeis guuineesis* Jacq.) during Storage

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Abstract: Oil palm plantations continue to increase in Indonesia. Oil palm which is no longer productive will be replanted and replace with new seeds. Oil palm replanted still has the potential to produce oil palm sap. Oil palm sap is perishable so it is necessary to handle palm oil sap before entering a further production process, one of which is natural preservative from jackfruit wood. This study used a completely factorial randomized design with 2 factors, namely the concentration of jackfruit wood added (K): (3%, 6%, 9%, 12%) and storage time (T): (0 days, 1 day, 2 days, 3 days). The result showed that the best oil palm sap was from the treatment the percentage increase of 12% jackfruit wood and storage for 3 days.

1 INTRODUCTION

African oil palm (*Elaeis guineensis* Jacq.) is basically a cultivated plant with good response to environmental condition. Climates and soil condition are the main factors beside other factors such as genetics, plant care and others. Efforts in improving the production of African oil palm has been seriously conducted, both through intensification and extensification. Indonesia is the biggest exporter of African oil palm. This plant potential is enormous. Contribution of African oil palm to APBN can reach 9.11 billion dollars. African oil palm export from Indonesia reached 23 million tons in 2010. An estimate of 35% from the profit of African oil palm came from small farmers who lived from certain sectors. In 2011, around 8 million hectares of African oil palm expansion in the world came from Indonesia (Tim Penulis PS, 1997). However, increased productivity of oil palm plantation is followed by their waste. Waste produced from oil palm production (OPP) can be divided into two types, i.e. liquid waste and solid waste. Solid waste from oil palm include 23% of empty fruit bunches (EFB), boiler ash (around 0.5% of OPP), fibers (around 13.5% of OPP) and shells (around 5.5% of OPP). Solid wastes produced from OPP commonly did not cultivated plant with good response to environmental condition. Climates and soil condition are the main factors beside other factors such as genetics, plant care and others. Efforts in improving the production of African oil palm has been seriously conducted, both through intensification and extensification. Indonesia is the biggest exporter of African oil palm. This plant potential is enormous. Contribution of African oil palm to APBN can reach 9.11 billion dollars. African oil palm export from Indonesia reached 23 million tons in 2010. An estimate of 35% from the profit of African oil palm came from small farmers who lived from certain sectors. In 2011, around 8 million hectares of African oil palm expansion in the world came from Indonesia (Authors, 1997).

However, increased productivity of oil palm plantation is followed by their waste. Waste produced from oil palm production (OPP) can be divided into two types, i.e. liquid waste and solid waste. Solid waste from oil palm include 23% of empty fruit bunches (EFB), boiler ash (around 0.5% of OPP), fibers (around 13.5% of OPP) and shells (around 5.5% of OPP). Solid wastes produced from OPP commonly did not need complicated management. Solid waste can be reused as fuel, fertilizer, animal feed, and can be sold to produce extra income. Solid wastes from oil palm still produces high sale value. Uprooted oil palm or replanted oil palm are the biggest waste with minimum management. Uprooted oil palm can produce sap when tapped on the tip and can produce other byproducts such as palm sugar. Sap is a perishable commodity because of fermentation which changes the taste of sap into acidic. Basically, fresh sap contains several good microbes in the form

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of yeast and bacteria. Fermentation process occurs when tapping process was started. Sap has quite high nutritional content, i.e. 87.66% water, 12.04% sugar, 0.36% protein, 0.36% fat, and 0.21% ash; therefore, sap is suitable as a media or a place for microbes to grow, such as fungi or bacteria during fermentation process (Gafar and Heryani, 2012). There are several natural preservatives commonly added by the tappers to inhibit fermentation in sap, including the wood or sap of jackfruit (*Artocarpus heterophylla* Lamk.), which is a local plant often found in various regions in Indonesia. Jackfruit is usually used as traditional medicine. The chemical contents of jackfruit wood include morin, cyanomaclurine (tanned substance), flavone, and tannin, Other than that, there are new flavonoid substances in the skin of jackfruit wood, i.e. morusin, artocarpin, artonin E, cycloartobilosanton, and artonol B. The bioactivity of those flavonoid substances is known empirically as anticancer, antivirus, antiinflammation, diuretic, and antihypertension (Robinson, 1995).

2 MATERIAL AND METHOD

This research was conducted at Food Technology Laboratory, University Sumatera Utara. The materials used were white sugar, jackfruit wood and oil palm sap which were obtained from Bingkat Village, Pegajahan, Serdang Berdagai Regency, North Sumatera. The preservatives were taken from a part of jackfruit wood, then cut into small size, then scaled for 100 g. Five liters of water was heated to boil for 30 minutes, then 100 g of jackfruit wood was put into boiling water and stirred evenly. Afterwards, the natural preservatives were left to cool. Natural preservative was added into container of tapped sap. Preservative was given incrementally to prevent damage to sap during collection. Previously prepared preservative then added into container with concentrations of 3% (K1), 6% (K2), 9% (K3), and 12% (K4) in 1 liter of sap. Afterwards, oil palm sap was left at room temperature for 0, 1, 2, and 3 days of shelf-life. This study was conducted using Complete Random Design which consisted of two factors, i.e. Factor I: Percentage of natural preservatives (K) which consisted of 4 phases, which are K1 (3%), K2 (6%), K3 (9%), K4 (12%), and Factor II: Storage duration (T) which consisted of 4 phases, which are T1 (0 day), T2 (1 day), T3 (2 days), T4 (3 days). The number of treatment combination (Tc) was 4 x 4 = 16. Two repetitions were performed for precision. The analytical parameters for sap and palm sugar include: reduction sugar (AOAC, 1995), sucrose, total sugar (Sudarmadji, et al., 1997).

3 RESULTS AND DISCUSSIONS

3.1 Reducing Sugar

Preservative addition (Table 1) and storage duration (Table 2) affected reducing sugar of oil palm sap significantly ($p < 0.01$), and the interaction of the two gave significantly different effect ($p < 0.01$). The decrease of reducing sugar level during the addition of jackfruit wood solution from the lowest to highest concentration, i.e. 3% of addition of jackfruit wood solution in 100% of oil palm sap, which was 0.778% (Table 1). The decrease of reducing sugar level of oil palm sap was caused by the wood percentage which cause reduced sap percentage needed, where the use of jackfruit wood solution of 3% needed 97% of sap, while the use of 12% jackfruit wood solution needed 88% sap, therefore the highest reducing sugar level was found in the lowest concentration of jackfruit wood. This was in accordance with Gusti et al, (2016) which stated that when a solution was added to sap, it will affect the concentration of sugar level, because added sap has high sugar level, which is 12.04%.

Storage duration for 3 days resulted in highest reducing sugar level concentration, i.e. 0.846% (Table 2). Increased reducing sugar level in oil palm sap was caused by changes in components or sugar degradation such as sucrose by the changes of acidic environment or enzyme during storage, thus increasing the number of simple sugar or reducing sugar in oil palm sap. Sucrose will undergo degradation due to acidic, hot environment, and certain minerals through hydrolytic reaction. Hydrolysis or inversion of sucrose can occur spontaneously in acidic condition. Hydrolysis reaction or inversion reaction to sucrose molecules, both full and partial, will create D-glucose and D-fructose monosaccharides which are more stable than sucrose.

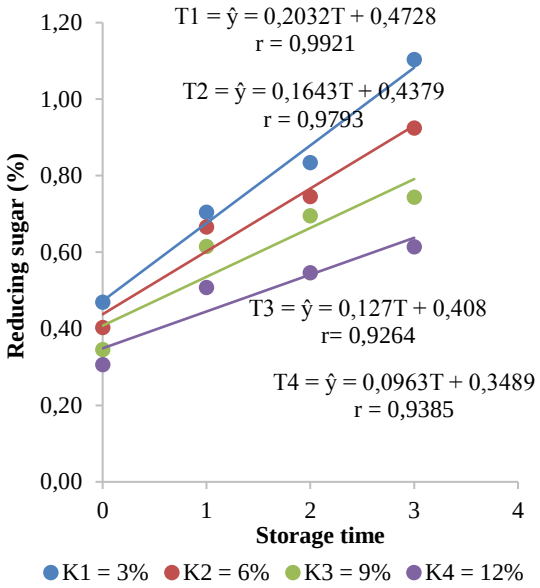

Figure 1: The interaction of addition of preservatives and storage time with reducing sugar palm oil sap.

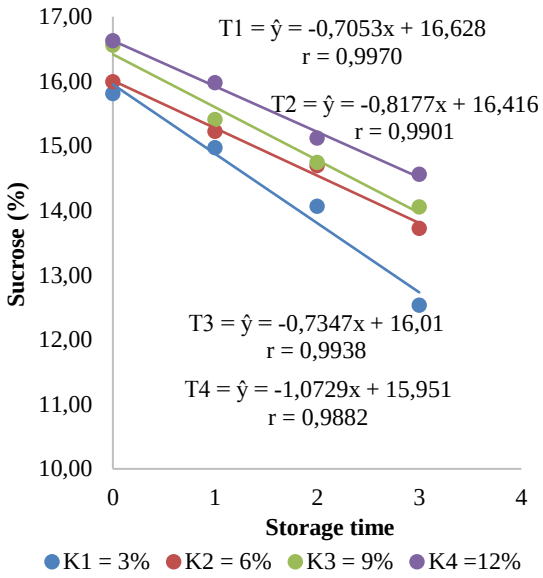

Figure 2: The interaction of addition of preservatives and storage time with sucrose palm oil sap.

3.2 Sucrose

Preservative addition (Table 1) and storage duration (Table 2) give significant difference ($p < 0.01$) to sucrose in oil palm sap, the interaction gives significant differences ($p < 0.01$). There was an increase of sucrose level during the addition of jackfruit wood solution of 12% to 15.570% (Table 1). Preservative addition caused inhibition of acidic condition in sap and inactivate enzyme activity which can degrade sucrose in sap. Therefore, highest addition of jackfruit wood solution had higher sucrose level. This result was in accordance with Ersam (2001) which stated that the chemical substances of jackfruit wood include morin, cyanomaclurine (tanned substance), flavone, and tannin which had bacteriostatic effect. These substances were strongly thought to play a role in inhibiting fermentation process of sap which produced acid, thus sucrose level in sap can be maintained. Decreased sucrose level in oil palm sap during storage duration (Table 2) was caused by spontaneous fermentation process that occurred during storage process, which cause changes in sucrose and increased acidity of sap. This was in accordance with Budiyanto (2014) which stated that the longer the storage duration, then the lower the pH of sap because sap is a fertile growth media for microorganism.

3.3 Total Sugar

Preservative addition (Table 1) and storage duration (Table 2) showed significant differences ($p < 0.01$) in sucrose of oil palm sap, including the interaction of both ($p < 0.01$).

The addition of jackfruit wood solution showed increase by adding the concentration of jackfruit wood solution to 12%. This was caused by antimicrobial substances in jackfruit wood which can inhibit the activity of microbes and inhibit fermentation which can reduce sugar level in sap. This was in accordance with Fauzi, et al, (2013), which stated that the addition of natural preservatives from jackfruit wood showed that higher concentration resulted in higher total sugar level in sap. Jackfruit wood contains yellow substances called morine, alcohol, saponins, glucosides and calcium oxalate. Jackfruit bark contains resins, cycloheterophyllin and tannins. Tannin has bacteriostatic properties that can inhibit bacterial growth (Filiyanti et al, 2006; Dalimarta, 2008). Sap is a sweet liquid that has 12.30-17.40 gr of sucrose. Fresh sap has a number of microbes in the form of yeast or bacteria from bunches or air when the tapping process takes place (Mussa, 2014). There was a decrease in sap up to 3 days of storage in the amount of 14.634%. The decrease of total sugar was caused by spontaneous fermentation during storage process, which caused changes in acidic environment and degradation of carbohydrates, thus resulted in decreased total sugar.

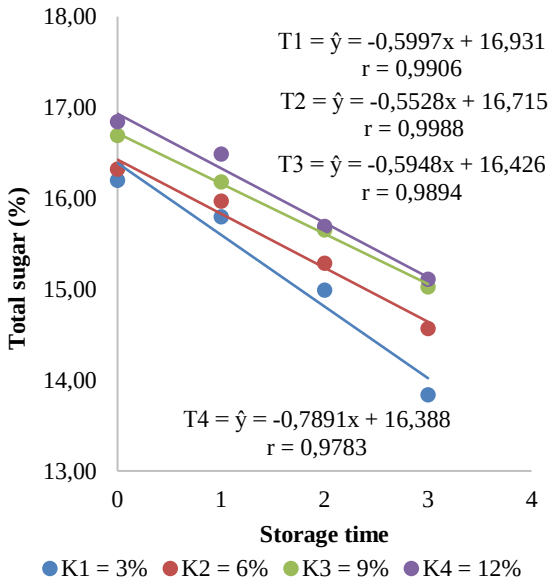

Figure 3: The interaction of addition of preservatives and storage time total sugar palm oil sap.

Table 1: Effect of additon jackfruit on reduction sugar, sucrose, and total sugar of palm oil sap.

Treatment	Reduction Sugar (%)	Sucrose (%)	Total Sugar (%)
K1 (3%)	0,777^{cD}	14,341^{cD}	15,204^{cC}
K2 (6%)	0,684^{bC}	14,907^{bC}	15,534^{bcBC}
K3 9%)	0,599^{bB}	15,189^{bB}	15,886^{abAB}
K4 (12%)	0,493^{aA}	15,570^{aA}	16,031^{aA}

The numbers followed by different letters on the same line show significantly different effects at the level of 5% (lowercase letters) and are very significantly different at the level of 1% (uppercase letters) with the LSR test.

Table 2: Effect of additon jackfruit on reduction sugar, sucrose, and total sugar of palm oil sap.

Treatment	Reduction Sugar (%)	Sucrose (%)	Total Sugar (%)
K1 (3%)	T1 (0 day)	0,381^{dD}	16,245^{aA}
K2 (6%)	T2 (2 days)	0,623^{cC}	15,394^{bB}
K3 9%)	T3 (3 days)	0,705^{bB}	14,654^{cC}
K4 (12%)	T4 (4 days)	0,846^{aA}	13,716^{dD}

The numbers followed by different letters on the same line show significantly different effects at the level of 5% (lowercase letters) and are very significantly different at the level of 1% (uppercase letters) with the LSR test.

4 CONCLUSIONS

From this study, the best oil palm sap was shown by K4T4 treatment, which was 12% addition of jackfruit wood and 3 days storage duration. This was obtained based on reducing sugar value.

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