

# Physicochemical Analysis of Liquid Palm Sugar (Arenga Pinatta Merr)

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**Abstract.** Palm sugar is generally available in three forms: molded sugar (kerek), granulated sugar, and palm sugar. However, some are also produced in liquid form. Conventionally processed sugar is solid and quite hard, requiring consumers to slice and dissolve it before use. This is inefficient for consumers and traditional sugar producers, therefore it is necessary to develop sugar products in liquid form. Liquid sugar is a clear liquid, has a sweet, thick, and odorless taste. Liquid palm sugar or palm syrup can be obtained from fresh sap and brown sugar. Liquid palm sugar with sap as raw material, the processing process is the same as the process of making brown sugar, namely the sap that is being heated in the process of making brown sugar is removed before the sugar crystallizes. This study aims to obtain the best results from the analysis of liquid palm sugar based on physicochemical analysis. The methods used in this study are the Treatment Design Method, Experimental Design, Response Design. The best viscosity value from the analysis of liquid palm sugar based on physicochemical analysis taken from various producers is sample a3 with a viscosity value of 614 cps.

**Keywords:** alm sugar, liquid palm sugar, physicochemical, viscosity.

## Introduction

The sugar palm is one of the most important plants and generally grows far inland. This type of plant grows naturally in southeastern island countries, including Malaysia, India, Myanmar, Laos, Vietnam, the Ryukyu Islands, Taiwan, and the Philippines (Lembang, 2012). Products made from sugar palm are widely marketed every day and demand for these products for domestic needs and for export is increasing. Almost all parts of the sugar palm plant useful and can be used for various needs, both physical parts (leaves, stems, fibers, roots, etc.) and production parts (fruit, sap and starch/flour). Palm sap is obtained by tapping the male flower stalks, and can be tapped at the age of 5-12 years. Each plant can be tapped for 3 years and each year can be tapped 3-4 flower stalks. The sap yield is 300-400 liters per flower stalk season (3-4 months) or 900-1600 liters of sap per year. In a day the palm sap tree can be tapped twice a day with a yield of 3-10 liters of sap (Reza, 2008).

Liquid palm sugar or palm syrup can be obtained from fresh sap and brown sugar. Liquid palm sugar with sap as the raw material, the processing is the same as the process of making brown sugar, namely the sap that is being heated in the process of making brown sugar is removed before the sugar crystallizes, but has reached a stage where the sap has boiled and formed a foam that overflows brownish yellow throughout the surface of the syrup and the foam will gradually overflow (like a honeycomb)

The development of modified sugar products in liquid form is an alternative that is expected to meet Indonesian National Standards (SNI) and make it easier for consumers to use. Furthermore, it will be more efficient for producers due to the shorter processing time compared to producing solid sugar.

## Methods

This study conducted a viscosity analysis using liquid palm sugar from different manufacturers. This allowed researchers to compare the viscosity values of liquid palm sugar samples from different palm sugar manufacturers. Different liquid palm sugar samples may have different viscosity levels. This study conducted

a viscosity analysis experiment by taking samples from Sukaresmi Village, Sobang District, Lebak Regency, Banten Province. Samples were obtained from different producers, with physicochemical observations, namely viscosity.

## Result and Discussion

**Table 1.** Viscosity Results of Sample a1

Repetition	Dial Reading	Factor	Viscosity Value (Cps)
1	68	40	2720
2	68	40	2720
3	67.5	40	2700
4	67.5	40	2700
5	67.5	40	2700
<b>Average Viscosity Value</b>			2708

Note: The viscosity results of sample a1 using the Brookfield Mode LVT Viscometer Serial Number 8545051, with spindle No.63 and Speed 30 rpm.

**Table 2.** Viscosity Results of Sample a2

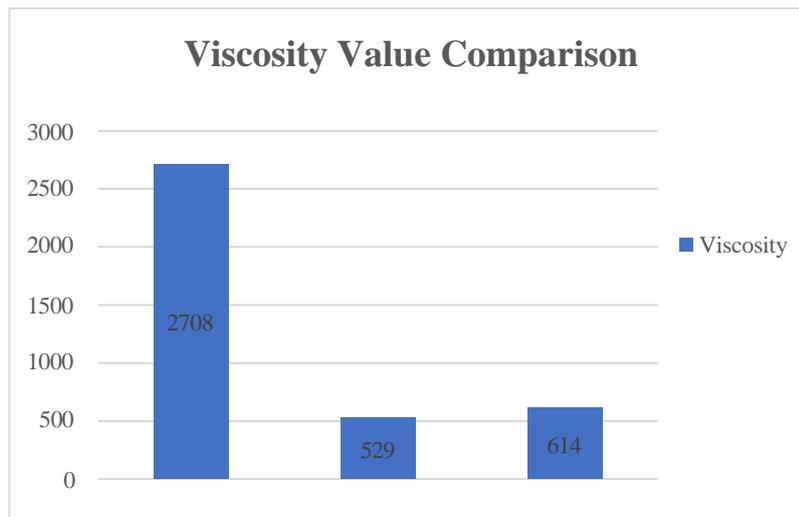
Repetition	Dial Reading	Factor	Viscosity Value (Cps)
1	53	10	530
2	52	10	520
3	53	10	530
4	55	10	550
5	51.5	10	515
<b>Average Viscosity Value</b>			529

Note : The viscosity results of sample a2 using the Brookfield Mode LVT Viscometer Serial Number 8545051, with spindle No.62 and Speed 30 rpm.

**Table 3.** Viscosity Results of Sample a3

Repetition	Dial Reading	Factor	Viscosity Value (Cps)
1	61	10	610
2	60.5	10	605
3	61	10	610
4	61.5	10	615
5	63	10	630
<b>Average Viscosity Value</b>			614

Note : The viscosity results of sample a3 using the Brookfield Mode LVT Viscometer Serial Number 8545051, with spindle No.62 and Speed 30 rpm.



**Figure 1.** Comparison Graph of Viscosity Values

Based on the results of the viscosity analysis research of liquid palm sugar, the highest result was sample a1 with a viscosity value of 2708 cps and the lowest was sample a2 with a viscosity value of 529 cps, this was influenced by several factors including:

The production process for liquid palm sugar is generally carried out by small-scale artisans and households in traditional rural areas. Critical factors in the production of liquid palm sugar are the quality of the sap and cooking (Muchaymien et al. 2014). Meanwhile, inhibiting factors in the production of liquid palm sugar include limited processing technology, production facilities, and consistency of the processing process.

After conducting a physicochemical analysis on liquid palm sugar based on the Indonesian National Standard (SNI) obtained from various producers, it can be concluded that according to the Indonesian National Standard (SNI) 01-2978-1992, the maximum water content of glucose syrup is 20%. And based on the results of the study, the higher the Brix value will cause an increase in viscosity (Agung Sukoyo et al., 2014). The longer the evaporation time will cause an increase in viscosity. This is because the water that evaporates will increase and the total dissolved solids will increase, so that the viscosity will increase (Diniyah et al., 2012). Based on the results of the study, the viscosity analysis of liquid palm sugar obtained the results of sample a1 2708 cps, sample a2 529 cps, and sample a3 614 cps. So it can be concluded that the best viscosity value from the analysis of liquid palm sugar based on physicochemical analysis taken from various producers is sample a3 with a viscosity value of 614 cps.

## Conclusion

The production process of liquid palm sugar is generally carried out by small-scale craftsmen and households which is carried out traditionally in rural areas which have limitations in processing technology, production facilities, and consistency of the processing process, therefore it is necessary to conduct further research on liquid palm sugar processing technology and physicochemical analysis with more samples of liquid palm sugar.

## References

- Agung S., Bambang Dwi Argo, Rini Yulianingsih. 2104. Journal of Tropical Commodity Bioprocessing Vol. 2 No. 2. Malang.
- Alam, S. and Suhartati, 2000. Community sugar palm forest management in Umpunge Village, Lalabata District, Soppeng Regency, South Sulawesi. Forestry Research Bulletin Vol.6 No.2 2000: 59-70. Forestry Research Center, Ujung Pandang.
- Anonymous. 2012. Microbiology Practical Guide. UMS Biology Laboratory: Surakarta.

- Atkns, P. 2007. Chemical Principles: Quest for Insight 4th Edition. New York: WHFreeman and Company.
- Bourne MC. 2002. Food Texture and Viscosity: Concept and Measurement 2nd edition. London (UK): Elsevier Science & Technology Books.
- National Standardization Agency [BSN]. 1995. Palm Sugar. SNI 01-3743-1995. BTPN-Banten. 2005. Socioeconomic Study of Sugar Palm in Banten. Research Center Banten Agricultural Technology.
- Deviarni and Sri Warastuti. 2107. Physicochemical Characteristics of Pidada Mangrove Syrup with Added Cmc and Heating Time. Galung Tropika Journal, 6 (3) December 2017, pp. 213 - 223. Pontianak
- Diniyah, N., Wijanarko, SB & Purnomo, H. 2012. Liquid Brown Sugar Processing Technology from Siwalan Palm Sap. (Borassus flabellifer L.). Journal of Food Technology and Industry Vol. XXIII No. 1. 2012.
- Effendi. 2010. Prospects for the Development of Sugar Palm (Arenga pinnata Merr) to Support Bioethanol Demand in Indonesia. Bogor.
- Effendi, 2010. Food Chemistry and Nutrition. PT. Gramedia. Jakarta
- Fajri et al. 2017. Addition of Carrageenan in Making Syrup from Pineapple Stems. <https://jom.unri.ac.id/index.php/JOMFAPERTA/article/view/17052>. Accessed November 2017.
- Firleyanti, AS, 2003. Study of the Production and Properties of Palm Sugar Syrup. Thesis. Department of Food Technology and Nutrition, Faculty of Agricultural Technology, Bogor Agricultural University.
- Kristianingrum. 2009. Nutritional Analysis of Palm Sugar. Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Yogyakarta State University. Yogyakarta
- Lempang. 2012. Sugar Palm Trees and Their Production Benefits. Forestry Research Center. Makassar.
- Lempang M, Mangopang AD. 2012. Effectiveness of palm sap as a leavening agent for bread dough. Wallacea Forestry Research Journal.
- Lelya H. 2104. Journal of Analysis of Respondents' Responses to Palm Syrup Produced from Palm Sap and Palm Sugar. Padang.
- Muchaymien Y, Rangga A, Nuraini F. 2014. Drafting of standard operating procedure (SOP) for making coconut brown sugar (case study of coconut brown sugar craftsmen in Purworejo Village, Negeri Katon District, Pesawaran Regency). Journal of Industrial Technology and Agricultural Products. Pesawaran.
- Nurrachman., et al. 2015. Physics Pharmacy Practicum Report. [https://www.academia.edu/23021505/LAPORAN\\_PRAKTIKUM\\_FARMA\\_SI\\_PHYSICS\\_Ostwald\\_Viscosity](https://www.academia.edu/23021505/LAPORAN_PRAKTIKUM_FARMA_SI_PHYSICS_Ostwald_Viscosity). Accessed on February 23, 2015
- Regulation of the Ministry of Agriculture of the Republic of Indonesia. 2013. Appendix GUIDELINES FOR GOOD CULTIVATION OF AREN (Arenga pinnata Merr). No. 133/Permentan/OT.140/12/2013. Accessed in 2104.
- Rahmawati. 2103. Packaging and labeling. <http://staff.uny.ac.id/sites/default/files/pengabdian/fitri-rahmawati-mp/pengemas-dan-pelabelan.pdf>
- Reza. 2008. Food Science and Nutrition. Bogor Agricultural University. Bogor
- Rika. 2109. Journal of Correlation of Fermentation Time on Liquid Sugar Characteristics from Sweet Potato Starch Fermented with Bacillus Subtilis Bacteria. Bandung.
- Rindengan, B and E. Manaroinsong. 2009. Sugar Palm. Plantation Crops Producing Biofuel (BBM). Center for Plantation Research and Development. pp. 1-22.
- Rumokoi MMM. 1990. Benefits of the sugar palm (Arenga pinnata Merr). Balitka Bulletin No. 10, 1990, pp. 21-28. Coconut Research Institute, Manado.
- Sinko, P. 2012. Pharmaceutical Physics and Pharmaceutical Sciences. Jakarta. EGC
- Sukoyo. 2104. Analysis of the Effect of Processing Temperature and Degree Brix on the Physicochemical and Sensory Characteristics of Liquid Coconut Sugar with the Vacuum Processing Method. Journal of Plantation Agro Industry. Malang. Accessed on November 2, 2019.
- Yunita F et al., 2108. The Effect of Storage Time on the Quality of Liquid Sugar from Palm Sap. Journal of Industrial Technology Research, Manado