Comparison of Reducing Sugar Content for Palm Sugar and Cane Sugar

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Abstract

In this research work, toddy palm juice was collected from Amarapura Township, Mandalay Region. Palm sugar was obtained from palm juice by freezing method. Cane sugar was collected from local market, Mandalay Region. The samples were determined by qualitative tests of sugar which gave rise to positive results for glycoside, reducing sugar, fructose, glucose and carbohydrate by various methods such as Glycoside test, Benedict's test,Fehling's tests,Molisch's test, Seliwanoff's test, Rapid Furfural test andBarfoed test respectively. Moreover, quantitative determination of total sugar was estimated by using Somogyi's reagent. Furthermore, reducing sugar contents of the palm sugar and cane sugar were measured by Rebelein method. 15.5 % of reducing sugar in palm sugar and 5.5 % of reducing sugar in cane sugar were observed.

Keywords: Palm Sugar, Cane Sugar, Somogyi's reagent, Rebelein method.

Indroduction

Toddy Palms are availableand they can pass through severe drought situations. In the content of today's climatic conditions it need to propagate and conserve the Toddy Palms. They are going to provide highly nutrient alternate food and will address various health matters. Hence it is clear that there is no need to speed single penny on plantation and maintenance. Many Asian countries are far ahead in this industry and they have tapped all the international markets. It has high potential of employment generation and the market demand for Toddy Palm Products is ever increasing both in domestic and global markets. Various organic products such as organic Jaggery, Diabetic free sugar, dietary fiber, Natural Wine, Handicrafts, canned Toddy Palm Seeds and many more useful products can be produced from toddy juice. Palms are highly productive trees, and their important role to tropical peoples cannot be unmeasured. Toddy Palms have been tapped particularly for their sweet sap which is made into sugar and both alcoholic and non-alcoholic beverages. Their sweet fruit and young stems are also used. The method of obtaining this sap is to climb the tree, cut the end of the inflorescence (flower cluster) and hang a container from it to catch the sap that drips out. If the container is not coated inside with lime juice, the sap with ferment and become fermented within a couple of hours. (website .1). ToddyPalm contains sugar, protein, carbohydrates, amino acid, vitamin C, yeast, potassium, zinc, magnesium, iron, vitamin B1,B2,B3 and B6. (https:// www. Curejoy.com/ content/ benefits-and-side-effects-of-palm-toddy) Sugarcane is an oldest crop known to man, a major crop of tropical and sub-tropical regions worldwide. Sugarcane is a glycophyte, sucrose storing member of tall growing perennial monocotyledonous grass. Across the world 70% sugar is manufactured from sugarcane. India is the second largest country in sugarcane production in the world.Sugarcane is a major source of raw material for sugar industries and other allied groups of byproduct industries. The economic importance of the crop is much more that signified by its share in gross cropped area. The world economy is currently dominated by technologies which rely on fossil energy , which is likely to remain the case for much of the 21st century. Sugarcane is one the most efficient crops in the world in converting solar energy into chemical energy.(Solomon, 2006)

Therefore, palm sugar and cane sugar were selected to study in this research work to analyze the qualitative and quantitative determination of reducing sugar.

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Botanical Description of Toddy Palm
Family name - Palmaceae
Botanical name - *Borassusflabellifer*L.
English name - Palmyra palm
Myanmar name - Htan

Botanical Description of Sugarcane
Family name - Poaceae
Botanical name - *Saccharumofficinaurm*
English name - Sugarcane
Myanmar name -Kyan


Figure 1. Tree of Toddy Palm and Sugarcane Plant

EXPERIMENTAL

Sample Collection

Palm Juice(Toddy Palm) was collected fromAmarapura Township,Mandalay Region. Cane sugar was collected from local market, Mandalay Region.

Preparation of Palm Sugar and Cane Sugar

1 liter of palm juice was frozenin a deep freezer. Then the freeze palm juice were transferred to water bath and heated about 5 hours. The dried palm sugar was obtained.Concentrating the collecting the sample of cane sugar, it was collected from local market, Mandalay Region.



Figure 2. FreezedPalm Juice, Palm Sugar and Cane Sugar

Qualitative Tests of Sugar (*Harbone .J. B (1973)*

Glycoside Test

The sample (2gram) was boiled with distilled water for about 10 minutes and filtered. The filtrate was tested with 10% lead acetate, white precipitate was obtained. So, reducing sugar is present.

Benedict's Test

5 drops of sample solution was added to 2 mL of Benedict's reagent. Then, the mixture was boiled for 5 minutes in a water bath and cooled the solution. Orange precipitate was formed. Therefore, the test solution contains reducing sugar.

Fehling Test

The sample (2 g) was boiled with 95% ethanol for few minute. The solution was cooled and filtered, equal amount of Fehling A+ B solution were added to the filtrate and then shokethe test tube. The yellow precipitate was obtained.

Molisch's Test

2 drops of Molisch's reagent was added to about 2 mL of the test solution. The solution was properly mixed and about 1 mL of concentrated sulphuric acid was poured along the sideof the test tube.Purple colour was developed due to the formation of furfural derivatives by the action of the acid on the carbohydrate.Therefore, the test solution is regarded as containing carbohydrate.

Seliwanoff's Test

2 mL of Seliwanoff's reagent was added to two drops of test solution and the mixture was boiled for about 2 minutes. Red to orange color developed on boiling was observed and faint orange color appears only on prolonged boiling (about 7 minutes) was observed. So, it is sure that fructose is present in the test solution.

Rapid Furfural Test

6 drops of 1% α-naphthol and 5 mL of concentrated HCl were added to 1 mL of sample solution in a test tube. Then, the mixture was boiled. A purple color was developed as soon as the solution started boiling. Purple color appeared only when the solution was boiled for a few minutes.So, it is explored that there is the presence of glucose in the sample solution.

Barfoed's Test

2 mL of Barfoed's reagent was added to 1 mL of the test solution. The mixture was heated up to boiling point for 1 minute. Red precipitate was obtained. Therefore, it is examined that glucose.

Extraction and Purification of Sugar from Palm Sugar and Cane Sugar

50 mL of distilled water was added in 10 g each of palm sugar and of cane sugar.And then, the resulting solutions were heated in water bath for 20 minutes. The solutions were filtered and cooled and made to 250 ml solutions to obtain stock solutions.

10 mL of 5% $ZnSO_4$ and 10 mL of $Ba(OH)_2$ solution were added in each 12.5 mL of stock solutions. The mixture solutions were filtered. The purified sugar solutions were obtained.

Estimation of Total Sugar by Somogyi's reagent (website-2)

15 mL of purified sugar solutions were hydrolyzed by 0.3 mL of HCl in water bath for 15 minutes. The solutions were cooled and neutralized with Na_2CO_3. Distilled water was added to obtained 50 mL of hydrolyzed sugar solution.

5 mL of hydrolyzed sugar solution and 5 mL of Somogyi's reagent were mixed and the solution was divided into three portions in each test tube and covered with Aluminium foil. These test tubes were heated in water bath for 20 minutes to get the sample solutions were obtained. 3 mL of sample solution, 2 mL of KI and 1.5 ml of 2M H_2SO_4were mixed and the mixture was titrated with $Na_2S_2O_3$ by using starch indicator.

Estimation of Reducing Sugar by Rebelein Method (Benedict, S.R.1908)

Blank Titration

10 mL of $CuSO_4.5H_2O$ solution and 5 mL of alkaline potassium tartrate solution were added into 250 mL conical flask. 2 mL of distilled water was added into the flask. And then, it was heated for about 30 seconds, and allowed to cool down at room temperature. 10 mL of concentrated sulfuric acid solution and 10 mL of potassium iodide/ starch solution were added in the flask. The solution was swirled to mix the contents. Sodium thiosulfate solution was filled in the burette and the initial volume was recorded. Then the mixture was titrated with

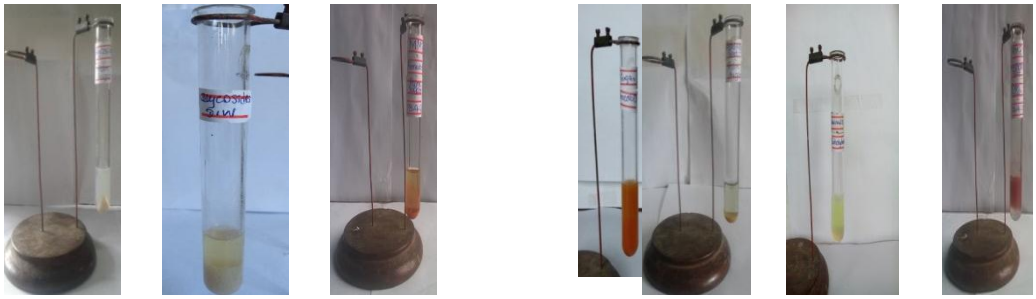
standard sodium thiosulfate solution, shaking the flask well to mix throughout the titration. When the endpoint was reached, the mixture changed into the creamy white color. After that, the final volume of sodium thiosulfate solution in the burette was recorded. A blank titration was performed prior to the titration of each sample.

Sample titration

10 mL of $CuSO_4.5H_2O$ solution and 5 mL of alkaline potassium tartrate solution were added into 250 mL conical flask. 2 mL of each sample solution was added into the flask. And then, it was heated for about 30 seconds, and allowed to cool at the room temperature. 10 mL of concentrated sulfuric acid solution and 10 mL of potassium iodide / starch solution were added into the flask. The solution was swirled to mix the contents. Sodium thiosulfate solution was filled in the burette and the initial volume was recorded. This mixture was titrated with standard sodium thiosulfate solution, shaking the flask well throughout the titration. When the endpoint was reached, the mixture changed into the creamy white color. After that, the final volume of sodium thiosulfate solution in the burette was recorded. Then, the final volume of sodium thiosulfate solution in the burette was recorded. A blank titration was performed prior to titration of each sample.

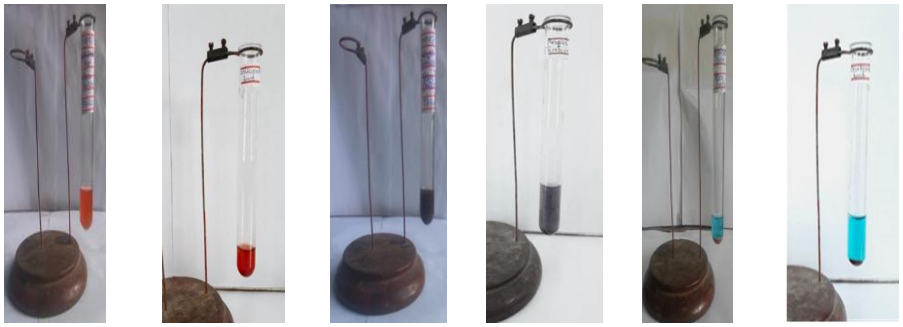
RESULTS AND DISCUSSION

Qualitative Tests of Sugar for Palm Sugar and Cane Sugar



Palm Sugar | Cane Sugar | Palm Sugar | Cane Sugar | Palm Sugar | Cane Sugar | Palm Sugar | Cane Sugar

Glycoside Test | Benedict's Test | Fehling's Test | Molisch's Test



Palm Sugar | Cane Sugar | Palm Sugar | Cane Sugar | Palm Sugar | Cane Sugar

Seliwanoff's Test | Rapid Furfural Test

Figure 3. Qualitative Tests of Sugar

Table 1. Qualitative tests of Sugar

No.	Experiment	Observation	Results	
			Palm Sugar	Cane Sugar
1.	Glycoside Test	white precipitate	Reducing sugar was present.	Reducing sugar was present.
2.	Benedict's Test	Orange precipitate	Reducing sugar was present.	Reducing sugar was present.
3.	Fehling'sTest	yellow precipitate	Carbohydrate was present.	Carbohydrate was present.
4.	Molisch's Test	Purple colour	Carbohydrate was present.	Carbohydrate was present.
5.	Seliwanoff's Test	Faint Orange precipitate	Fructose was present.	Fructose was present.
6.	Rapid Furfural Test	Purple Precipitate	Glucose was present.	Glucose was present.
7.	Barfoed's Test	Red precipitate	Glucose was present.	Glucose was present.

From qualitative tests of sugar, it is found that both samples gave rise to positive results for glycoside, reducing sugar, fructose, glucose and carbohydrate by various methods such as Fehling's test, Benedict's test, Seliwanoff's test, Rapid furfural test, Molisch's test, Barfoed's test and respectively.

Determination of Total Sugar by Somogyi's Reagent

Table 2. Results of Titration of $Na_2S_2O_3$ for Blank Solution by Somogyi's Reagent Indicator – Starch

No.	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	46.7	46.7
2	0	46.6	46.6
3	0	46.6	46.6
		Mean	46.6

Estimation of Total Sugar Content in the Palm Sugar

Table 3. Results of Titration of Palm Sugar with $Na_2S_2O_3$ Indicator – Starch

No.	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	39.4	39.4
2	0	39.3	39.3
3	0	39.3	39.3
		Mean	39.3

Estimation of Total Sugar Content in the Cane Sugar

Table 4. Results of Titration of Cane Sugar with $Na_2S_2O_3$ by Somogyi's Reagent Indicator – Starch

No.	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	33.2	33.2
2	0	33.1	33.1
3	0	33.1	33.1
		Mean	33.1

Determination of Reducing Sugar by Rebelein Method

Table 5. Results of Titration of $Na_2S_2O_3$ for Blank Solution by Rebelein Method Indicator – Starch

No	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	14.7	14.7
2	0	14.6	14.6
3	0	14.6	14.6
		Mean volume	14.6

Determination of Reducing Sugar by Rebelein Method

Table 6.Results of Titration of $Na_2S_2O_3$ for Blank Solution byRebelein Method Indicator – Starch

No	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	14.7	14.7
2	0	14.6	14.6
3	0	14.6	14.6
		Mean volume	14.6

Determination of Reducing Sugar Contents in Palm Sugar Solution

Table 7. Results of Titration of Palm Sugar Solution with $Na_2S_2O_3$ by Rebelein Method Indicator-Starch

No	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	11.6	11.6
2	0	11.5	11.5
3	0	11.5	11.5
		Mean volume	11.5

Calculation

Reducing sugar content (g/L) = Blank titration – Palm sugar

= 14.6 – 11.5

= 3.1 g/L (from 20 g of palm sugar)

% by mass of reducing sugar in palm sugar = $\frac{3.1}{20} \times 100$ = 15.5 %

Determination of Reducing Sugar Contents in Cane Sugar Solution

Table 8. Results of Titration of Cane Sugar Solution with $Na_2S_2O_3$by Rebelein Method Indicator – Starch

No	Initial volume (cm^3)	Final volume (cm^3)	Used volume (cm^3)
1	0	13.6	13.6
2	0	13.5	13.5
3	0	13.5	13.5
		Mean volume	13.5

Calculation

Reducing sugar content (g/L) = Blank titration – Cane sugar

= 14.6 – 13.5

= 1.1 g/L (from 20 g of cane sugar)

$$\% \text{ by mass of reducing sugar in palm sugar} = \frac{1.1}{20} \times 100 = 5.5\ \%$$

The quantitative determinations of total sugar were detected by using Somogyi's reagent. 13.14 % of total sugar in palm sugar and 24.3 % of total sugar in cane sugar were present. Reducing sugar contents of the palm sugar and cane sugar were measured by Rebelein method. 15.5 % of reducing sugar in palm sugar and 5.5 % of reducing sugar in cane sugar were present.

CONCLUSION

In addition, the quantitative determinations of total sugar were detected by using Somogyi's reagent. 13.14 % of total sugar in palm sugar and 24.3 % of total sugar in cane sugar were present. Reducing sugar contents of the palm sugar and cane sugar were measured by Rebelein method. 15.5 % of reducing sugar in palm sugar and 5.5 % of reducing sugar in cane sugar were present. The results revealed that palm sugar displayed the highest reducing sugar content. Cane sugar contained less reducing sugar content than palm sugar. Palm sugar has a very good taste thus is very useful for enhancing food taste. Herbal medicines produced with palm sugar is used for treating typhoid, bad breathe, cold, anemia, cough, high blood pressure, leprosy and asthma. Palm sugar helps a lot with basic regulatory processes in our body. It helps the digestive system in digesting the food. It also helps in clearing out the intestinal tracts and generates enzymes helpful and conductive to the process of digestion of the ingested food.

REFERENCES

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Online Materials

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http://biocyclopedia.com>index>plant-protocol>carbohydrates>redu...