DETERMINATION OF REDUCTION SUGAR FORM BANANA (*MUSA ACUMINAT A BALBISIANA COLLA*) WITH DIFFERENT COOKING PROCESS BY UV-VISIBLE SPECTROPHOTOMETER

Rina Putri Romadhoni[1,*], Tri Esti Purbaningtias[2], Muhaimin[3], Lina Fauzi'ah[3]

[1]Student of Chemical Analyst Department, Islamic University of Indonesia
Kampus Terpadu UII, Jl. Kaliurang Km 14,5 Sleman, Yogyakarta,
[2]Cemical Analyst Department, Faculty of Mathematics and Science, Islamic University of Indonesia
[3]Chemistry Education Department, Faculty of Mathematics and Science, Islamic University of Indonesia

*email: putririna172@gmail.com

Abstract

Banana (*Musa acuminat a balbisiana Colla*) was the one of the most useful plants in the world, especially in tropical regions of indonesia. Banana's content was strongly believed could lowered blood pressure. This research aimed to determine the effect of banana's cooking on reduction of sugar content using somogyi-nelson method. The cooking processes of banana were boiled, roasted, steam and fried. Reduction of sugar content was analyzed using UV-Visible spectrophotometer at 761 nm. The result showed that the cooking process decreased the sugar content from Banana. The highest glucose concentration was obtained from banana without cooking process, i.e. 0.0667 mg/mL or 0.1667%, While the lowest glucose concentration was obtained from banana with burning process, i.e. 0.0468 mg/mL or 0.1171%.

Keywords: banana, Somogyi-nelson method, cooking processes, reduction of sugar, UV-Visible Spectrophotometer

INTRODUCTION

Banana is an herbal plant that originated from Southeast Asia (including Indonesia). It has excellent nutritional properties and value (Suyanti, 2001). It is one of the fruits that contain many sources of vitamins and minerals. Similar to vegetables, bananas contain complete macronutrients, namely proteins, fats, and carbohydrates (Tirtawinata, 2006).Changes in starch levels and the addition of sugar levels is a prominent feature in the banana ripening process. At harvest time, bananas contain starch about 20-30% wet weight. At the end of ripening

fruit, almost all starch is hydrolyzed to simple sugar only 1-2%. The content of sugar in young bananas is only about 2% but after cooking increases to 15-20% (Musita, 2012).

Carbohydrates belonging to the digestible group are glucose, fructose, lactose, maltose and starch. Glucose ($C_6H_{12}O_6$) is a six-carbon monosaccharide (hexona) used as a source of energy by a heterotrophic cell. Carbohydrates serve as a sweet giver. This sweet taste is due to reducing sugar. Determination of carbohydrate levels is done by measuring the amount of sugar content reduction therein. Sugar reduction is sugar that has the ability to reduce. Examples of sugars including reducing sugars are glucose, mannose, fructose, lactose, maltose, and others. The reducing property of a sugar is determined by the presence or absence of reactive free hydroxyl groups.

The nelson-somogyi method is used to measure reducing sugar by using copper reagents and arsenolmolibdat. The working principle of somogyi-nelson is the amount of deposro oxide deposits that react with arsenomolibdate which is reduced to molybdine blue and the blue color is measured absorbance. The nelson-somogyi reagent acts as an oxidizing agent between coupro oxide which reacts with reducing sugar to form a brick red precipitate, by comparing it to standard solutions. The concentration of sugar in the sample can be determined, the reaction of the forming color can determine the sugar concentration in the sample by measuring the absorbance (Sudarmadji, S. 1984).

MATERIAL AND METHOD

1. Raw Material

The raw material used in this experiment was banana *(Musa acuminat a balbisiana Colla)* from traditional market in Sleman,Yogyakarta.

2. Chemicals and Reagents

Chemicals that were used for these experiment: pure glucose solution, H_2O, Nelson's arsenomolybdate reagent.

3. Research Variable

The variable of this research was banana cooking process. They were boiled, roasted, steamed and fried. Then calculated glucose concentration after cooking process by nelson-somogyi method.

4. Determination of The Maximum Wavelength (Nelson, 1944)

The maximum wavelength determination was performed by adding 1 ml of a 0.02 mg / mL glucose standard solution with 1 mL alkaline Cu reagent (A and B A reagent mixture). The solution is heated over a waterbath with a temperature of 100 ℃ for 20 minutes. The solution was cooled to 25 ℃, then solution plus 1 mL of arsenomolybdate reagent and solution was shaken. The determination of the maximum wavelength was measured using a UV-Vis spectrophotometer at a wavelength of 745-765 nm.

5. Determination of The Standard Curve

Determination of standard curve is done by making a series of standard solutions are 0; 0.02; 0.04; 0.06; 0.08; 0.1 (mg / mL) was then added with 1 mL of an alkaline Cu reagent. The solution is heated over a waterbath with a temperature of 100 ℃ for 20 minutes. The solution was cooled to 25 ℃, then the solution was added 1 mL of arsenomolybdate reagent and the solution was stirred. the solution is allowed to stand for 25 minutes then add Aquadest 7 mL and absorbance is read with a visible spectrophotometer at maximum wavelength. Then graphs the relationship between concentration and absorbance.

6. Determination of Glucose Levels in The Sample

Determination of glucose levels in the sample was done by adding 1 mL of sample extract solution with 1 mL of alkaline Cu reagent (A and B A reagent mixture). The solution is heated over a waterbath with a temperature of 100 ℃ for 20 minutes. The solution was cooled to 25 ℃, then the solution was added 1 mL of arsenomolybdate reagent and the solution was stirred. Then added aquadest 7 mL. The solution was immobilized for 25 minutes and the absorbance was read by UV-Vis spectrophotometer at maximum wavelength.

7. Calculation of Glucose Concentration in Sample

The calculation of the concentration on the sample was done using the linear regression equation of standard solution obtained y = ax + b where Y is the

absorbance of the measured sample solution and X is the concentration of the sample solution($^{mg}/_{mL}$).

$$C = \frac{Y - b}{a}$$

RESULTS AND DISCUSSION

Determination of glucose levels in banana was done by using the Nelson-Somogyi method. The process of forming complex solutions in the sample is that the reaction occurring between cu alkalis reagents (Cu^{2+}) is specific with reducing sugars to Cu^{+} (red brick deposits) then when added the arsenomolybdate of the precipitate dissolves and forms a greenish-blue (Cu^{+} converted back to Cu^{2+}). Therefore, other non-reducing sugars present in the sample will not affect the reaction (Kautsar, 2011). The color intensity formed shows the amount of reducing sugar contained in the example, because the reduced arsenomolibdate concentration is proportional to the concentration of copper (1) oxide (Cu_2O), while the concentration of Cu_2O is proportional to the reducing sugar concentration (Nelson, 1944).Reaction of reducing sugar is presented in Fig 1.

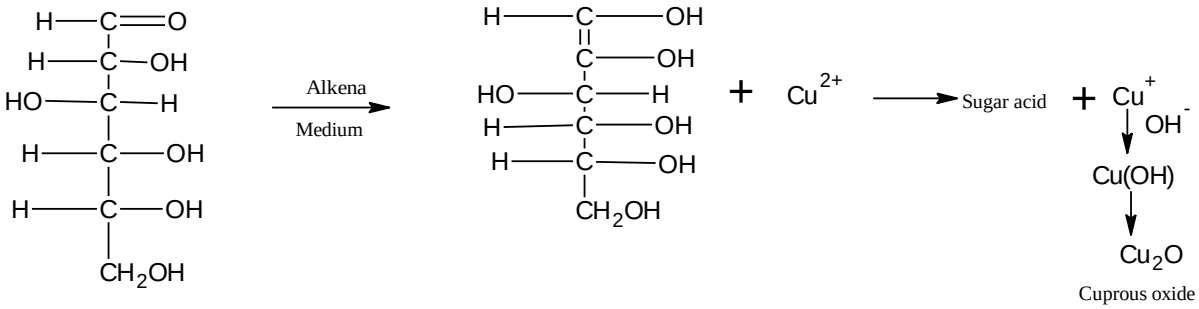

Fig 1. Reaction of Reducing Sugar(Lang, 2004)

The maximum wavelength determination result was 761 nm. Then,itwas used to determine the concentration of standard solution and sample. The curve of the relationship between the concentration of the tandar slope and the absorbance is presented in Fig 2.

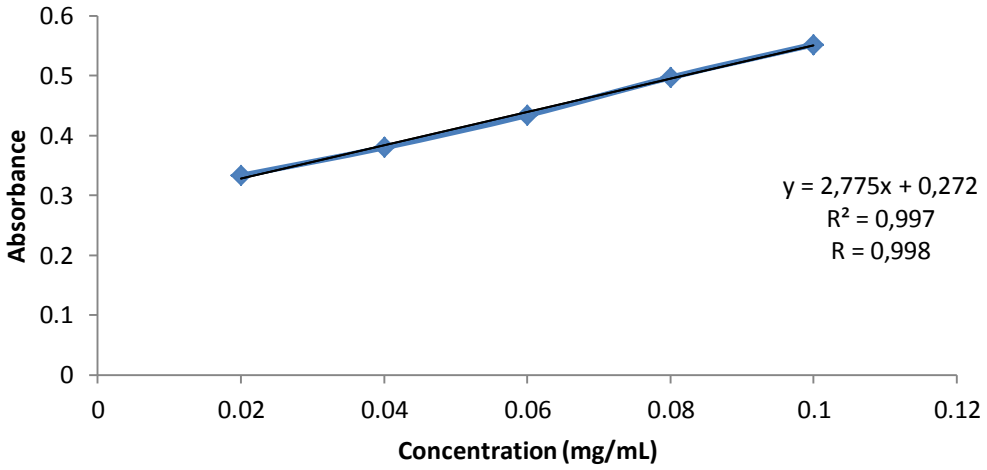

Fig 2. Glucose Standard Curve

In this spectrophotometric technique, analysis of a number of monosaccharides and disaccharides can only describe reducing sugar levels (Al-kayyis and Susanti 2016). The results of the analysis of reducing sugar content in the sample with several processing variables werewithout cooking, boiled, roasted, steam and fried process shown in Table 2 and Fig 3.

Table 2. Glucose Levels in Bananas

Sample	Without Cooking	Fried	Roasted	Boiled	Steam
Glucose Level (mg/mL)	2,56	2,31	2,41	2,45	2,52

Table 2 has shown that reducing sugar concentrations decreased after cooking. The lowest glucose concentration was in the frying process because high temperatures in cooking oil could damage the structure of glucose, resulting in reduced glucose concentration in fried bananas compared with glucose levels before cooking.

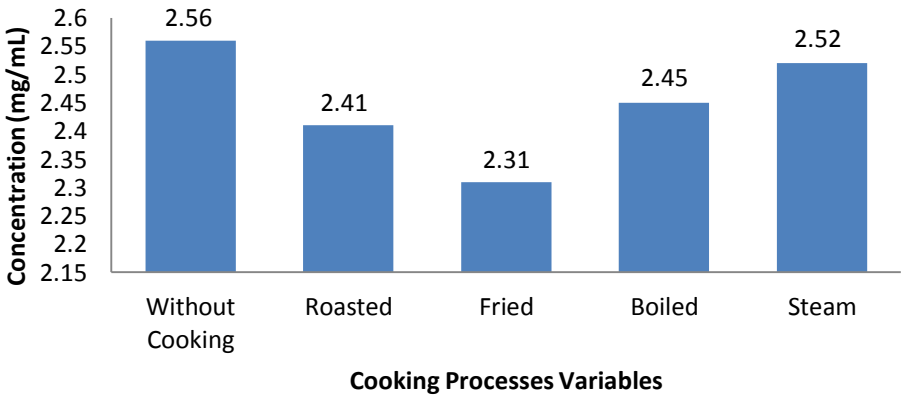

Fig 3. Glucose Level in Bananas with some cooking process

The result of determining the% RPD value is presented in Table 3. Table 3 showed that the value of% RPD less than ≤2% means that the average repetition results have good precision.

Table 3. The value of % RPD response to the Sample

No	Sample	Concentration	%RPD
1	Without Cooking	0,0256	0
2	Fried	0,0231	0
3	Roasted	0,0241	0
4	Boiled	0,0245	0
5	Steam	0,2623	0

CONCLUSION

Based on the results of the study showed that the reducing sugar content of bananas *(Moses acuminat a balbisiana Colla)* through the processing of baked, fried, boiled, steamed are2.56; 2.41; 2.31; 2.45; 2.52 mg / mL. This suggests that the process of cooking bananas can lower glucose levels in the banana.

BIBLIOGRAPHY

Al-kayyis, H. K., & Susanti, H., (2016), Perbandingan Metode Somogyi-Nelson Dan Anthrone-Sulfat Pada Penetapan Kadar Gula Pereduksi Dalam Umbi Cilembu (Ipomea batatas L.),*Journal of Pharmaceutical Sciences and Community*, 13(2), 81-89.

Kautsar, R. H.,2011, *Kajian Hidrolisis Enzimatis Selulosa dari Alga Merah (Euchema spinosum dan Eucheuma cottoni) Menggunakan Enzim Selulase dari Aspergillus niger*. Malang: Universitas Negeri Islam Malang

Lang, A. T. P.,2004, *Physico-Chemical Properties of Starch in Sago Palm (Metroxylon sagu) at Different Growth Stages*, Pulau Pinang : Universiti Sains Malaysia.

Musita, N., (2012), Kajian Kandungan dan Karakterisik Pati Resisten dari Berbagai Varietas Pisang,*Jurnal Teknologi & Industri Hasil Pertanian*, 14(1).

Nelson, N., 1944, A photometric adaptation of the Somogyi method for the determination of glucose,*Journal Biol. Chem*, 153(2), 375-379.

Sudarmaji, S., Haryono, B., Suhardi,*Prosedur analisa untuk bahan makanan dan pertanian*, Liberty, 1984.

Suyanti S, A Supriyadi, (2001),*Pisang Budidaya Pengolahan dan prospek Pasar*, Jakarta : Penebar Swadaya.

Tirtawinata, T. C., 2006,*Makanan dalam Perspektif Al-Quran dan Ilmu Gizi*, Jakarta : Balai Penerbit FK UI.