Determinination Of Iron, Potassium, Calcium, And Sodium In The Fruit Of Guava (*Syzygium Aqueum*) And Guava Semarang (*Syzygium-Samarangense*) In Spectrophotometry Atomic Absorption

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Abstract.
Syzygium belongs to the guava tribe or Myrtaceae, originating from Southeast Asia. Syzygium is divided into two: small water guava known as Syzygium aqueum and large water guava known as Syzygium samarangense. This study aims to determine the mineral levels of iron, potassium, calcium, and sodium contained in guava and guava Semarang and to compare mineral levels between a guava and guava Semarang. Each sample was dry digested, and then quantitative analysis of iron, potassium, calcium, and sodium was carried out using atomic absorption spectrophotometry (AAS) with a wavelength of 248.3 nm; potassium 766.5 nm; calcium 422.7; and sodium 589.0 nm. The advantage of this method is that it can determine the content of minerals in small quantities without being influenced by other minerals. The results showed the levels of iron, potassium, calcium, and sodium in guava and guava Semarang, respectively: (0.2553 ± 0.0077) mg/100g and (0.1548 ± 0.0152) mg/100g; (70.2326 ± 1.5738) mg/100g and (45.7714 ± 0.9827) mg/100g; (3.8588 ± 0.1619) mg/100g and (0.4663 ± 0.0507) mg/100g; (8.1187 ± 0.3375) mg/100g and (6.1648 ± 0.1689) mg/100g. A comparison of mineral content between guava and guava Semarang shows that iron, potassium, calcium, and sodium minerals in guava are more significant than in guava Semarang. Statistically, the different tests of the average content of iron, potassium, calcium, and sodium between guava and guava Semarang using the F distribution found that the content of iron, potassium, calcium, and calcium sodium in guava was significantly higher than in guava Semarang.

Keywords: *Water guava, iron, potassium, calcium and sodium atomic absorption spectrophotometry.*

I. INTRODUCTION

Guava is included in the Myrtaceae tribe originating from Southeast Asia. Water guava is divided into two: small guava known as Syzygium aqueum and large water guava known as Syzygium samarangense. Other names for small guava, namely: Camplong, Bangkalan, Button, Rose (guava palace), Sukaluyu, Baron, and Bell. While the big water guava has other names such as guava Semarang, Madura, Lilin (super sweet), Apple and Cincalo (red and green). Some of these types of guava are difficult to distinguish, so the common name guava often names them (Haryanto, 2000).Guava (Syzygium aquarium) and Semarang guava (Syzygium samarangense) have similar trees and fruit. The differences between Sygygium aquarium and Syzygium samarangense are as follows, Syzygium aquarium: is generally a small tree; the upper surface of the grooved side leaf bone; the shape of the fruit is less varied, namely only in the form of buttons and bells; the colour of the fruit is whitish pink, pink, red and dark red; sour fruit taste. As for Syzygium samarangense: small to large trees. Generally, the upper surface of the lateral leaf veins is flat; the shape of the fruit varies; there are bouncing, rounded, egg-shaped, forming a dome, flattened; fruit colour varies from dark green, light green, white, yellowish, light pink, dark pink, red, brownish, and blackish; sweet fruit taste (Rohman, 2007).

Potassium is needed as an element for forming skeletal and heart muscles, maintaining fluid balance in the body and as a carbohydrate and protein metabolism (Barasi, 2007). Calcium, or lime, is a mineral substance that functions in forming bones and teeth and has a role in the vitality of muscles in the body. The metabolism of calcium (Ca) and phosphorus (P) is closely related. Ca and P bonds in bones and teeth occur as inorganic crystals (Hirdan, 2021).Sodium is the principal cation in extracellular fluid; 35 to 40 percent of sodium is in the body. Gastrointestinal fluids, such as bile and pancreatic juices, contain large amounts of sodium. The primary source of sodium is table salt or NaCl (Almatsier, 2001). Some minerals combine with organic substances; some are in the form of free ions. These mineral elements function as building blocks and regulators. Mineral sources can come from plants or animals. The mineral needs per day are 2,500 mg potassium/day, 800 mg calcium/day, and 2,500 mg sodium/day (Ditjen POM, 1979).According to the USDA, guava fruit contains 0.07 mg/100g iron, 123 mg/100g potassium, and 29 mg/100g calcium. Guava water (Syzygium aquarium) and guava Semarang (Syzygium samarangense) with atomic absorption spectrophotometry method because the implementation is simple, selective and has high sensitivity (detection limit is less than 1 ppm) (Gandjar dan Rohman, 2012).

II. METHODS

2.1 Tools and Materials

Shimadzu Atomic Absorption Spectrophotometer (AA-7000F) complete with potassium, calcium, sodium, magnesium, and iron cathode lamps, analytical balance 20 (BOECO Germany), hot plate (BOECO Germany), furnace, blender, Whatman No.42 filter paper, porcelain crucibles and glassware (Pyrex and Oberoi). The sample used in this study was guava which was taken on Jalan Medan Area Gang Cendrawasih, Medan, North Sumatra. Meanwhile, guava Semarang was purchased at Sukaramai Market, on Jalan AR Hakim, Medan Area sub-district, North Sumatra.

2.2 Work Procedures

Plant materials were collected and determined at the Herbarium Medanense, Biology Research Center, University of North Sumatra. Each sample is weighed to a maximum of 25 g, placed in a porcelain crucible, heated on a hot plate, and then ashed in a kiln with an initial temperature of 100°C and the temperature is gradually increased to 500°C with intervals of 25°C every 5 minutes. After 24 hours of scrubbing (calculated at 500°C), the porcelain crucible is removed from the furnace and allowed to cool. The porcelain crucible is then set aside to cool. The ash was mixed with 5 ml of HNO3 (1:1) and evaporated on a hot plate (temperature between 100 and 120 degrees Celsius) until dry. The porcelain crucible was reinserted into the kiln with an initial temperature of 100°C, and the temperature was gradually increased to 500°C at the rate of 25°C every five minutes. Ashing is performed for one hour, and the furnace is allowed to cool (temperature 27°C) (Soeditomo, 2008).The digested sample was dissolved in 5 mL of HNO3 (1:1), then transferred to a 50 mL volumetric flask, and rinsed in a porcelain crucible with 10 mL of demineralized water three times up with demineralized water to the marked line and then filtered with Whatman No.

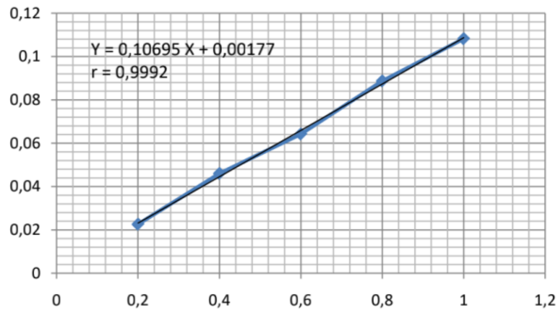
Filter paper. 42 where the first 5 mL of the filtrate is discarded to saturate the filter paper then the filtrate is then collected into a bottle (Santoso, 2008).The quantitative examination is done by making calibration curves for potassium, calcium, sodium and iron. For the potassium calibration curve, 10 mL of potassium standard solution (concentration 1000 g/mL) was pipetted, put into a 100 mL volumetric flask and made up to the mark with demineralized water (concentration 100 g/mL). The solution for the potassium calibration curve was prepared by pipetting 0.5 mL; 1 mL, 1.5 mL; 2 mL and 2.5 mL of standard 100 g/mL, respectively, were put into a 25 mL volumetric flask and made up to the mark with demineralized water (this solution contains potassium at a concentration of 2 g/mL, 4 g/mL, 6 g/mL, 8 g/mL and 10 g/mL). The absorbance was measured at a wavelength of 766.5 nm with an air-acetylene flame.Determination of levels is done by pipetting the sample solution from the destruction of 0.4 mL and then put into a 100 mL volumetric flask and filled with demineralized water to the marked line (dilution factor = 100 mL/0.4 mL = 250 times). Then the absorbance was measured at a wavelength of 766.5 nm using an atomic absorption spectrophotometer adjusted to an air-acetylene flame. The absorbance value must be within the range of the calibration curve of the standard potassium solution. The potassium concentration in the sample is determined based on the equation of the regression line of the calibration curve.

III. RESULT

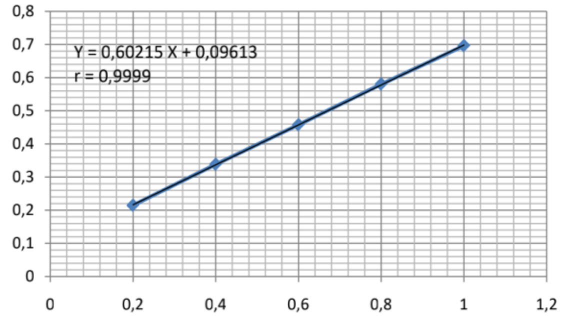
Calibration Curve

The calibration curve for standard iron, potassium, calcium, and sodium solutions can be seen in the following figure.

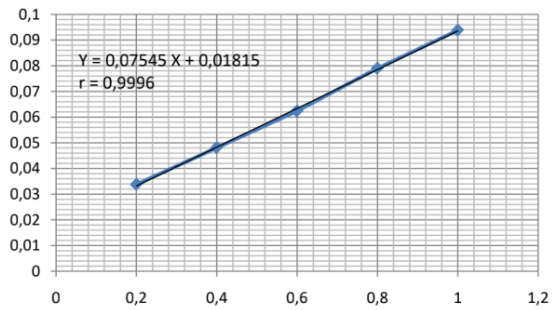
Curve of iron



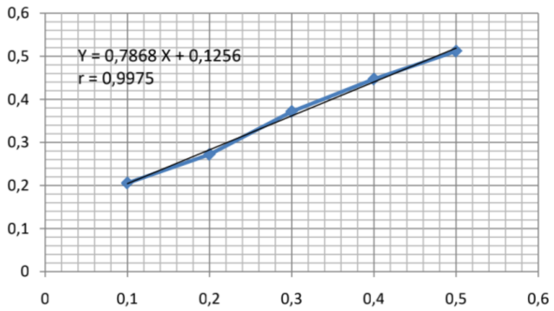
Curve of Potassium



Curve of calcium



Curve of sodium



Information:
X = Concentration (mcg/ml)
Y = Absorbance

Analysis with AAS

The results of the quantitative analysis of iron, potassium, calcium, sodium, and magnesium minerals in the sample can be seen in Table 1.

Table 1. Results of Analysis of Iron, Potassium, Calcium, and Sodium Contents in the sample

No	Sample	Iron (mg/100g)	Potassium (mg/100g)	Calcium (mg/100g)	Sodium (mg/100g)
1	Syzygium aqueum	0.2553 ± 0.0077	70.2326 ± 1.5738	3.8588 ± 0.1619	8.1187 ± 0.3375
2	Syzygium samarangense	0.1548 ± 0.0152	45.7714 ± 0.9827	0.4663 ± 0.0507	6.1648 ± 0.1689

Different from the literature, which states that guava contains 0.07 mg/100g iron, 123 mg/100g potassium, and 29 mg/100g calcium, this study resulted in higher iron levels than the literature, while for potassium and calcium levels, the results showed lower than that stated in the literature. For comparison of sodium levels and mineral levels of iron, potassium, and calcium in guava Semarang, no research has been carried out to support this study's results. The different levels obtained from each mineral and metal can be influenced by several factors such as variety, where the plant grows and the processing process (Bassar dan Westendorf, 2012). To find out the difference in levels of iron, potassium, calcium, and sodium minerals between a guava and guava Semarang, an Independent Samples T Test was carried out, which is a test used to prove whether there is a difference in the average value between 2 (two) independent samples.10 From the results of these 38 tests, it was concluded that the levels of iron, potassium, calcium, and sodium had significant differences in levels (Santoso, 2008).

Detection Limit and Quantitation Limit

The detection and quantitation limits for the five minerals were obtained based on the calibration curve data for iron, potassium, calcium, and sodium. From the calculation results obtained for the measurement of the detection limit of iron, potassium, calcium, and sodium respectively 0.0446 mcg/ml;

0.0298 mcg/ml; 0.0116 mcg/ml; and 0.0391 mcg/ml. While the limit for each mineral is 0.1487 mcg/ml; 0.0994 mcg/ml; 0.0387 mcg/ml; and 0.1302 mcg/ml. From the calculation results above, it can be seen that all the results obtained in the sample measurement are above the detection limit and quantitation limit (Sudjana, 2005).

IV. CONCLUSION

[1]The results showed the levels of iron, potassium, calcium, and sodium in Guava and Guava Semarang, respectively: (0.2553 ± 0.0077) mg/100g and (0.1548 ± 0.0152) mg/100g; (70.2326 ± 1.5738) mg/100g and (45.7714 ± 0.9827) mg/100g; (3.8588 ± 0.1619) mg/100g and (0.4663 ± 0.0507) mg/100g; (8.1187 ± 0.3375) mg/100g and (6.1648 ± 0.1689) mg/100g. The results of statistical tests found that the levels of iron, potassium, calcium, and sodium in guava were relatively significantly higher than in guava in Semarang.

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