Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 38 – 42

talenta PUBLISHER

JCNaR
Journal of Chemical Natural Resources

JCNaR

Effect of Addition of Chitosan Derived From Shrimp Shell to Reduce The Caffeine Content of Powder Coffee

Hendi Surya Lubis[1], Harry Agusnar[2*], and Zul Alfian [3]

[1,2,3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Jalan Bioteknologi No.1 Kampus USU Medan 20155, Indonesia

Abstract. A study on the effect of the addition of chitosan derived from shrimp shells to reduce the caffeine content of powder coffee has been conducted. Chitosan was used as an adsorbent to reduce the caffeine content in coffee powder with mass variations of as much as 0,2; 0,4; 0,6; 0,8; and 1 g in the extraction of coffee powder. The number of caffeine contents was analyzed by using spectrophotometry. The result obtained showed that the caffeine content without the addition of chitosan is 0.168 % while caffeine content after the addition of the mass variations of 0.2; 0.4; 06; 0.8, and 1 g chitosan, the caffeine content decreased to 0,083% ; 0,043 % ; 0.019 % ; 0,014 % and 0,006 %, respectively.

Keywords: Caffeine, Chitosan, Spectrophotometry

Received [29 October 2019] | Revised [3 December 2019] | Accepted [28 January 2020]

1 Introduction

Powder coffee according to SNI no.01-3542-2004 is roasted coffee beans and then ground, with or without the addition of other ingredients at certain levels without reducing the taste and aroma, and does not harm health.

Caffeine is a stimulant of the central nervous system and can cause diuresis, stimulate the heart muscle and relax the smooth muscles of the bronchus. Clinically, it is usually used based on its central efficacy, stimulating all the central nervous system (Suriani, 1997).

Many people who drink drinks containing caffeine can relieve fatigue, hunger, and drowsiness. The excessive use of caffeine can cause palpitations, stomach disorders, trembling hands, restlessness, reduced memory, and difficulty sleeping (Tjay et al, 2002).

*Corresponding author at: Department of Chemistry, Faculty of Mathematics and Natural Sciences Universitas Sumatera Utara, Medan, Indonesia.

E-mail address: harryagusnar@yahoo.com

Journal Homepage: http://jcnar.usu.ac.id

Journal of Chemical Natural Resources Vol. xx, No. xx, xxxx | 38 – 42

Kapal Api is a brand of powder coffee owned by Pt Santos Jaya Abadi which has won the Indonesian Trademark Award 2003 from the government. Based on the top Brand survey for 13 years, the fireship brand has always occupied the top position. The special ingredients of Kapal Api offer the best quality, steady taste, and an alluring aroma. (http://moko31.wordpress.com/2009/08/30/strategi-marketing-mix-kopi-kapal-api). In contrast to energy drinks, Kapal Api drinks do not include the total amount of caffeine in each package.

Chitin is commercially generally extracted from shrimp shells, and crab shells obtained from industrial waste processing. The extraction process of chitin from shrimp shells and crab shells is chemically relatively simple. (Muzzarelli,1977).

Chitosan is produced from the deacetylation process of chitin using a strong alkali. Chitosan is a cationic polymer that was insoluble in water, and alkaline solutions with a pH above 6.5. Chitosan is readily soluble in organic acids such as formic acid, acetic acid, and citric acid (Rahayu, 2007).

Chitosan is often used as an adsorbent in transition metal ions and organic species. It was caused by the presence of amino group ($-NH_2$) and hydroxyl group (-OH) of the chitosan chain that can be used as a place to coordinate and react (Hwang, 2002).

Based on the description above, it was assumed that the addition of chitosan derived from shrimp shells can reduce the caffeine content from Kapal Api powder coffee produced by PT Santos Jaya Abadi.

2 Materials and Methods

2.1 Materials

The main materials used were chitosan derived from shrimp shells, Kapal Api powder coffee, distilled water, silica gel, caffeine (USP, anhydrous), chloroform, ether, ammonia, sodium hydroxide (NaOH) 2N, sulfuric acid ($H_2SO_{4)}$ 4N and acetic Acid 1%.

2.2 Equipment

In this study, UV/Visible Shimadzu spectrophotometer device. glassware Pyrex. electric scales, hot plates, and chromatographic columns were used.

2.3 Preparation of Caffeine Standard Solution

In order to make a standard solution of caffeine by dissolved 100 mg of caffeine with chloroform in a 100 L volumetric flask, then take 10 mL of the solution and put it into a 100 mL volumetric flask, and the distilled water is added to the marked line. As much as 4, 6, 8, 10, and 12 mL of solution was placed respectively into a volumetric flask of 100 mL and added the

Journal of Chemical Natural Resources Vol. xx, No. xx, xxxx | 38 – 42

chloroform to the marked line. The caffeine standard solution was obtained with 4, 6, 8, 10, and 12 µg caffeine/mL.

2.4 Maximum Wavelength

The maximum wavelength was obtained by measuring the absorbance of caffeine standard solution 8 HDMI G caffeine / mL at 266-284 nm. Chloroform was used as a blank solution. In this study, the maximum wavelength obtained was 275.5 nm.

2.5 The Curve Calibration of Caffeine Standard Solution

The calibration curve of the caffeine standard solution was obtained by measuring the absorbance of a standard solution of 4, 6, 8, 10, and 10 µg caffeine/mL at 275.5 nm. The calibration curve was obtained by making a curve between the concentration and the absorbance of the standard solution.

3 RESULT AND DISCUSSION

Measurement of caffeine content reduction of Kapal Api powder coffee was performed by comparing the difference between the caffeine content of Kapal Api powder coffee with the addition of chitosan and no chitosan.

Tabel 1. Caffeine content with addition of chitosan and no chitosan

Caffeine Solution	Yield (%)
No chitosan	0.168
1 g of chitosan	0.006
0.8 g of chitosan	0.014
0.6 g of chitosan	0.019
0.4 g of chitosan	0.043
0.2 g of chitosan	0.083

Tabel 2. Caffeine absorbed after the addition of chitosan

Caffeine Solution	Caffeine absorbed (%)
1 g of chitosan	0.162
0.8 g of chitosan	0.154
0.6 g of chitosan	0.149
0.4 g of chitosan	0.125
0.2 g of chitosan	0.085

Journal of Chemical Natural Resources Vol. xx, No. xx, xxxx | 38 – 42

The chart of caffeine content with the addition of chitosan and no chitosan of Kapal Api powder and caffeine absorbed are presented in figure 1 and figure 2.

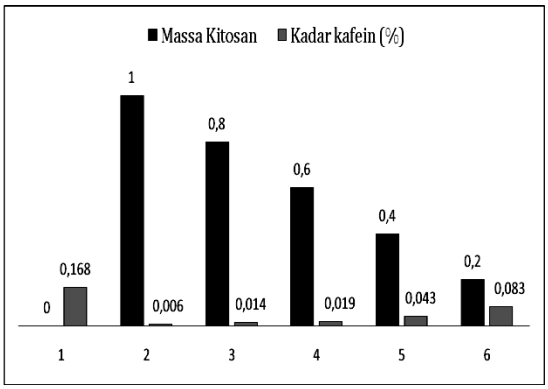

Figure 1. Chart of caffeine content with the addition of chitosan and no chitosan

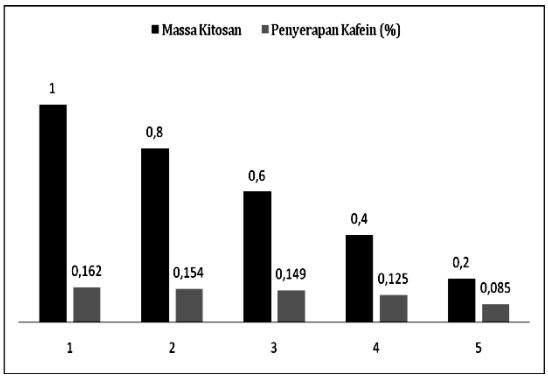

Figure 2. Chart of absorbed caffeine levels after addition of chitosan

Figure 1 showed that the caffeine content of Kapal Api powder coffee with the addition of chitosan treatment decreased. Caffeine content with no chitosan treatment was 0.168%. In addition, addition each of chitosan with mass variation 0.2, 0.4, 0.6 0.8 and 1 g continued to decrease the caffeine contents were 0.083%, 0.043%, 0.019%, 0.014% and 0.006%, respectively

The absorption process could operate when the surface of the adsorbate molecule bent the surface of the absorbent so that some will stick to the surface of the solid and be absorbed. Firstly, the adsorption rate was quite large because the entire surface was still empty. However, after a longer contact time, the surface filled by molecules increased and the cacant area decreased So which caused the adsorption rate also decreased. The interaction involved in the absorption process of caffeine by chitosan between the adsorbate and the adsorbent is Van der Waals. It happened because hydrogen bond between the chitosan and caffeine molecules.

4 Conclusion

Based on the result of the research, it can be concluded that caffeine content after the addition of chitosan decreased. Caffeine content with no chitosan treatment was 0.168%. In addition,

addition each of chitosan with mass variation 0.2, 0.4, 0.6 0.8 and 1 g continued to decrease the caffeine contents were 0.083%, 0.043%, 0.019%, 0.014% and 0.006%, respectively.

References

Http://moko31.wordpress.com/2009/08/30/strategi-marketing-mix-kopi-kapal-api

Hwang, J. & Shin, H. 2002. Rheological Properties of Chitosan Solution. Korea: Australia rheology Journal.

Muzarelli, R, A, A.1977. Chitin. Pergamon Press. New York: Oxford.

Rahayu, L. H and S. Purnavita. 2007. Optimization of manufacture of Chitosand of chitin shell waste crab (*Portunus pelagicus*) for adsorbent of Mercury metal ions. Semarang.

SNI 01-3542-2004. Ground Coffee.

Suriani. 1997. Analysis of the content of Kofeina in instant coffee of various brands circulating in Ujung Pandang. Makassar: Faculty of Mathematics and Natural Sciences, Hasanuddin University.

Tjay,T.H., Rahardja, K., 2002. Drugs Are Important. Fifth Edition. Jakarta: PT. Elex Media Komputindo.Greenberg, A.E. 1985. Standards Methods for The Examination of Water and wastewater. Sixteenth edition. Washington DC: American Public Health Association.