



## **Pengaruh Pelarut Pada Ekstraksi Antosianin Dari Buah Buni (*Antidesma Bunius* (L) Spreng)**

### ***The Effect of Solvent on The Extraction of Anthocyanin Pigment from Buni (*Antidesma Bunius* (L) Spreng)***

**Muryanto Muryanto<sup>1,2\*</sup>, Egy Putra Pratama<sup>1</sup>, Muhamad Septian Yunus<sup>1</sup>**

<sup>1</sup>Chemical Engineering Department, Faculty of Engineering, University of Pamulang, Jl. Witana Harja No. 18b, Tangerang Selatan, 15417, Indonesia

<sup>2</sup>Research Center for Chemistry, National Research and Innovation Agency, Kawasan Puspiptek Serpong, Tangerang Selatan 15314, Indonesia

\*Corresponding Author. Email: [moeryanto.mrt@gmail.com](mailto:moeryanto.mrt@gmail.com)

Received: 8<sup>th</sup> June 2022; Revised: 27<sup>th</sup> June 2022; Accepted: 8<sup>th</sup> July 2022

#### **Abstract**

Buni fruit (*Antidesma bunius* (L) Spreng) contains vitamins, anthocyanins, flavonoids, and phenolic acids. Anthocyanins are a group of red to blue pigments widely distributed in plants. Anthocyanins in Buni are dyes that can be used as alternative natural dyes. In this research, anthocyanin was extracted from Buni. The extraction process was carried out using various solvents, namely 10% citric acid, 70% ethanol, and distilled water for three days. The results showed the total levels of anthocyanins with 10% citric acid, 70% ethanol, and distilled water was 453.05 mg/L, 410.91 mg/L, and 361.64 mg/L, respectively. Citric acid was more optimal solvent for extracting anthocyanins in Buni.

*Keywords: Buni fruit, extraction, citric acid, ethanol, solvent*

#### **Abstrak**

Buah Buni (*Antidesma bunius* (L) Spreng) mengandung vitamin, antosianin, flavonoid dan asam fenolat. Antosianin merupakan kelompok pigmen yang berwarna merah sampai biru yang tersebar luas pada tanaman. Antosianin dalam buah Buni merupakan zat warna yang dapat dijadikan sebagai alternatif pengganti pewarna sintetis yang aman bagi kesehatan. Pada penelitian ini akan dilakukan proses ekstraksi antosianin dari buah Buni. Proses ekstraksi dilakukan dengan variasi pelarut yang digunakan, yaitu etanol 70%, aquades, dan asam sitrat 10% selama 3 hari. Hasil penelitian menunjukkan kadar total antosianin dengan pelarut asam sitrat 10%, etanol 70% dan aquades masing-masing sebesar 453,05 mg/L, 410,91 mg/L dan 361,64 mg/L. Asam sitrat lebih optimal dalam mengekstrak antosianin pada buah Buni.

*Kata kunci : buah Buni, ekstraksi, asam sitrat, etanol, pelarut*

Copyright © 2022 by Authors, Published by JITK. This is an open-access article under the CC BY-SA License (<https://creativecommons.org/licenses/by-sa/4.0>).

How to cite: *muryanto, m. (2022). THE EFFECT OF SOLVENT ON THE EXTRACTION OF ANTHOCYANIN PIGMENT FROM BUNI (*Antidesma bunius* (L) Spreng). Jurnal Ilmiah Teknik Kimia, 6(2), 65-71.*

Permalink/DOI: 10.32493/jitk.v6i2.21012



## INTRODUCTION

Dyes are usually used to increase the attractiveness of both food and clothing. Sometimes synthetic dyes are used to give food coloring, such as red dye Rhodamine B, Brilliant blue, tartrazine, allura red, etc. (Xu et al. 2016; Djarismawati et al. 2012; El-Wahab & Moram 2013; Hajimahmoodi et al. 2013). If used in the long term, this dye can cause cancer and damage the liver and kidneys (Skjolding et al. 2021). The use of natural dyes can replace synthetic dyes.

Indonesia is a tropical country with various fruit and vegetable crops. Some fruits contain vitamins, anthocyanins, flavonoids, and phenolic acids. The anthocyanin content in fruit can be used as a natural dye. The anthocyanin pigment is red color and can be used as a colorant because it gives an attractive color, especially to food (Ingrath 2015; Widyasanti et al. 2018).

Many anthocyanin pigments are obtained from red fruits and plants, such as dragon fruit (Widyasanti et al. 2018), roselle flower (Djaeni et al. 2017), mangosteen peel (Meriatna & Ferani 2017), sweet potato (Handayani & Zurrahmi Wirda 2017), sappan wood (Nomer et al. 2019), etc. Anthocyanins can give red, violet, purple, and blue colors to leaves, flowers, fruits, and vegetables (Bridle & Timberlake 1997). Anthocyanins belong to pigments called flavonoids (Harborne & Mabry 2013). Buni is a red fruit when ripe. Buni grows wild in India, Sri Lanka, Burma, Malaysia, and Indonesia. Buni is widely found on the island of Java (Sosef et al. 1998). Buni contains nutrients such as carbohydrates, proteins, vitamins, minerals, organic acids, phenolic acids, and anthocyanins. The anthocyanin value in Buni is higher than in apple, red cabbage, plum, and strawberry (Octaviani & Rahayuni 2014). Buni is rarely consumed directly

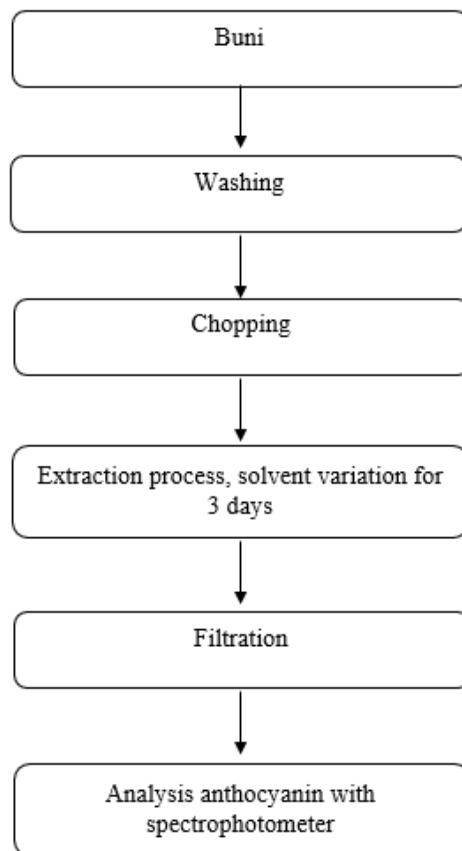
because its taste is sour. Therefore, using Buni for other high-value products can increase the added value of Buni.

Several studies have been conducted regarding the extraction of anthocyanin pigments from fruit. For example, research conducted by Saati (Saati 2010) extracted anthocyanins from super red dragon fruit skin, using water and citric acid as a solvent, resulting in the most significant yield of 10.20% at a 4-day storage mass with a solvent ratio of 9:1 water and citric acid and a pH of 1.91. Anthocyanins can also be obtained from the fruit of Rosella flowers and the sappan wood. The anthocyanin extraction process is influenced by several factors, including solvent, solvent ratio, and soaking time. Therefore, the aim of this study was to investigate the effect of solvents on the extraction of anthocyanin substances in Buni, which can be used as natural dyes.

## MATERIAL AND METHODS

The Buni used in this research came from the traditional market in Pamulang, South Tangerang, Indonesia. All solvents used in this process are of technical grade, but chemicals for analysis are of analytical grade from Merck.

Buni was washed using tap water to remove impurities attached to the fruit, then drained in the open air. The Buni was then cut into small pieces and put into a glass beaker. In this extraction process, 200-gram Buni was used and immersed in 500 ml of solvent. The solvent used was 10% citric acid, 70% ethanol, and distilled water. The extraction process was conducted for three days. After the extraction process, the filtrate was filtered from solid waste and stored in a refrigerator before analysis. The research scheme is shown in **Figure 1**.



**Figure 1.** Scheme of extraction of anthocyanins

Analysis of anthocyanin content was carried out using the differential pH method. A specific volume of Buni extract was dissolved in two different buffer solutions. The first solution was dissolved with 0.025 M KCl buffer pH 1.0, and the other solution was dissolved in 0.4 M sodium acetate buffer pH 4.5. This sample was then measured using a spectrophotometer at two wavelengths, at the

maximum absorbance and at 750 nm. This wavelength is the wavelength that produces the highest absorbance value. Anthocyanin levels were measured using a spectrophotometer UV-Vis (Agilent). Anthocyanin content was calculated based on the formula for total anthocyanin content (Nicoue et al. 2007) as follows:

$$A = (A_{\lambda_{Max}} - A_{700})_{pH\ 1.0} - (A_{\lambda_{Max}} - A_{700})_{pH\ 4.5}$$

$$\text{Total Anthocyanin Content (mg/1000ml)} = \frac{AxMVxDFx1000}{\epsilon xL}$$

Where

- $\epsilon$  = extinction coefficient = 26900 L/cm.mol
- MW = 449 g/gmol acting as cyaniding-3-glucoside
- DF = Dilution factor
- L = cuvette width (1 cm)



## RESULT AND DISCUSSION

In this study, the extraction process was carried out on various solvents with different pH. (aquades and alcohol are neutral, while citric acid is a solvent with acidic). The anthocyanin extraction process in Buni is shown in **Figure 2**. As shown in **Figure 2**, it can be seen that the extraction process of Buni produces a red color. Buni contains anthocyanins which produce a red color at

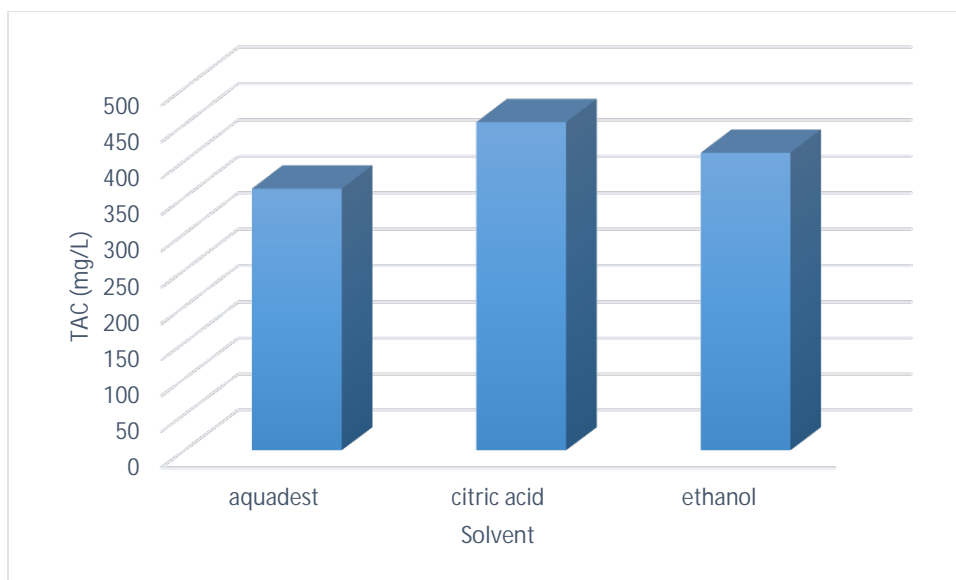
low pH (1-3). Anthocyanins in Buni are natural pigments influenced by the presence of light, oxygen, enzymes, proteins, and metal ions (Rein 2005). This phenomenon shows the extraction of anthocyanins from Buni occurred in the three solvents. Compounds of the flavonoid group such as anthocyanins are polar compounds and can be extracted with polar solvents. (Harborne & Mabry 2013).



**Figure 2.** Extraction process of Buni (a) distilled water, (b) ethanol 70%, (c) citric acid

The total anthocyanin content (TAC) from Buni extraction is shown in Figure 3. The pigment anthocyanins is affected by pH so in this study the extracted was dissolved in different pH and measure in two wavelengths of spectrophotometry. The results of the absorbance measurement of buni ekstrak showed that buni extract absorbed the visible long spectrum at a wavelength of 520 nm. This is because the color of the anthocyanin

substance in the buni extract is purplish red. The main dyes found in buni fruit are delphinidine-3-O-glucoside, cyanidin-3-O-glucoside and cyanidin-3-O-rutinoside. These compounds are flavonoids and phenolic groups (Kapasakalidis et al. 2006). The red color of the buni extract is due to the presence of glucosides with cyanidin compounds (Fernando & Senadeera 2008).



**Figure 3.** Total Anthocyanin Content with variant solvent

In **Figure 3**, it can be seen that the TAC produced from the use of distilled water, citric acid, and ethanol as solvents were 361.6369 mg/L, 453.0476 mg/L, and 410.9101 mg/L, respectively. The use of water as a solvent in the buni extraction process aims to produce extracts without chemicals addition. This process will produce extracts more friendly to the human and environment. The use of water can extract TAC with value 361.6369 mg/L. This result is still lower than the other two solvents. However, this concentration can still give a deep red color in the resulting extract.

Buni extracted using citric acid produced higher anthocyanins levels than using distilled water and ethanol. This is because the pH of citric acid is more acidic than the other two solvents. Acidic conditions will affect the extraction results. An increasingly acidic situation will cause more anthocyanin pigments to form colored flavilium or oxonium cations (Moulana et al. 2012). In addition, citric acid can cause hydrolysis of acyl groups, a labile, co-pigment, or metal complex that is part of the

original form of anthocyanins that contributes to its stability. Besides that, the more acidic conditions cause many of the vacuole cell walls to break, so more anthocyanin pigments are extracted (Tensiska & Natalia 2007). This study showed results that were close to the same as the anthocyanins extracted from the skin of the dragon fruit (Ingrath 2015).

Using citric acid results in high TAC levels in buni extract so this extract can be used for various benefits; one example can be used as a dye. With high levels, the colored substance can be converted into powder form so that the application of the dye becomes wider and lasts longer (Permatasari & Deofsila 2021)

## CONCLUSIONS

Based on the study results, it can be concluded that anthocyanin pigments can be extracted from the Buni. The extraction process can be carried out using all three solvents, but the highest anthocyanin content is obtained with citric acid as a solvent. The highest anthocyanin content is 453 mg/L. The



anthocyanin pigment extracted from this Buni can be used as a natural colorant for food and non-food dyes.

### ACKNOWLEDGMENT

The authors sincerely thank ELSA BRIN - National Research and Innovation Agency for the instruments' support.

### REFERENCES

Bridle, P., & Timberlake, C.F.(1997): Anthocyanins as natural food colours—selected aspects. *Food chemistry*, 58(1–2): p.103–109.

Djaeni, M., Ariani, N., Hidayat, R., & Utari, F.(2017): Ekstraksi antosianin dari kelopak bunga rosella (*Hibiscus sabdariffa* L.) berbantu ultrasonik: Tinjauan aktivitas antioksidan. *Jurnal Aplikasi Teknologi Pangan*, 6(3).

Djarismawati, D., Sugiharti, S., & Nainggolan, R.(2012): Pengetahuan Dan Perilaku Pedagang Cabe Merah Giling Dalam Penggunaan Rhodamine B Di Pasar Tradisional Di DKI Jakarta.

El-Wahab, H.M.F.A., & Moram, G.S.E.-D.(2013): Toxic effects of some synthetic food colorants and/or flavor additives on male rats. *Toxicology and industrial health*, 29(2): p.224–232.

Fernando, J., & Senadeera, G.K.R.(2008): Natural anthocyanins as photosensitizers for dye-sensitized solar devices. *Current Science*,: p.663–666.

Hajimahmoodi, M. et al.(2013): Determination of eight synthetic dyes in foodstuffs by green liquid chromatography. *Food Additives & Contaminants: Part A*, 30(5): p.780–785.

Handayani, P., & Zurrahmi Wirda, dan.(2017): Pengaruh Jenis Umbi

Gadung (*Dioscorea hispida*Dennst.) Terhadap Kadar Bioetanol pada Proses Fermentasi Menggunakan Ragi Roti Different Kinds of Gadung (*Dioscorea hispida* Dennst.) and Its Effect on Level of Bioethanol in Fermentation Process using Yeast. *Jurnal Agrium*, 14(2): p.45–58.

Harborne, J.B., & Mabry, T.J.(2013): The flavonoids: advances in research.

Ingrath, W.(2015): Ekstraksi pigmen antosianin dari kulit buah naga merah (*Hylocereus costaricensis*) sebagai pewarna alami makanan dengan menggunakan microwave (kajian waktu pemanasan dengan microwave dan penambahan rasio pelarut aquades dan asam sitrat). *Jurnal Bioproses Komoditas Tropis*, 3(3): p.1–8.

Kapasakalidis, P.G., Rastall, R.A., & Gordon, M.H.(2006): Extraction of polyphenols from processed black currant (*Ribes nigrum* L.) residues. *Journal of agricultural and food chemistry*, 54(11): p.4016–4021.

Meriatna, M., & Ferani, A.S.(2017): Pembuatan pewarna makanan dari kulit buah manggis dengan proses ekstraksi. *Jurnal Teknologi Kimia Unimal*, 2(2): p.1–15.

Moulana, R., Juanda, J., Rohaya, S., & Rosika, R.(2012): Efektivitas Penggunaan Jenis Pelarut dan Asam dalam Proses Ekstraksi Pigmen Antosianin Kelopak Bunga Rosella (*Hibiscus sabdariffa* L). *Jurnal Teknologi dan Industri Pertanian Indonesia*, 4(3).

Nicoue, E.E., Savard, S., & Belkacemi, K.(2007): Anthocyanins in wild blueberries of Quebec: extraction and identification. *Journal of agricultural and food chemistry*, 55(14): p.5626–



- 5635.
- Nomer, N.M.G.R., Duniaji, A.S., & Nocianitri, K.A.(2019): kandungan senyawa flavonoid dan antosianin ekstrak kayu secang (*Caesalpinia sappan* L.) serta aktivitas antibakteri terhadap *Vibrio cholerae*. *Jurnal Ilmu Dan Teknologi Pangan (ITEPA)*, 8(2): p.216–225.
- Octaviani, L.F., & Rahayuni, A.(2014): Pengaruh berbagai konsentrasi gula terhadap aktivitas antioksidan dan tingkat penerimaan sari buah buni (*Antidesma bunius*). *Journal of Nutrition College*, 3(4): p.958–965.
- Permatasari, N.A., & Deofsila, Y.K.(2021): PERUBAHAN KUALITAS BUBUK PEWARNA ALAMI BUAH BUNI (*Antidesma Bunius* (L) SPRENG) SELAMA PENYIMPANAN DENGAN MENGGUNAKAN METODE AKSELERASI. *Jurnal Teknologi Industri Pertanian*, 31(2): p.176–189.
- Rein, M.(2005): Copigmentation reactions and color stability of berry anthocyanins.
- Saati, E.A.(2010): Identifikasi Dan Uji Kualitas Pigmen Kulit Buah Naga Merah (*Hylocereus Costaricensis*) Pada Beberapa Umur Simpanan Perbedaan Jenis Pelarut. *Jurnal Gamma*, 6(1).
- Skjolding, L.M. et al.(2021): Assessing the aquatic toxicity and environmental safety of tracer compounds Rhodamine B and Rhodamine WT. *Water Research*, 197: p.117109.
- Sosef, M.S.M., Hong, L.T., & Prawirohatmodjo, S.(1998): *Plant Resources of South-East Asia. Backhuys SV Kerkwerve, The Netherlands.*
- Tensiska, E.S., & Natalia, D.(2007): Ekstraksi pewarna alami dari buah arben (*Rubus idaeus* (Linn.)) dan aplikasinya pada sistem pangan. *Jurnal Teknologi dan Industri Pangan*, 18(1): p.25–31.
- Widyasanti, A., Nurlaily, N., & Wulandari, E.(2018): KARAKTERISTIK FISIKOKIMIA ANTOSIANIN EKSTRAK KULIT BUAH NAGA MERAH MENGGUNAKAN METODE UAE (Physicochemical Characteristics of Red Dragon Fruit Skin Anthocyanin Extracts using UAE Method): Physicochemical Characteristics of Dragon Fruit Peels (*Hylocereus* p. *Jurnal Ilmiah Rekayasa Pertanian dan Biosistem*, 6(1): p.27–38.
- Xu, X. et al.(2016): Determination of rhodamine b in food using ionic liquid-coated multiwalled carbon nanotube-based ultrasound-assisted dispersive solid-phase microextraction followed by high-performance liquid chromatography. *Food Analytical Methods*, 9(6): p.1696–1705.