Utilization of Bougainvillea Spectabilis Flower Extract and Red Ashoka Extract as Formaline and Boraxs Teskit

Youstiana Dwi Rusita(✉) and Rini Tri Hastuti

Food and Pharmaceutical Analyses Faculty, The Health Polytechnic of Surakarta, Surakarta, West of Java, Indonesia
josicanme@gmail.com

Abstract. Bougainvillea (Bougainvillea spectabilis Willd) and red ashoka (Ixora cocinea) flowers contains natural color pigment, namely anthocyanins. Anthocyanin levels in these two flowers are high enough so that can be used as natural color pigment. Anthocyanins can be used as an indicator for detection of borax food additives and formalin food preservatives. The subject of this research was creating a test media (test paper) of formaldehyde and borax from the extract of bougainvillea and red ashoka flowers. The test paper was used to analyze food samples such as sausages, kolang kaling fruit, wet noodles, meatball tofu, rambak crackers and tofu. The samples were selected based on the type of food consumed most often and survey, the type of food was mixed with dangerous substances, namely borax and formaldehyde. The anthocyanin content in the extract Bugenville flowers was 57.66 mg/100 g and extract Ashoka flowers was 8.66 mg/100 g. Screening of anthocyanin content in CEA was reacted with HCl, which resulted in a purple color change in the CEA of Bugenville flowers and in CEA of Ashoka flowers a bright red color change. The reaction of CEA with NaOH is a change in the bluish green color of the bougainvillea flowers and the CEA of the Ashoka flowers a green color change. Samples containing formaldehyde will change the color of the bougainvillea CEA test medium from magenta to deep purple and samples containing borax will change the color of the test medium to red. Samples containing formaldehyde will change the color of the red ashoka flower CEA test medium from red brown to bright red and samples containing borax will change the color of the media to green. The anthocyanin content in Bougainvillea flowers and Ashoka flower crowns can be used as a test medium (test paper) and is effective enough to be used as a test indicator for the content of formalin and borax in food.

Keywords: Formaldehyde · Borax · Test media · Anthocyanin · Bougainvillea · Ixora coccinea

1 Introduction

Food products are increasingly taking various forms, both in terms of types and in terms of taste and processing methods. Over time with the rapid development of food processing

S. Syamsuriansyah et al. (Eds.): ICoMTech 2021, AHSR 51, pp. 11–19, 2023.
https://doi.org/10.2991/978-94-6463-018-3_3

technology, the addition of additives to food products is difficult to avoid. As a result, food safety has become the basis for selecting a food product to be consumed. Food safety is something that is being studied a lot, because humans are increasingly aware of the importance of food sources and the ingredients in their food. This occurs due to advances in science and technological advances, so we need a way to monitor food safety. Food additives can be detected by plants containing active substances such as anthocyanins [1]. Chemical content in bougainvillea flowers include: tannins, pinitol, alkaloids, flavonoids, betasianin, anthocyanins. Chemical content in red Ashoka flowers include: saponins, anthocyanins. Anthocyanins (English: anthocyanin, from a combination of Greek words: antho = "flower", and cyano = "blue") are water-soluble pigments that are naturally found in various types of plants. As the name implies, this pigment provides color to flowers, tubers, fruit and leaves of plants which have been widely used as natural dyes in various food products. Anthocyanins give color to their arrangement of long conjugated double bonds. This conjugated double bond system is also able to make anthocyanins an antioxidant with a free radical scavenging mechanism.

Formaldehyde, also called formaldehyde, methylene aldehyde or formol, is a clear, colorless liquid with a pungent odor, its vapor is able to stimulate the mucous membranes of the nose and throat, resulting in a burning burning sensation. Miscible with water and alcohol, but incompatible with chloroform and ether [2]. In formaldehyde contains about 37% formaldehyde in water, usually methanol is added up to 15% as a preservative [3]. The Molecular Weight of Formalin is 30.03 with the Molecular formula of HCOH. Due to the small size of this molecule, it facilitates absorption and distribution into the body's cells. The carbonyl group which it has is very active, can react with the –NH2 group of proteins present in the body to form compounds that precipitate [4]. The function of formaldehyde is very commonly used in everyday life. If used correctly, we will feel many benefits of formalin, for example as an antibacterial or germ killer in various types of industrial needs, namely cleaning floors, ships, warehouses and clothes, fly repellent and various other insects. In the world of photography it is usually used as a hardener for gelatin and paper layers. Formalin is often used as an ingredient in urea fertilizers, perfume products, preservatives for cosmetic products, nail hardeners and as an ingredient for foam insulation. Formalin may also be used as a corrosion inhibitor for oil wells. In the wood industry, formaldehyde is used as an adhesive for plywood products [1].

Borax or Sodium Tetrabonate with the molecular formula (Na2B4O7.10H2O) is a soft crystalline powder containing boron, white in color, odorless, easily soluble in water, insoluble in alcohol, pH: 9.5. Borax has other names sodium biborate, sodium pyroborate, sodium tetraborate which should only be used in the non-food industry. The function of Borax is basically a material for making solders, detergents, wood preservatives, cockroach control and glass-making materials. Borax is slightly soluble in water, but can be useful when dissolved in water [5].

2 Objective

Based on these facts, this research focuses on making formalin and borax testing media in food by extracting anthocyanins in bougainvillea and red Ashoka flower crowns. The purpose of this study was to make a test media (test paper) with active anthocyanin substances from Bougainvillea and Red Ashoka flowers extracts which can detect the content of harmful substances such as formalin and borax in food. The benefit of this research is to provide an alternative test media for detecting formaldehyde and borkas in food safely.

3 Material and Methods

This type of research is descriptive quantitative with a laboratory experimental approach that aims to determine the content and levels of anthocyanins in bougainvillea (Bougainvillea spectabilis) and red Ashoka (ixora cocinea) flowers).

3.1 Tools and Materials

The tools used include: measuring cup, petri dish, knife, scissors, erlenmeyer, spatula, filter paper, glass funnel, mortal and stamper, digital scales. The materials used include: Bougenville flowers, red Ashoka flowers, distilled water, HCl, NaOH.

3.2 Procedure for Preparation and Extraction of Bougainvillea and Red Ashoka Flowers

The extraction process was carried out by maceration method for 24 h. Weighing bougenville and red Ashoka flowers each as much as 500 g. Then put it in a container that has been covered with aluminum foil to protect it from light, then 1000 ml of 96% ethanol is added. After that, it is shaken for 1 h every 6 h using a shaker. Furthermore, filtering with a Buchner filter is carried out to separate the ethanol extract from the residue. The filtered filtrate (dilute extract) is evaporated by a rotary evaporator at a temperature of 40 °C at a speed of 100 rpm until a thick extract is obtained. Extract that is collected as Crude Extract Anthocyanin (CEA) [6].

3.3 Copigmentation Method

At this stage, the CEA on Bougainvillea and Ashoka Merah Flowers that has been obtained is dissolved using technical ethanol. Then added the ascorbic acid copigment with a concentration ratio of 1:3; 2:4; 3:5 (w/w) in 10 ml ethanol solvent. Then measure the anthocyanin levels using a UV-VIS spectrophotometer at the maximum wavelength [7].

3.4 Anthocyanin Screening in CEA

Proof of the existence of anthocyanins can be done in a simple way. The first way is that the sample is reacted with 2M HCl for 2 min, then the color of the sample is observed. If the red color in the sample turns purple, it indicates the presence of anthocyanins. The second way is by adding the sample with 2M NaOH dropwise. If the red color turns green blue and fades slowly, it indicates the presence of anthocyanins [8].

3.5 Determination of Total Anthocyanin Content

The anthocyanin content was first qualitatively identified using ammonia HCl test following a previous procedure [9]. To be specific, 2 mL of the extract was added with 2 mL of 2N HCl and ammonia. The color change from pink-red to blue-violet indicates the presence of anthocyanin. The total anthocyanin content was determined by the pH di erential method which bases on the structural changes in chemical forms of anthocyanin and absorbance measurements at pH 1.0 and 4.5. Crude extracts were diluted separately with 0.025 M hydrochloric acid–potassium chloride buffer (pH = 1) and 0.4M sodium acetate buffer (pH = 4.5). Each sample was diluted with the buffers to give an absorbance reading between 0.2 and 1.4. The absorbance of the mixture was measured at λvis-max and 700 nm using a UV-Vis spectrophotometer (UV1601; Shimadzu, Kyoto, Japan). The total anthocyanin content was expressed as cyanidin-3-glucoside equivalents as in the following equation [10–13].

$$\text{Anthocyanin pigment (mg/L)} = \frac{(\mathrm{A} \times \mathrm{MW} \times \mathrm{DF} \times \mathrm{V} \times 1000)}{(\alpha \times \mathrm{l} \times \mathrm{m})}$$

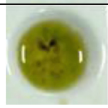
Where A is the absorbance, MW is the molecular weight of cyanidin-3-glucosode (449.2 g/mol), DF is the dilution factor, V is the solvent volume (mL), α is the molar absorptivity (26,900 L.mol−1.cm−1), and l is the cell path length (1 cm).

4 Results and Discussion

The screening of anthocyanin content in CEA was obtained by reacting CEA in two ways. The first way is reacted with HCl. The result of this reaction is that the CEA of bougainvillea flowers changes in purple color and in CEA of Ashoka flowers a bright red color changes. The second method used was by reacting CEA with NaOH, and the results obtained were that the bougainvillea flower CEA had a bluish green color change and the Ashoka flower CEA had a green color change. The difference in color change in this reaction occurs because of the different types of anthocyanins contained in bougainvillea and Ashoka flowers as seen from the color of bougainvillea flowers, namely magenta and red Ashoka flowers (see Table 1).

Maximum Absorption Wavelength of the CEA of Bugenville flowers and in CEA of Ashoka flowers. In order to determine the maximum absorbance spectrum, the extract

Table 1. Anthocyanin phytochemical screening results.

Sample	+ HCl 2M		+ NaOH 2M	
CEA Bugenville	Violet puple		bluish green	
CEA Asoka	Bright Red		Green	

was dissolved in distilled water and scanned through the spectrometer with the wavelength ranging from 400 to 700 nm. Figure 1 shows that the absorption peak ranged from 500 to 530 nm, which is consistent with the absorption spectrum of the anthocyanin color group [14].

As can be seen from Fig. 1, Maximum absorption point was reached at wavelength λvis-max = 520 nm. Therefore, subsequent surveys and calculations will be evaluated at this wavelength of maximum absorption. This result is in line with the color anthocyanin of Bugenville flowers and Ashoka flowers in another study [5]. Water and scanned through the spectrometer with the wavelength ranging from 400 to 700 nm. According to Tensiska et al. [15] at a wavelength of 510 nm is the maximum wavelength for cyanide - 3 - glycosides as long as a wavelength of 700 nm to correct any edgies that are still present in the sample. If the sample is completely clear then the absorbance at 700 nm is 0.

Based on the results of Table 2, it states that the CEA results on Bougainvillea contain more anthocyanins.

Based on research by Meiny S et al. [16] stated that the 25 C maceration method produced a total of 128.76 mg/100 g anthocyanins.

The color test procedure is carried out by immersing the formalin and borax test media in a solution of formalin, a solution of borax and water. In water solvents with neutral PH, the test results can be seen in Table 3.

Anthocyanins are compounds that are sensitive to changes in pH. So that anthocyanins are often used as a natural indicator of acid-base because anthocyanins can

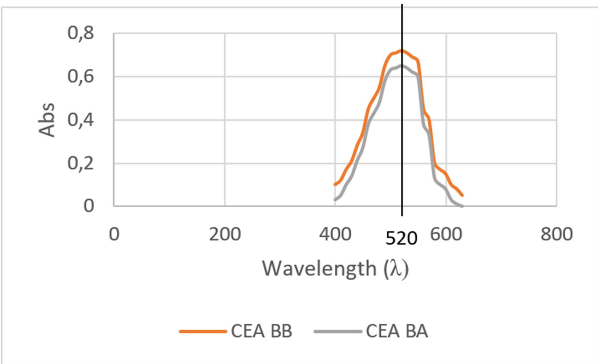


Fig. 1. Maximum Absorption Wavelength of the CEA of Bugenville flowers and in CEA of Ashoka flowers.

Table 2. Determination of total anthocyanin content results.

CEA	Concentration
CEA Bugenville	57.66 mg/100 g
CEA Asoka	8.656 mg/100 g

Table 3. Test results of formalin and borax test papers on variations of standard formalin and borax.

Sample	Formalin		Boraxs	
	Before	After	Before	After
CEA Bugenville	violet	Dark purple	Ungu muda	Ungu tua
CEA Asoka	Reddish brown	Brownish red	Reddish brown	Brownish red

Table 4. Test results of foods/snacks containing borax or formalin using test paper

Sample	Formalyn contain	Borax contain
Sosis	+	+
Kolang-kaling	–	+
Mie basah	–	+
Tahu bakso	–	+
Rambak	–	+
Tahu	+	+

Note:

Formalyn (+) = Paper test BB dark purple
Paper test BA red

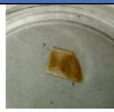
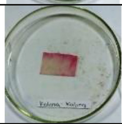
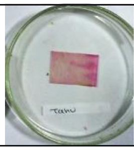
Borax (+) = Paper tes BB red
Paper test BA green

change color specifically to changes in the pH of a solution. Therefore, anthocyanins can be used for identification in foods containing borax and formalin because of the nature of borax, namely alkaline (alkaline salt), while the nature of formalin is acidic. So that the identification of borax and formalin content in food samples using extracts of purple bougainvillea and red ashoka flowers containing anthocyanins is based on color changes due to changes in pH. According to research by Jordheim, et al., [17] that anthocyanins are unstable molecules. Anthocyanin stability is influenced by pH and temperature.

Proof of the existence of anthocyanins can be done in a simple way. The first method is that the sample is reacted with 2M HCl for 2 min, then the color of the sample is observed. If the red color in the sample turns purple, it indicates the presence of anthocyanins. The second way is by adding the sample with 2M NaOH dropwise. If the red color turns green blue and fades slowly, it indicates the presence of anthocyanins [8].

The following is an identification of the formaldehyde and borax content in several foods/snacks can be seen in Table 4 (Table 5).

Table 5. Test results of CEA Bougainvillea test media and CEA Asoka test media.

Sample	CEA Bougainvillea Test Media	CEA Asoka Test Media
Negatif Control		
Positif Control		
		
Sosis		
Kolang-Kaling		
Mie Basah		
Tahu Bakso		
Rambak		
Tahu		

Formaldehyde has strong acidic properties because it contains formic acid which is the result of formaldehyde oxidation. The nature of the strong acid in formalin will make it easier for anthocyanins to detect the presence of formaldehyde in white tofu and tempeh. Anthocyanins will react with strong acids, and the resulting color will change, which becomes more concentrated because it binds to the acid [18]. The presence or absence of the resulting color change indicates that the Bougainvillea and Ashoka red flower extract can be used as a natural indicator in identifying the presence of formaldehyde. Samples containing borax after being tested with tumeric paper will have a reddish-brown color [19].

5 Conclusion

Based on the above results, it shows that bougainvillea and Ashoka flowers can be used as an indicator to test the formalin and borax content in food by extracting the anthocyanins contained in the flower crowns.

References

1. N. Rochyani, M. R. Akbar, dan Y. Randi, “Pembuatan media uji formalin dan boraxs menggunakan zat antosianin dengan pelarut etanol 70%,” Jurnal Redoks, vol. 2(1), pp. 28–35, 2017.
2. R.O.C Norman and D. J. Waddington, Modern Organic Chemistry. New York: Colliens Educational. Oke, 2008. 1983.
3. M. Astawan, Mengenel Formalin Dan Bahayanya. Jakarta: Penebar Swadaya. 2006.
4. Harmita, Buku Ajar Analisis Fisikokimia. Depok: departemen farmasi FMIPA Universitas Indonesia, 2006.
5. Asri, Fungsi Boraxs [online]. Accessed by: 22 Agustus 2016. Available at: http://asri77.blogspot.co.id/2012/12/boraxs.html
6. E. J. Putri, Nurhaeni, P. Satrimafitrah, D. J. Puspitasar, Stabilitas Ekstrak Warna Bunga Asoka (Ixora javanica) Berdasarkan Variasi pH Selama Masa Penyimpanan, KOVALEN, 5(2): 207–213, Agustus 2019
7. H. Munawaroh, G. Fadillah, L. N. M. Z. Saputri, Q. A. Hanif, R. Hidayat, and S. Wahyuningsih, “Kopigmentasi dan Uji Stabilitas Warna Antosianin dari Isolasi Kulit Manggis (Garcinia mangostana L.).” In Seminar Nasional Matematika, Sains, Dan Informatika 2015, April, pp. 321–329. 2015.
8. L. N. Lestario, E. Rahayuni, and K. Herawan Timotius, "Kandungan antosianin dan identifikasi antosianidin dari kulit buah jenitri (Elaeocarpus angustifolius Blume)." Agritech 31, no. 2. 2011.
9. C. Egbuna, J. C. Ifemeje, M. C. Maduako, H. Tijjani, S. C. Udedi, A. C. Nwaka, and M. O. Ifemeje, “Phytochemical test methods: qualitative, quantitative and proximate analysis.” In Phytochemistry, pp. 381–426. Apple Academic Press, 2018.
10. N. Anuar, A. F. M. Adnan, N. Saat, N. Aziz, and R. M. Taha, “Optimization of extraction parameters by using response surface methodology, purification, and identification of anthocyanin pigments in Melastoma malabathricum fruit.” The Scientific World Journal. 2013.
11. J. P. Maran, V. Sivakumar, K. Thirugnanasambandham, and R. Sridhar, “Extraction of natural anthocyanin and colors from pulp of jamun fruit.” Journal of food science and technology 52, no. 6, 3617–3626. 2015.
12. L. Yang, Ya-Lan Cao, Jian-Guo Jiang, Qing-Sheng Lin, J. Chen, and L. Zhu, “Response surface optimization of ultrasound-assisted flavonoids extraction from the flower of Citrus aurantium L. var. amara Engl.” Journal of separation science 33, no. 9. 1349–1355. 2010.

13. T.-B. Zou, M. Wang, R.-Y. Gan, and W.-H. Ling, “Optimization of ultrasound-assisted extraction of anthocyanins from mulberry, using response surface methodology.” International journal of molecular sciences 12, no. 5. 3006–3017. 2011.
14. J. B. Harborne, Spectral methods of characterizing anthocyanins. Biochem. J. 70, 22–28. 1958.
15. E. S. Tensiska, and D Natalia, "Ekstraksi pewarna alami dari buah arben (Rubus idaeus (Linn.)) dan aplikasinya pada sistem pangan." Jurnal Teknol. dan Industri Pangan 18, no. 1. 2006.
16. M. Suzery, S. Lestari, and B. Cahyono, “Penentuan total antosianin dari kelopak bunga Rosela (Hibiscus sabdariffa L) dengan metode maserasi dan sokshletasi.” Jurnal sains dan Matematika 18, no. 1. pp. 1–6. 2010.
17. M. Jordheim, “Isolatio Identification and Propertiees of Pyranaoanthocyanins and anthocyanin Form” University of Bergen, Norway. 2007.
18. N. Rochyani, “Comparison analysis of anthocyanin subtances in various plants for testing media of formalin and borax content in food,” E3S Web of Conferences, vol. 68, p. 1–9, 2018.
19. N. R. Fuad, Identifikasi Kandungan Boraxs Pada Tahu Pasar Tradisional Di Daerah Ciputat: Skripsi. Jakarta. Fakultas Kedokteran dan Ilmu Kesehatan. 2014.