AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

Effect of Particle Size and Citric Acid Concentration on the Yield and pH of Butterfly Flower (*Clitoria ternatea L.*) Extract

Nilam Sitaresmi Cahyono[1], Anwar Kasim[1] and Kurnia Harlina Dewi[1]*

[1]*Agricultural Industrial Technology.Department, Agricultural Technology, Andalas University, Padang., Indonesia.*

ARTICLE INFO

Article History:
Received: 24 January 2024
Final Revision: 07 March 2024
Accepted: 28 March 2024
Online Publication: 29 March 2024

KEYWORDS

Butterfly Flower, Clitoria ternatea L., anthocyanin, extraction

CORRESPONDING AUTHOR

*E-mail: nilamstrsmc@gmail.com

A B S T R A C T

This research aimed to determine the effect of differences in butterfly pea flower particle size and citric acid concentration on butterfly pea flower extraction, including yield and pH value analysis. The results showed that the particle size of butterfly pea flowers and the concentration of citric acid affected the yield. pH analysis showed that only treatments with different concentrations of citric acid affected the pH of butterfly pea flower extract. The highest yield in the treatment (7.52) and the highest pH (4,74). The above treatment can only be used for acidic food products, and citric acid can be replaced with food additives that lower the pH value but do not affect the taste so that it can be applied to all types of food.

1. INTRODUCTION

1.1. Research Background

The Telang flower (Clitoria Ternatea) is a simple source of natural blue dye. Anthocyanin pigments found in Telang flowers have the potential to be used as a natural food colouring in a variety of culinary sectors. In addition to enhancing color quality attributes, local natural dyes have the potential to offer antioxidant effects across a range of industries. Dyse from butterfly pea flowers can be obtained by extraction. The type of solvent used depends on the purpose of the extract; butterfly pea flower extraction is intended for food applications, so it is better to use a water solution because it is safer. Water in extraction is less than optimal than methanol, so additional treatments are needed to maximize extraction results. The main anthocyanin that causes the dark blue to purple color of butterfly pea flowers is delphinidin [1]. Delphinidin is the anthocyanidin that is most soluble in methanol, with the others being soluble in water, ethanol, and acetone [2]. A simple method is to add acidic additives. The easiest additive to find on the market is citric acid, so there is a need to study the effect of citric acid concentration on the results of butterfly pea flower extraction. According to Ref. [3], sample particle size influences the yield, total carotenoid content, color score and color strength in the extraction process. To obtain more efficient extraction, it is necessary to study the effect of particle size on the extraction results of butterfly pea flowers to obtain optimal extraction results [3].

1.2. Literature Review

The Telang flower (Clitoria ternatea L.) as its name suggests, Clitoria ternatea L. comes from the Ternate area, Maluku. Telang flower is a plant that contains antioxidants, namely anthocyanin, a pigment-rich in anthocyanins that might be used in various culinary sectors as a regional natural color. Antioxidants are molecules or compounds that are stable enough to donate electrons or hydrogen to free radical molecules or compounds and neutralize them, thereby reducing the ability to carry out free radical chain reactions [4].

The advantage of using anthocyanins is that there have been no side effects from anthocyanin consumption because there have been no reports of anthocyanin toxicity or intolerance. The Food and Drug Administration in the US and the European Union regulates its usage as a food additive. It is one of the colorants that is exempt from the Certification Food Additive Color

category. With the inclusion of anthocyanins in this group, the use of anthocyanins does not have a certain maximum limit as long as it is still in reasonable conditions [5].

Anthocyanin obtained from butterfly pea flowers can be extracted, and the most commonly used method is the maceration method. Maceration is an extraction method by soaking the material in a solvent suitable for the active compound to be taken with low or no heating. Factors influencing extraction include time, temperature, solvent type, ingredient ratio, and particle size [6]. Therefore, this paper aims to examine the effect of different particle sizes of butterfly pea flower powder on dissolution by adding different acid concentrations, thus producing optimal extraction results.

1.3. Research Objective

This research aims to determine the effect of butterfly pea flower particle size (i.e., 40 mesh, 60 mesh, 80 mesh, 100 mesh) and different concentrations of citric acid (i.e., 0%, 1%, 3%, 5%) to optimize the extraction of butterfly pea flowers.

2. MATERIALS AND METHODS

2.1. Preparation of Flower

The process of preparing research raw materials began with butterfly pea flowers (Clitoria ternatea L.) harvested from the yards of residents' houses on the Lintas Sumatra road, Solok Regency (at coordinates 0°45'33.4"S 100°41'17.4"E). The flowers used are fresh. Next, the process of splitting the flower petals is carried out; the material taken is the flower crown. First, the fresh flowers were sorted, then thirdly, the fresh flowers were dried using a food dehydrator (Shanben SMX-01 345W) at a temperature of 450C for 4 hours, before which the butterfly pea flowers were wilted at room temperature in an open container for 8 hours. Flowers dried using a food dehydrator are subjected to a size reduction process using a flour mill (Padabanic 6977 180W), then sieved using a sieve according to the treatment.

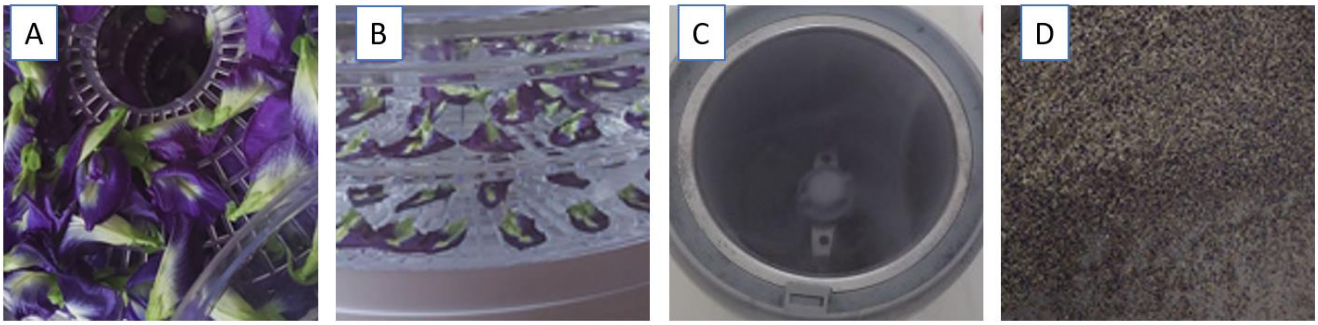

Fig 1. Preparation of flower: (A) Raw material, (B) dried flower, (C) Milling, (D) Particle size.

2.2. Maceration Extraction Method of Butterfly Pea Flower

The extraction process uses butterfly pea flower material with a material and solvent ratio of 1:100. The maceration method uses a solvent according to the treatment, and the maceration time is 45 minutes at a temperature of 65^0C. After that, the sample was filtered using Whatman filter paper no. 41 then produces butterfly pea flower extract in a solvent. The extract obtained is then put into a glass bottle coated with aluminum foil and stored in a refrigerator at a temperature of 1^0-12^0C for use.

Fig 2. Extraction of butterfly pea flower: (A) Butterfly pea flower powder, (B) Maceration, (C) Extract filtering, and (D) Extract after filtering.

2.3. Analytical methods

The research was carried out experimentally, using a Randomized Completely Block Design (RCBD) factorial with 2 factors: factor I, butterfly pea flower particle size with 4 butterfly pea flower particle sizes, and factor II, 4 different solvent concentrations. The research parameters consisted of yield. The method was adopted by Ref. [7]. Total anthocyanin [8] and pH value were measured with a pH meter.

https://doi.org/10.29165/ajarcde.v8i1.376

3. RESULT AND DISCUSSION

3.1. Total Yield

Based on the research results, it is known that there is an interaction between particle size treatment and citric acid concentration in butterfly pea flower extract. The treatment of 100 mesh butterfly pea flower powder with distilled water solvent: 5% citric acid was the treatment with the highest value, namely 7.52%, while the treatment of 40 mesh butterfly pea flower powder with distilled water solvent was the treatment with the lowest yield value, namely 0.58%. It can be seen in Figure 3. The treatment with the highest concentration of citric acid and the smallest particle size had the highest yield. Meanwhile, treatment without adding citric acid and the largest particle size had the lowest yield value.

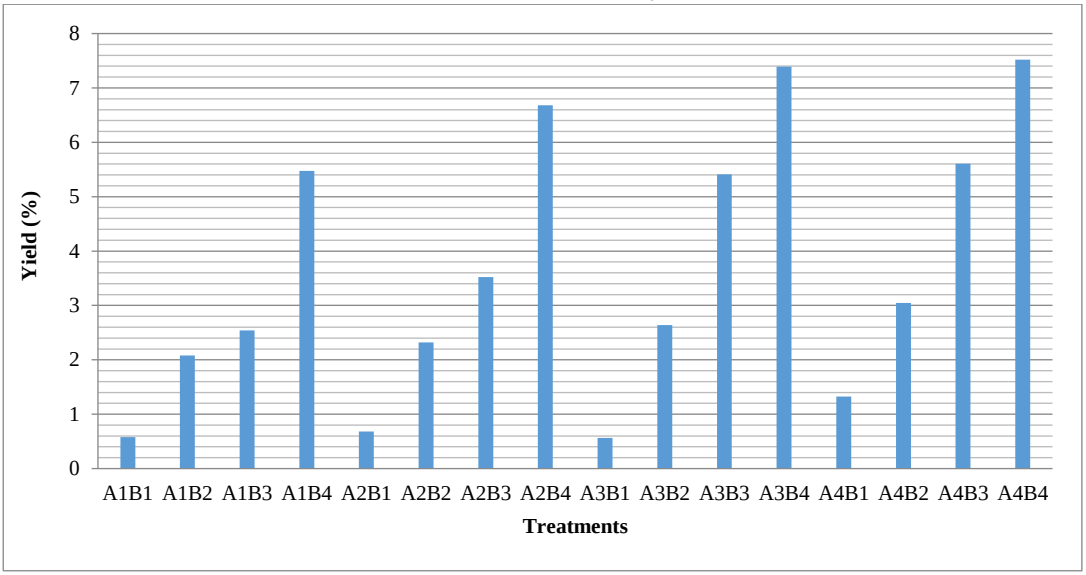

Fig 3. Yield: (A1) Butterfly butterfly pea flower powder 40 mesh, (A2) Butterfly butterfly pea flower powder 60 mesh, (A3) Butterfly butterfly pea flower powder 80 mesh, (A4) Butterfly butterfly pea flower powder 100 mesh, (B1) Aquades, (B2) Acid 1% citric acid, (B3) 3% citric acid, (B4) 5% citric acid.

According to Jackman and Smith (1996), adding an acid solution to the pigment extraction process causes damage to plant cell membranes and simultaneously dissolves the pigment [9]. So, as the concentration of citric acid increases, more and more of the substances that are attracted to a raw material are obtained. The extraction mechanism begins with solvent adsorption on the sample surface, followed by solvent diffusion into the sample and analyte (analyte-solvent interaction). Next, the analyte solvent diffuses onto the sample surface, and the analyte solvent is desorbed from the sample surface and added to the solvent. When the sample and solvent come into contact, the analyte solvent moves to the sample surface very quickly [10]. So, it can be concluded that the smaller the sample particle size, the greater the sample's surface area, so the yield from the extraction of Telang flowers is greater.

3.2. pH

Based on the research results, it is known that there is no interaction between particle size treatment and citric acid concentration in butterfly pea flower extract. Still, the citric acid concentration factor has a real influence (Table 1.). In Saati's opinion (2005), the pH of the pigment will also affect its yield; the higher the pH concentration, the larger the yield because a high pH can hydrolyze more anthocyanin pigments [11]. The pH of the pigment will decrease as the concentration of citric acid added increases. The average pH value of butterfly pea flower extract in several treatments of particle size and citric acid concentration is presented in Table 1.

Table 1. pH Analysis of Butterfly Flower Extract

Treatments	pH	
Citric acid concentration (%)		
0	4.74	d
1	2.41	c
3	2.05	b
5	1.89	a

The concentration of 5% citric acid with an average pH of 1.89 had the highest acidity compared to other treatments (Figure 4). The 0% citric acid treatment had the lowest acidity, with an average pH of 4.74. The research results showed that the higher the concentration of citric acid, the higher the acidity of the extract obtained.

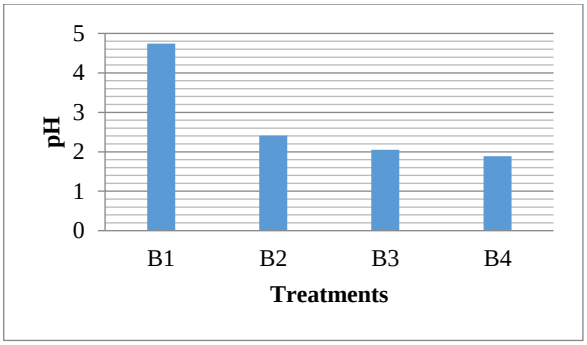

Fig 4. pH: B1 (Citric Acid Concentration 0%), B2 (Citric Acid Concentration 1%), B3 (Citric Acid Concentration 3%), B4 (Citric Acid Concentration 5%).

4. CONCLUSION

Treatment using different sizes of butterfly pea flower particles and citric acid with different concentrations significantly affected the yield, whereas, in the test, only the treatment with differences in citric acid concentration had a significant effect. The above treatment can only be used for acidic food products, and citric acid can be replaced with food additives that lower the pH value but do not affect the taste so that it can be applied to all types of food.

ACKNOWLEDGMENT

The authors were gratefully acknowledged by the University of Andalas and were carried out using equipment from the Faculty of Agricultural Technology laboratory, Andalas University, Padang, Indonesia.

REFERENCE

[1] Campbell, S., "Butterfly Pea (*Clitoria ternatea*) Flower Extract (BPFE) and Its Use As a pH-Dependent Natural Colorant," In 2020 ASHS Annual Conference, ASHS, August 2020.

[2] Kumoro, AC, Retnowati, DS, & Budiyati, CS., "Kelarutan delphinidin dalam air dan berbagai pelarut organik antara (298,15 dan 343,15) K." Journal of Chemical & Engineering Data , 55 (7), 2603-2606. 2010.

[3] Antari, N.M.R., N. M. Wartini., and S. Mulyani. "The effect of particle size and extraction time on the characteristics of the natural color extract of pandan fruit (Pandanus tectorius)." Journal of Agro-Industrial Engineering and Management 4 (2): 5-10. 2015.

[4] Irianti, T. T., & Nuranto, S. "Antioxidants and health." UGM Press. 2021.

[5] El Husna, N., Novita, M., & Rohaya, S. "Anthocyanin content and antioxidant activity of fresh purple sweet potato and its processed products." Agritech, 33(3), 296-302. 2013.

[6] Chairunnisa, S., Wartini, Nm, & Suhendra, L. "The Effect of Temperature and Maceration Time on the Characteristics of Bidara Leaf Extract (Ziziphus Mauritiana L.) as a Source of Saponin." Journal of Agro-Industrial Engineering and Management Issn, 2503, 488x. 2019.

[7] Sholihah, M. A., Ahmad, U., & Budiastra, I. W. "Aplikasi gelombang ultrasonik untuk meningkatkan rendemen ekstraksi dan efektivitas antioksi dan kulit manggis." Jurnal keteknikan pertanian, 5(2). 2017.

[8] AOAC, "Official Methods of Analysis of the Association of Official Analytical Chemists." 18th ed. Gathersburg, MD USA. 2005.

[9] Yusmita, L., Kasim, A., & Nurdin, H. 'The effect of extraction temperature and citric acid concentration on the betacyanin pigment of red cremah leaves (Alternanthera dentata) and its application in food." ProFood, 3(1), 178-185. 2017.

[10] Leba, M. A. U. "Textbook:Extraction and Real Chromatography." First Printing. Yogyakarta: CV. Budi Utama. 2017.

[11] Saati EA. "Study of the stability of anthocyanin pigment extract from fallen roses during certain storage periods (study of variations in media pH and pasteurization temperature)." Department of Agricultural Products Technology. 1 (1)l:77-82. 2005.

 https://doi.org/10.29165/ajarcde.v8i1.376