The Appropriate Way to Serve Butterfly Pea Flower Drink at Home

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Abstract: This study conducted to find the appropriate way to serve butterfly pea flower drink at home. The colorless, red, purple, and green transparent glass and colorless glass covered by aluminum foil used to contain four grams butterfly pea petal. A 250 ml of boiling water poured to the glass to soak the petal for 60 minutes. The color intensity and total anthocyanin of the liquid measured every five minutes. The regression slope analysis exhibited that light gave no significant decrease in color intensity and total anthocyanin. About 83% of color and anthocyanin extracted within 5 minutes. There was no significant increase of the color and anthocyanin after 30 minutes. Therefore, the maceration of butterfly pea flower in boiling water for five minutes was appropriate to serve the drink. Furthermore, to reach the maximum color and anthocyanin content the 30 minutes maceration is needed. The maximum anthocyanin content of the drink was 19.57 ± 1.16 mg/l or equal to 1.22 ± 0.07 mg per gram fresh petal.

Keywords: anthocyanins, butterfly pea

1. Introduction

Butterfly pea (Clitoria ternatea L.) is a flowering ornamental plant that relatively easy to cultivate. The flowers have started to appear at the age of 4 to 6 weeks. At suitable conditions, the plant continue to flower every day for several years. Butterfly pea flower has been recognized as a potential source of anthocyanin called ternatins (Terahara et al., 1990). There are 9 types of ternatin in fully-opened butterfly pea flower (Kazuma et al., 2003). They are reported to have several health benefits such as antioxidant (Rao et al., 2009), antidiabetic and hypolipidemic (Daisy & Rajathi, 2009), anti-inflammation (Mukherjee et al., 2008) and anticancer (Morris, 2009).

Anthocyanins are water soluble bioactive compound that stored in vacuole of the plant cell. Heat is usually needed to release the anthocyanins from vacuole. However, anthocyanins are relatively unstable. They are reported degraded due to the heat exposure during processing like extraction, pasteurization, sterilization, and blanching (Sadilova et al., 2009; Cisse et al., 2011). Other than heat, the stability of anthocyanins also affected by light, pH, oxygen, and enzyme (Patras et al., 2010). In general, anthocyanins exhibit higher stability when kept in the absence of light (Cavalcanti et al., 2011).

The preparation of butterfly pea flower drink at home is relatively easy, i.e., by soaking the fresh petal in boiling water for several minutes and separate the solid residue from the liquid. However, there was no report describing the effect of heat during the maceration to the anthocyanin content of the drink. Secondly, related to the sensitivity of anthocyanins to light, there was no study to disclose the effect of different color of the glass to the anthocyanin content of the drink.

2. Methodology

Materials

The fresh fully-open butterfly flower harvested from a garden in South Tangerang, Banten, Indonesia. The buffer solution pH 1 (potassium chloride and hydrochloric acid) was obtained from Merck® (Germany).
2.1. Maceration

Each four grams of fresh petal added to colorless, red, purple, and green transparent glass and colorless glass wrapped with aluminum foil. The 250 ml of boiling distilled water poured into each glass, then the glass immediately covered by a cup cover. The maceration time was 60 minutes in room temperature. The color intensity (CI) and total anthocyanin (TA) of the liquid measured every 5 minutes by a UV-Vis Spectrophotometer (Genesys 10uv Thermo Electron Corporation, USA).

The CI was determined as \((A_{\lambda_{\text{max}}} - A_{700}) \times DF\) (Cisse et al., 2011). The TA was evaluated based on the single pH method (Lee et al., 2005). The 0.5 ml extract adjusted with buffer solution pH 1.0 and the absorbance at \(\lambda_{\text{max}}\) measured. The TA obtained by \((A \times MW \times DF \times 1000)/(\varepsilon \times l)\). MW was molecular weight of cyanidin-3-glucoside (449.2 g/mol), DF was a dilution factor, \(\varepsilon\) was molar absorptivity (26 900), and \(l\) is the cuvette width.

2.2. Statistical Analyses

The statistical analyses involved were trend analyses (Pearson’s correlation, regression analysis and slope test) (Microsoft Excel® 2010 software, Microsoft Corporation). The significant level of all analyses was \(\alpha=0.05\).

3. Results and Discussion

3.1. Color intensity and Total Anthocyanin

The color intensity and total anthocyanin of the extracts made by soaking boiling water to fresh butterfly pea flower in the various color of glass are shown in Figure 1. The regression slope test showed that the color of glass gave no significant difference (p-value > 0.05) in the rate of color intensity and total anthocyanin increase during maceration. Hence, the use of dark or opaque glass as the container to extract the ternatins from butterfly pea flower at home was unnecessary. This was in alignment to the report that ternatins are amongst the most stable anthocyanin (Terahara, Saito, Honda, Toki, & Osajima, 1990). The high stability of ternatins was due to the intramolecular copigmentation configured by a hydrophobic interaction between the aromatic acids and anthocyanin chromophore (Yoshida et al., 2009).

![Figure 1. Color intensity and total anthocyanin of butterfly pea flower extract during maceration in various glass color.](image-url)
There was a very strong correlation between the color intensity and total anthocyanin ($R^2 = 0.96$). The total anthocyanin content (mg/l) during maceration for 5 to 60 minutes could be appropriately predicted by $14.18 \times \text{color intensity} + 4.90$.

### 3.2. Three Phases of Color and Anthocyanin Increase During Maceration

In this research, four grams of butterfly pea petal soaked in 250 ml boiling water. The amount was about equal to 20 pieces of the fresh petal. During maceration, there were three phases of the color intensity and anthocyanin increase in the extract (Figure 2). The first phase occurred between 0 to 5 minutes of maceration. At this phase there were rapid increase of color intensity and total anthocyanin. In average, 83% of color intensity and total anthocyanin gained during this stage. This percentage was about equal to $16.31 \pm 0.84$ mg anthocyanin per liter or $4.1$ mg anthocyanin per 250 ml. The high percentage of color and anthocyanin extracted indicated that the cell wall of butterfly pea flower was relatively easy to destructed. At the second phase (5 minutes to 30 minutes), there were slight increases of color intensity and total anthocyanin. The increase rate of color intensity and total anthocyanin in this phase were $0.0013$ absorbance unit (AU) per minute and $0.1$ mg/l per minute, respectively. The approximate total anthocyanin content at the end of the second phase was $19.57 \pm 1.16$ mg/l or $4.89$ mg/250 ml. The anthocyanin content came from the extraction of 4 grams fresh butterfly pea petal with 250 ml water. Hence, the anthocyanin content per gram of fresh petal was $1.22 \pm 0.07$ mg.

The recommended daily intake of anthocyanins has not been established yet. However, China has currently defined a specific proposed level of 50 mg/day (Wallace & Giusti, 2015). Therefore, the anthocyanin content of the butterfly pea flower extract in a glass after 30 minutes was about 10% of the proposed level. The third phase was the stationary phase that began after 30 minutes to 60 minutes of maceration. At this phase there was no significant color or anthocyanin increase (coefficient of determination $R^2 < 0.35$ and p-Value > 0.05).

![Figure 2. Color intensity and total anthocyanin of butterfly pea flower extract during maceration in various glass color.](image-url)
4. Conclusions

The preparation of butterfly pea flower drink by soaking the petal in boiling water for 5 minutes was appropriate. The maximum anthocyanin content achieved by extending the maceration until 30 minutes. The use of opaque or dark glass as the container for the maceration was not needed. During 60 minutes of maceration, there was no significant effect of the light to the anthocyanin content.

References


