Thermal Stability Characterization of Anthocyanin from Ficus aurata as Natural Food Colorant

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Abstract. The fruit of Ficus aurata has been identified as a potential source of anthocyanin pigment based on its physical properties. This study focused on a simple characterisation of contained anthocyanins in the fruits of Ficus aurata as a food colorant material. The fresh Ficus aurata were extracted with the acidified ethanol with citric acid at room temperature for 8 hours in the dark environment. The pigment stability under several heat treatments such as on (30, 50, 70, 100 °C) and three different pH solutions (pH 1, 3, 9) were observed with UV-Vis Spectroscopy measurement. As results, it can be concluded that anthocyanin pigment from Ficus aurata has thermal resistant capability in all acidic, neutral and alkali conditions.

Keywords: Thermal Stability, Anthocyanin, Ficus aurata, Natural Food Colorant

1. Introduction

Anthocyanins belong to the widespread class of phenolic compounds, collectively named flavonoids. Anthocyanins are water-soluble glycosides and acylglycosides of anthocyanidins. At Andalas university botanical garden has a large variety of wild Ficus, where there is a Ficus has yellow-brown colored fruits with purple to red colored seeds namely Ficus aurata. Ficus aurata is a variety of ficus or fig species that is very common ficus along roadsides at Andalas University which important for forest ecosystem. When it is mature, it can acquire colouring seed hues to black-violet that might as a function and indication of the presence of anthocyanin despite the peel is not acquire any color. Although there is limited efforts on identification and characterization of anthocyanin from the seed of Ficus aurata fruit that has no attractive color on its peel, Syukri et al 2019 [1] has reported the anthocyanin sturcture elucidation from it. It had informed that the anthocyanins have malonyl glycoside form which mean it may possibility have heat resistant ability. Therefore, in this study, this hypothesis was clarified.

2. Methods

2.1 Materials

Plant samples

The fruit samples were picked at Andalas University botanical garden in West Sumatera, and transported to the laboratory immediately. The Ficus aurata was identified at herbarium identification laboratory of Andalas University (Identification Number: 101/K-ID/ANDA/III/2019).

2.2 Chemicals
HPLC-grade water, ethanol and buffer solution were obtained from Merck, Germany. All chemicals used in this study were analytical grade. Instrumentation Shimadzu spectrophotometer UV1800, Water bath (Memmert) and stove.

2.3 Procedure Extraction of anthocyanins
The extraction procedure and anthocyanin analysis were performed according to Syukri et al. 2014 with some modifications [2]. Briefly, acidified of ethanol pH 2 were prepared by mixed of ethanol with citric acid 35%. 200 ml acidified ethanol was added into 500 mL Erlenmeyer flask containing 50 g fruit. Anthocyanins were extracted at room temperature for 8 hours in dark environment; this procedure was repeated three times to collect the extract solution. The extraction was concentrated under vacuum at room temperature using a rotary evaporator until left 1/3. About 10 ml of extracted solution was passed through a 0.45 µm millipore filter for analysis.

2.4 Measurement of the stability of anthocyanin extract from temperature treatment
The stability of color intensity of anthocyanin in extract with three different solution pH conditions (pH 1, pH 3, and pH 9) and four temperature treatment (30°C, 50°C, 70°C and 100°C) were observed by using a double beam spectrophotometer Shimadzu UV-1800 with an area measuring wavelengths between 200-800 nm.

3. Results and discussion

3.1 pH treatments
As natural characteristic of anthocyanin, the color of Ficus aurata extracts at different pH conditions provide different color, which are also followed by differences in the maximum wavelength of absorbance of each extract at each pH condition. The color of the extract produced high intensity of red color in the low pH and become less along the increment of pH solution (Table 1). This result has clarified the chemical characteristic of anthocyanin that has high stability on acidic condition [3,4].

| No | pH | Color   |
|----|----|---------|
| 1  | 1  | Red     |
| 2  | 3  | Moderate red |
| 3  | 7  | Less red |

3.2 Heat treatments
Heat stability is one of the most important chemical parameter that could indicate whether the natural colorant can be applicable for food processing practice. Most of natural colorant has less stability on thermal condition. The chemical characteristics of Malonyl glycoside anthocyanin has been reviewed by Bakowska-Barczak (2005) [5] that it have thermal stability characteristic. Previous research informed that the anthocyanin in Ficus aurata available in the form of cyanidin 3-glucoside and cyanidin 3-(6"-acetylglucoside) as the major anthocyanin and delphinidin 3-O-(6"-acetylglucoside), pelargonidin 3-glucoside, delphinidin 3-O-galactoside, cyanidin 3-O-(6-O-malonyl-β-D-glucoside) and cyanidin 3-O-sophorose as the minor anthocyanins [1]. According to the results in can be suggested that anthocyanin pigment from Ficus aurata also has the characteristic as a thermo resistant anthocyanin pigment.

Table 2 indicates the spectrophotometric observation of the extract of Ficus aurata that treated under various pH and various temperatures. There were no significant reductions of spectrophotometric absorption on all extract under various temperatures. Both of ultraviolet UV absorption which indicate the flavonoid skeleton and visible absorption which indicate the conjugated skeleton showed a stable absorbance compared to low temperature treatments (30 °C). Moreover,
although in high pH solution such as at pH 3 and 7, the heat treatments did not affect the stability of anthocyanins. This result has pointed the valuable characteristic of anthocyanin pigment extract of *Ficus aurata* fruits.

**Table 2** Observation of UV-Vis absorption of extract of Ficus Padana burm.f fruits under various pH and temperature conditions.

| No | pH | Temperature (°C) | Absorbance | λ 278 | λ 525 |
|----|----|------------------|------------|-------|-------|
| 1  | 1  | 30               | 2.212      | 0.210 |
|    |    | 50               | 2.212      | 0.212 |
|    |    | 70               | 2.212      | 0.210 |
|    |    | 100              | 2.212      | 0.282 |
| 2  | 3  | 30               | 2.210      | 0.192 |
|    |    | 50               | 2.234      | 0.198 |
|    |    | 70               | 2.132      | 0.202 |
|    |    | 100              | 2.243      | 0.192 |
| 3  | 7  | 30               | 2.213      | 0.059 |
|    |    | 50               | 2.356      | 0.052 |
|    |    | 70               | 2.670      | 0.059 |
|    |    | 100              | 2.398      | 0.051 |

4. **Conclusion**

Anthocyanin pigment from the fruits of *Ficus aurata* which is suggested as acylated anthocyanins has a strong potentiality to be developed as a source of natural food colorant due to its characteristic that is not easily degraded by the effect of heat treatment.

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