

## ANTIOXIDANT ACTIVITY, TANNIN CONTENT AND DIETARY FIBER FROM COFFEE HUSK EXTRACT AND POTENTIAL FOR NUTRACEUTICAL

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### ABSTRACT

The coffee processing industry still produces a lot of solid waste that has not been utilized optimally. The use of coffee husk waste is only as animal feed and fertilizer. While, the compound content in coffee husk waste contains high-fiber and it is indicated to be used as an antioxidant, antimicrobial, anti-allergic, and anti-hypertensive. The sample of coffee husk waste was mashed into a homogeneous powder then the analysis was carried out using volumetric, gravimetric, and UV-Vis spectrophotometry methods. Here, we report the antioxidant activity, tannin content, total dietary fiber and potential nutraceutical from the coffee husk. Antioxidant activity of coffee husk was very strong ( $IC_{50} = 20$  ppm) and tannin content was 10%. Hence, the coffee husk can be potential as raw material for making nutraceutical that used for the treatment of diseases caused by free radical exposure. The total dietary fiber of coffee husk was obtained by 34%. Thus, coffee husk waste also can be utilized as the prevention of digestive diseases.

**Keywords:** Coffee Husk, Extract, Antioxidant, Tannin, Dietary Fiber

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### INTRODUCTION

Waste produced from the process of separating coffee from the seeds (pulping process) in the biomass form is very abundant. It is currently used as animal feed, compost, and raw material for making bioethanol. Coffee husk is outer skin that has a hard surface and has been separated from the husk (coffee silverskin). Residues from the coffee industry process can be used as a flavour, biosorbents, emulsions, fibers, soft drinks, energy drinks, and cosmetics). This is due to coffee husk containing caffeine, tannin, polyphenol, pectin, monosaccharide, and disaccharide compounds<sup>1</sup>.

The coffee husk contains various phenolic and caffeine compounds with phytochemical bioactivity in food mixtures which have potential properties to maintain human health. Phenolic and flavonoids have the potential as antioxidants, antimicrobial, anti-allergic, and anti-hypertensive activities<sup>2</sup>. Polyphenol compounds in coffee husk have an antioxidant activity of 13 mg/g<sup>3</sup>. The antioxidant is an important role in human health because the antioxidant can capture free radicals<sup>4,5</sup>.

Also, coffee husk waste is thought to contain high fiber, probiotics, and antioxidants. It is usually used for food formulations that contain low-calorie sugar. Coffee husk is known to improve sugar level and stimulate insulin secretion<sup>6</sup>. With the increase in obesity in the world, cardiovascular disease, cancer, metabolic syndrome, and diabetes, some research is now directed at novel discoveries in food products and supplemental drugs to treat various diseases. Based on research in Spain, the nutrients composition contained in the coffee husk is applied to drinks that can treat various diseases<sup>7</sup>. Polyphenol and caffeine compounds in the coffee husk can be analyzed by high-performance liquid chromatography/mass spectrometry (LCMS)<sup>8</sup>.

The potential use of coffee husk as a nutraceutical through analysis of antioxidant activity, tannin levels, and dietary fiber. Coffee husk samples were mashed into homogeneous powder, then the analysis was

carried out using volumetric, gravimetric, and UV-Vis spectrophotometry methods. This study aims to determine antioxidant activity, tannin levels, and dietary fiber in samples of coffee husk. It is a process to present the nutraceutical composition of coffee husk to overcome human health problems. It included preparation of coffee husk samples and continued analysis of dietary fiber levels using the gravimetric method, tannin levels using the volumetric method, and antioxidant activity by UV-Vis spectrophotometry.

## EXPERIMENTAL

### Material and Methods

Arabica (*Coffea arabica*) coffee husks were obtained directly from coffee collectors in Pangalengan, West Java. Coffee husks were washed several times with distilled water. Then, they were dried using an oven equipped with blower at a temperature of 50 °C. The dried coffee husks were crushed using crusher until the particle size was passed through 18 mesh sieve ( $\pm 1$  mm).

### Tannin Content Analysis

The sample was weighed 2.0 g and entered to beaker glass. Then, 50 mL of boiling water was added to the beaker glass. The sample solution was left for 20 min and entered into a 100 mL volumetric flask. It was filtered into a dry beaker glass. A 5 mL filtrate was entered to erlenmeyer and added 75 mL distilled water, 5 mL indigo carmine.  $\text{KMnO}_4$  with the concentration of 0.1N was used to titration of the solution until the color changed from blue to yellow. The volume of titrant was recorded as A. Then, a 10 mL filtrate was added 10 mL NaCl, 5 mL sample (filtrate) was added of 10 mL NaCl, 5 mL gelatin and 2 g kaolin. It was stirred to reach homogeneous and filtered slurry from the filtrate. 5 mL filtrated was added 75 mL distilled water and 5 mL indigo carmine. It was titrated with 0.1 N  $\text{KMnO}_4$  and the color was changed from blue to yellow. The volume of titrant was recorded as B. The result was calculated using this equation:

$$\text{Tannin (\%)} = \frac{(A-B) \times N \text{ KMnO}_4 \times 42 \times \frac{100}{5} \times 10^{-3}}{\text{sample (g)}} \times 100\% \quad (1)$$

### Antioxidant Activity

The solution of DPPH 0.4 mM was made by weighing 3.98 mg DPPH and dissolved into a 25 mL volumetric flask with methanol<sup>9</sup>. A standard solution of 500 ppm was made by weighing 5 mg of sample and dissolved in a 10 mL volumetric flask with distilled water. The serial samples were made with a concentration of 1, 3, 5, 7, and 10 ppm by pipetting the standard solution of 10, 30, 50, 70, and 100  $\mu\text{L}$ . Then, each serial was added 1 mL DPPH and methanol up to the volume of 5 mL, left for 30 min and measured the absorbance at a wavelength of 517 nm. Percent of free radicals reduction was determined with the following equation :

$$\% \text{ Inhibition} = \frac{(A_0 - A_T)}{A_0} \times 100\% \quad (2)$$

Where  $A_0$  is the absorbance of sample solution added 0.1 mM DPPH solution.  $A_t$  is an absorbance control solution

### Total Dietary Fiber

The sample was weighed 0.5 g and added 40 mL MES-TRIS (Buffer pH 8,2). It was stirred to reach homogeneous. The 50  $\mu\text{L}$  of  $\alpha$ -amylase was added to the solution and was stored in 95-110 °C for 35 min. It was left to 60 °C and beaker glass was rinsed 10 mL of distilled water. After that, it was added 100  $\mu\text{L}$  protease and incubated at the temperature of 60 °C for 30 min. HCl was used to make pH 4.5 of the solution. The volume of 200  $\mu\text{L}$  amyloglucosidase was added and the solution was incubated for 30 minutes at the temperature of 60 °C. The solution was precipitated using 225 mL ethanol 95% at 60 °C. The precipitate was left for an hour at room temperature. It was filtered with filter paper no. 42 which has known the weight. The precipitate was dried in the oven at 70 °C or 105 °C. The residue obtained consists of two parts, namely protein, and ash which was a total dietary fiber.

$$\text{Tannin (\%)} = \frac{(A-B) \times N \text{ KMnO}_4 \times 42 \times \frac{100}{5} \times 10^{-3}}{\text{sample (g)}} \times 100\% \quad (3)$$

## RESULTS AND DISCUSSION

The results of tannin content in coffee husk waste using the volumetric analysis method were shown in Table-1.

Table-1: Tannin Content in Coffee Husk Waste

| Analysis | Content(%) |
|----------|------------|
| Tannin   | 10.05      |

Tannin content found in coffee husk waste was 10.05%. Tannin was generally obtained from deciduous bark and certain types of tree bark because coniferous trees only have a small amount of tannin. Tannin contained in dry bark of several species varies from 2-40%<sup>10</sup>. Tannin was often used as an active antioxidant and antimicrobial substances. Therefore, coffee husk waste can be used to isolate the tannin. It also can be applied as a nutraceutical which provides benefits for the prevention and treatment of microbial diseases. Hence, tannin can be obtained from the coffee industry waste and no longer need to be obtained by cutting down wood in the forest. Also, tannin content in coffee husk waste was equivalent to the tannin content found in tea leaves and coffee beans. Tannins are the complex compounds contained polyphenols with high biological activity<sup>11</sup>. The results tannin content indicates the potential of coffee husk waste as an antioxidant. Therefore, coffee husk waste was determined the antioxidant activity quantitatively. The results were shown in Table-2.

Table-2: Antioxidant Activity in Coffee Husk

| Concentration (ppm) | Absorbance | Inhibition (%) |
|---------------------|------------|----------------|
| 0                   | 0.8784     | 0              |
| 1                   | 0.8181     | 6.86           |
| 3                   | 0.8094     | 7.85           |
| 5                   | 0.7839     | 10.76          |
| 7                   | 0.7272     | 17.21          |
| 10                  | 0.6602     | 24.84          |

Table-2 shows the inhibition of free radical activity using the DPPH method including the percent inhibition of coffee husk extract. This shows that the higher the coffee husk waste concentration, the greater the antioxidant activity. Therefore, if it was observed the correlation between the coffee husk waste concentration analyzed on its antioxidant activity, a linear relation was obtained. The correlation between sample concentration and inhibition percentage was shown in Fig.-1.

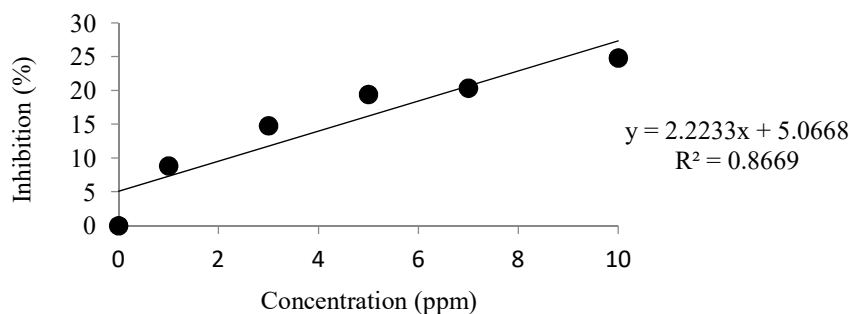


Fig.-1: Correlation of Coffee Husk Concentration to Antioxidant Activity

The antioxidant activity of coffee husk waste was determined quantitatively. The linear regression was obtained in the form of  $y = a + bx$  used to find the  $IC_{50}$  value (inhibitor concentration 50 %) of each sample by indicating the Y value of 50 and the x value to be determined from  $IC_{50}$ . The  $IC_{50}$  value indicates the amount of solution concentration needed to reduce DPPH free radicals of 50%. The calculation results of the linear regression were obtained  $y = 2.2233x + 5.0668$ , so the  $IC_{50}$  value was 20 ppm. These show that the coffee husk waste has the potential to inhibit free radicals of 50% classified very strong. The classification of antioxidants was divided into 5 classes namely very strong (< 50 ppm), strong (50-100 ppm), medium (100-150 ppm), weak (150-200 ppm) and very weak (>200 ppm)<sup>12</sup>. Cancer starts from a genetic mutation that causes damage to DNA. Hence, antioxidant compounds were studied from food, drinks, and herbs related to their activities in genetic damage prevention. Another potential nutraceutical determined from the coffee husk waste was total dietary fiber. Total dietary fiber results in coffee husk were shown in Table-3.

Table-3: Total Dietary Fiber in Coffee Husk

| No. | Sample (g) | Average Sample (g) | Ash (g) | Protein (g) | Total Dietary Fiber (%) |
|-----|------------|--------------------|---------|-------------|-------------------------|
| 1   | 0.5040     | 0.3061             | 0.0843  | 0.0496      | 34.14                   |
| 2   | 0.5045     |                    |         |             |                         |
| 3   | 0.5060     | 0.3061             | 0.0841  | 0.0496      | 34.16                   |
| 4   | 0.5028     |                    |         |             |                         |

Total dietary fiber in coffee husk was 34% that higher than total dietary fiber in a grain of rice which is 0.94%. Dietary fiber is a carbohydrate class compounds that do not undergo the digestion and absorption process. It also did not undergo fermentation by microbes in the human intestinal tract. Nutraceutical intake with high levels of dietary fiber has the efficacy to maintain human health from the risk of cardiovascular disease, hypertension, diabetes, obesity, and digestive tract diseases. Therefore, women with an energy requirement of 2000 kcal/day were recommended for a daily intake of 28 g/day of dietary fiber. Whereas men with a calorie requirement of 2600 kcal/day were recommended dietary fiber intake of 36 g/day.

### CONCLUSION

The coffee husk waste has potential as raw material for making nutraceutical that used for the treatment of diseases caused by free radical exposure. This was caused by tannin content as much as 10 % and very strong antioxidant activity ( $IC_{50} = 20$  ppm). On the other hand, the coffee husk waste can be utilized as prevention of digestive diseases, because the total dietary fiber was quite high, which was equal to 34%.

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