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Tannin Extraction from Bark of *Cinnamomum burmannii* and Its Application for use as Natural Dye in Cosmetic Products

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Abstract

Cinnamon bark (*Cinnamomum burmannii*) contains tannins which have the potential to act as natural dyes. This research to synthesis natural dye from cinnamon bark extract (*Cinnamomum burmannii*). The research was carried out by making cinnamon bark extract with comparing the amount of solvent by maceration using 96% ethanol, calculating the yield, tannin analysis, FTIR analysis, and stability test color. The comparison of the amount of cinnamon bark extraction solvent affected the resulting yield. Testing the tannin compound with 1% gelatin reagent in 10% NaCl showed a white precipitate and 1% $FeCl_3$ reagent produced a greenish-brown color so the extract was positive for tannin, analysis FTIR ratio 1:10 for the presence of O-H, C-H, C=C, C-O groups, ratio 1:15 for the presence of O-H, C-H, C=C, C-O group. The color stability test of cinnamon bark extract is more stable than Rhodamine-B. Based on the extraction results, it was concluded that cinnamon bark extract can be used as an alternative to natural dye in cosmetic products.

Keywords: Cinnamon Bark, Extract, FTIR Analysis, Natural dyes, Tannin

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Abstrak (Indonesia)

Kulit kayu manis *(Cinnamomum burmannii)* memiliki kandungan tanin yang berpotensi sebagai pewarna alami. Penelitian ini bertujuan untuk membuat pewarna alami dari ekstrak kulit kayu manis *(Cinnamomum burmannii)*. Penelitian yang dilakukan adalah pembuatan ekstrak kulit kayu manis dengan membandingkan jumlah pelarut dengan cara maserasi menggunakan etanol 96%, menghitung rendemen, uji senyawa tanin, analisis FTIR dan uji stabilitas warna. Perbandingan jumlah pelarut ekstraksi kulit kayu manis berpengaruh terhadap rendemen yang dihasilkan. Pengujian senyawa tanin dengan pereaksi gelatin 1% dalam NaCl 10% menunjukkan adanya endapan putih dan pereaksi $FeCl_3$ 1% menghasilkan warna coklat kehijauan sehingga ekstrak positif mengandung tanin. Berdasarkan analisa FTIR perbandingan 1:10 diketahui adanya gugus O-H, C-H, C=C, C-O dan perbandingan 1:15 diketahui adanya gugus O-H, C-H, C=C, C-O. Pada uji stabilitas warna, ekstrak kulit kayu manis lebih stabil dibandingkan Rhodamin-B. Berdasarkan hasil ekstraksi disimpulkan bahwa ekstrak kulit kayu manis dapat digunakan sebagai alternatif pewarna alami dalam produk kosmetik.

Kata Kunci: Kulit Kayu Manis, Ekstrak, Analysis FTIR, Pewarna Alami, Tanin

INTRODUCTION

Synthetic dyes have obvious advantages over natural dyes. Synthetic dyes have stronger color strength, are more stable and are usually cheaper. The use of synthetic dyes is often misused, and is very dangerous to health because of the heavy metal residues in the dyes [1,2]. The negative impact of synthetic dyes has made people aware to return to natural pigments which are still considered safer, harmless and have no side effects [3].

Due to the various negative impacts caused by synthetic dyes, the reuse of natural dyes must be encouraged [4]. Natural dyes are safer to use than synthetic dyes because natural dyes use ingredients obtained from plant extract so they are more environmentally friendly. Natural dyes are non-toxic,

non-allergenic to the skin, non carcinogenic and easily available [5].

One part of the plant that can be used as a natural dye is the outer bark of cinnamon. The main cinnamon producing area is Jambi Province (Kerinci Regency) that there are still a lot of exports of cinnamon bark in roll form, while in processed form it is still relatively small. The chemical contained in Cinnamon bark is the essential oil eugenol, safrole, as well as cinnamaldehyde, tannin and calcium oxalate [6].

The types of extraction methods that can be used are maceration, percolation, soxhlet and reflux. Maceration method is a simple method to immerse the spices simplicia powder in the solvent. Maceration has many advantages such as simple, easy inexpensive and keep components that easily damaged by heat. The extraction process is affected by several factors such as size a raw material, solvent, temperature and duration of the extraction process [7].

The effectiveness of extraction of a compound by solvent depends largely on the solubility of the compound in the solvent. Several studies have shown the effect of variations solvent concentrations of the resulting extract. Concentrations of solvents affects the levels of tannin obtained [8]. The selection of the type of solvent is an important factor to consider in the process of extraction [9].

The aim of this research is to find out the percent yield resulting from a ratio of solvent amounts of 1:10 and 1:15, to find out the presence of tannin compounds in cinnamon bark extract (*Cinnamomum burmannii*), and knowing the stability of the color produced from cinnamon bark extract (*Cinnamomum burmanni).*

MATERIALS AND METHODS

Materials

The material used in this research was cinnamon bark (*Cinnamomum burmannii*). Solvents and reagents used include distilled water, ethanol 96% (COA), ethanol p.a, $FeCl_3$ 1%, gelatin, sodium chloride, rhodamine-B.

Methods

The method used in this research is an in vitro laboratory experimental method with natural dyes from cinnamon bark extract (*Cinnamomum burmannii*).

Procedure

Sample collection and preparation

Samples of cinnamon bark (Cinnamomum burmannii) taken from cinnamon bark traders from Tambak Tinggi village, Kerinci Regency, Jambi Province. The samples taken were cinnamon bark that was 10-20 years old. Next, the samples are cleaned and chopped into small pieces so that during the drying process they dry more easily and quickly, then dried in the sun covered with a black cloth. After drying, the cinnamon bark is blended until smooth, then sieved using a 40 mesh sieve to get the finest powder.

Extraction of Cinnamon bark

Macerated Cinnamon bark (*Cinnamomum burmannii*) is made by macerating 30 grams of dry simplicia of cinnamon bark that has been powdered into a brown bottle and added with ethanol solvent at a solvent ratio of 1:10 (30 grams of ingredients: 300 ml solvent), 1: 15 (30 grams of ingredients: 450 ml solvent), then macerated for 24 hours with manual stirring every 6 hours for 5 minutes. The results of the maceration were then filtered using Whatman 42 filter paper, then the filtrate obtained was evaporated using a rotary vacuum evaporator at a temperature of 60 ^{O}C at a speed of 100 rpm to obtain a thick extract. The thick extract obtained from the comparison of solvent amounts is weighed to calculate the highest extract yield [10].

Analysis tannin

The tannin test was carried out with 2 test reagents. In the first test, 0.5 g of sample was dissolved in distilled water and then added with 2-3 drops of 1% $FeCl_3$. Positive results are indicated by the formation of a green-brown color [11]. For the second test, 0.5 g of sample was dissolved in distilled water and then added with 1% gelatin in 10% sodium chloride. A positive result is indicated by the appearance of a white precipitate [12].

FTIR analysis test

0.1 gram of each thick extract of cinnamon bark (*Cinnamomum burmannii*) was taken. Then add KBr powder and grind in a mortar until smooth and mixed. Pellets are made and then identified using an FTIR spectrophotometer in the wave number range of 4000-450 $cm^{-1.}$

Color stability test

In testing the stability of natural dyes from Cinnamon Bark extract with 2 types of solvent ratios. The comparison solution was made by weighing 0.5 grams of extract dissolved in ethanol and put into a 25 mL volumetric flask for one concentration and tested for color fastness by irradiating it under a 356nm UV lamp. Every 0 minutes, 10 minutes, 20 minutes, 30 minutes, 40 minutes, 50 minutes. After that, the absorbance of the six concentrations was calculated

using a UV-Vis Spectrophotometer at the maximum wavelength and repeated three times.

In testing the stability of the synthetic dye Rhodamine-B, 0.05 grams were weighed, dissolved in ethanol, put into a 25 mL volumetric flask for one concentration and color resistance was tested by irradiating it under a 356 nm UV lamp. Every 0 minutes, 10 minutes, 20 minutes, 30 minutes, 40 minutes, 50 minutes. After that, the absorbance of the six concentrations was calculated using a UV-Vis Spectrophotometer at the maximum wavelength and repeated three times [13].

Data Analysis

Determination of yield is calculated using the formula:

$$\%\ \text{yield} = \frac{\text{Weight of extract obtained (g)}}{\text{Initial simplicia weight (g)}} \times 100\% \quad (1)$$

RESULTS AND DISCUSSION

Results of the extraction stage

Based on **Table** 1. the results of extracting cinnamon bark using a comparison of the amount of solvent provide different percent yields. This difference is due to the difference in the amount of solvent used. In the ratio of (1:15), the yield was 43 % and in the ratio of (1:10) the yield was 33%. The comparison of the amounts of different solvents in the extraction process can affect the resulting yield value. The greater the amount of solvent, the average value of the yield obtained increases. This can happen because a high amount of solvent can maximize contact between the material and the solvent to absorb more compounds contained in the material so that the amount of yield obtained is maximum [14].

Table 1. Extraction and yield results

Powder weight (grams)	Solvent comparison	Weight of thick extract (grams)	Yield (%)
30	1:10	12.9	33
30	1:15	16.8	43

Analysis tanin

In the first test, a 1:10 ratio extract was added with 1% gelatin in 10% NaCl. The results are indicated by the appearance of a white precipitate in the sample. To the extract ratio of 1:15, 1% gelatin in 10% NaCl was added. Characterized by the presence of a white precipitate. extracts that add 1% gelatin in 10% NaCl will result in a white precipitate indicating the presence of tannin compounds [15].

Second test is using 1% $FeCl_3$ reagent, adding 2-3 drops of $FeCl_3$ to the filtrate obtained. Positive results occur if the color changes to brownish green. if 1% $FeCl_3$ is dropped into the extract, the color will change to blackish green, greenish brown or blackish blue, which indicates the presence of tannin compounds [16]. Qualitative test results showed in **Table** 2.

Table 2. Qualitative Test Results

Compound	Reagent		Results
Tannin 1:10	$FeCl_3$ 1%	(+)	
	Gelatin 1% in 10 % NaCl	(+)	
Tannin 1:15	$FeCl_3$ 1%	(+)	
	Gelatin 1 % in 10 % NaCl	(+)	

Characterization using FTIR

Cinnamon bark extract *(Cinnamomum burmanni)* in a ratio of 1:10 and 1:15 which had identified tannins was also characterized using FTIR. This characterization aims to identify the functional groups present in tannin compounds.

Based on the **Figure** 1. extract (1:10) is found at wave number 3292.60 cm^{-1} showing phenols (O-H), at wave number 2925.95 cm^{-1} is alkanes (C-H). At wave 1520.10 cm^{-1} it shows aromatics (C=C). At wave 1060.12cm^{-1} it shows esters (C-O).

Extract (1:15) contains phenols (O-H) at wave number 3327.92 cm^{-1}, absorption at wave 2852.14 cm^{-1} shows alkanes (C-H). The absorption at 1519.90 cm^{-1} shows aromatics (C=C). At wave 1063.09 cm^{-1}, 1106.32 cm^{-1} shows esters (C-O) [8].

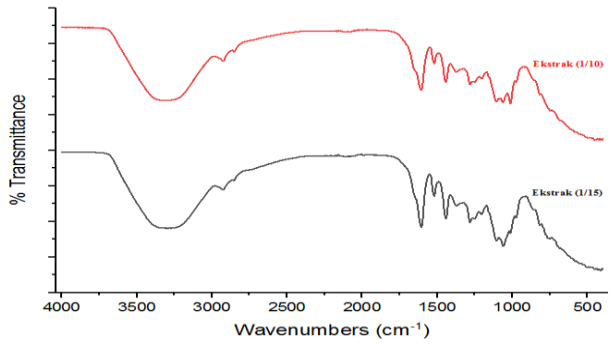

Figure 1. FTIR Spectrum (Extract 1:10) and (Extract 1:15)

The obtained spectrum constitutes the fingerprint of a compounds indicated by the form of characteristic peaks of the various functional groups present in the studied extracts [17,18].

Color Stability Test Results

Effect of 356 nm UV lamp exposure time

After obtaining the results from the extraction, namely maceration with 96% ethanol solvent, then proceed with a color stability test of Cinnamon Bark at a solvent ratio of 1:10 and 1:15 with irradiation using a 356 nm UV lamp. Made with six exposure time concentrations, namely 0 minutes, 10 minutes, 20 minutes, 30 minutes, 40 minutes and 50 minutes. After that, measurements were made of the synthetic dye used as a comparison, namely Rhodamine-B. Used Rhodamine B as comparison to see the difference in color stability between natural dyes produced from C*innamon burmanii* and synthetic dyes from Rhodamine B. Rhodamine B has a color similar to extract produced.

After that, the absorbance of the extract was measured at a wavelength of 405 nm with a UV-Vis spectrophotometer and compared to the synthetic dye used as a comparison, namely Rhodamine-B with a wavelength of 565 nm.

Based on **Figure** 2. under the influence of long exposure to a 356 nm UV lamp, the value of decreasing the absorbance of cinnamon bark extract by 1:15 was more stable, decreasing the absorbance after measuring for 50 minutes. Meanwhile, the absorbance value of 1:10 cinnamon bark extract was unstable, decreasing the absorbance because the decrease in the absorbance value from 20 minutes to 30 minutes further decreased the absorbance. For the comparison dye Rhodamine-B, the absorbance value was unstable because the decrease in the absorbance value from the 20th minute to the 30th minute decreased significantly compared to the decrease in the absorbance value of the natural dye extract. The decrease in absorbance value is proportional to the decrease in color intensity (the color of the extract fades more quickly) [19].

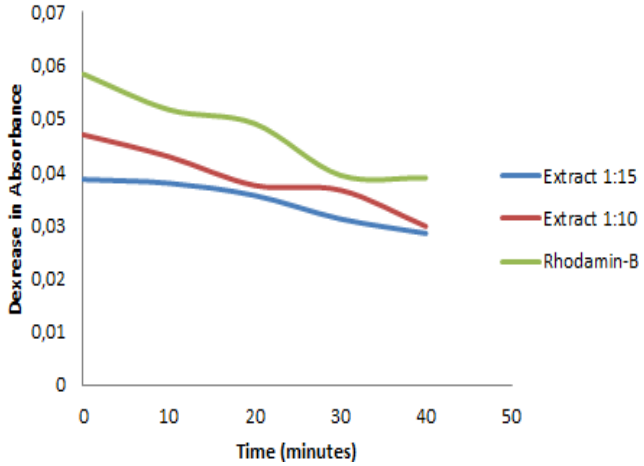

Figure 2. Graph of Decrease in Absorbance of Extract (1:10), (1:15) and Rhodhamine-B

Color intensity is a value that shows the level of strength of purity of a color. The higher the intensity value, the brighter the color will be [20]. From the results of color stability test, extract of cinnamon bark which has been influenced by UV lamp had a lower decreased intensity reduction than Rhodamin-B.

The resulting dye was then tested using photo images. **Figure** 3. Visually displays the color appearance produced by each extract C*innamon burmanii* 1:15, 1:10 and Rhodamin B. This test is aimed at seeing difference in color intensity of the extract and rhodamin B. The picture shows that extract 1:15 have a higher color intensity level than extract 1:10 and Rhodamin B. This shows that there is a higher tannin pigment content in the extract *Cinnamomum burmannii* 1:15 [21].

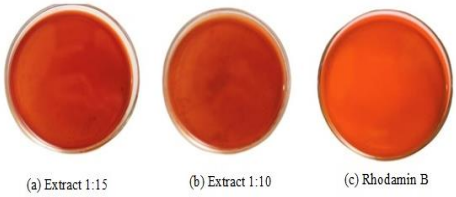

Figure 3. Photo image results of cinnamon bark extract and Rhodamin-B

CONCLUSION

Based on the research results, data analysis and discussion, the conclusion from this research can be drawn: The higher the amount of solvent, the higher the % yield produced. Cinnamon bark extract contains tannin compounds with qualitative and FTIR tests. The stability of the dye was better than the cinnamon bark extract compared to Rhodamine-B.

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