

BIOLOGICAL ACTIVITIES STUDY OF CINNAMON (*CINNAMOMUM BURMANNI* (Nees & T.Nees) BLUME) FOR DEVELOPMENT OF COSMETICS PRODUCT

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ABSTRACT

Objectives: The goal of this research was to study the biological activities of cinnamon bark extract related to its use as cosmetic ingredients. The potential use of cinnamon bark as cosmetic preparations was studied by confirming its antioxidative, antimicrobial, and its inhibition towards tyrosinase activity.

Methods: Extraction was performed by maceration using 70% ethanol. Antioxidative activity using the DPPH methods, melanin inhibitory effect was determined using *in vitro* anti tyrosinase assay. MHC and MIC of cinnamon bark extract were determined towards *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Cutibacterium acnes*.

Results: The standardization result of the crude drugs showed positive result on qualitative analysis of flavonoid, tannin, and quinone groups. Flavonoid content was also found on the ethanolic extract. The IC₅₀ antioxidative activity of cinnamon ethanolic extract was 7.52 ± 0.13 µg/mL compared to ascorbic acid with 2.54 ± 0.02 µg/mL. The Ethanolic extract of cinnamon inhibited tyrosinase activity with IC₅₀ of 9.44 ± 0.26 mg/mL. Lowest minimum inhibitory concentration of ethanolic extract was found towards *C. acne* with 1000 µg/mL. Whereas weak antimicrobial activity was showed towards *S. aureus* and *S. epidermidis* with MIC and MBC value started from 2000 µg/mL.

Conclusion: Comparable result on antioxidative and anti-tyrosinase analysis shows that cinnamon bark has fair potential to further developed and formulated for topical maintenance product.

Keywords: Cinnamon, Antioxidan, Anti Tyrosinase, Antimicrobial, Cosmetic.

INTRODUCTION

In the realm of cosmetics and personal care, the quest for natural, safe, and effective ingredients has intensified which is driven by a growing consumer preference for products that promote well-being and sustainability. Cinnamon, the aromatic spice derived from the bark of *Cinnamomum* trees, has garnered significant attention for its versatile applications. Beyond its traditional role as a flavour enhancer and medicinal remedy, cinnamon has emerged as a potent contender in the cosmetic industry (Chanchal and Swarnlata, 2008).

Cinnamon's appeal in cosmetics is rooted in its multifaceted attributes. As a source of natural antioxidants, cinnamon possesses the capacity to combat free radicals, protecting the skin from oxidative stress and premature aging. Its rich composition includes polyphenols and flavonoids, which have been associated with anti-inflammatory and anti-aging properties. Furthermore, cinnamon's antimicrobial and antibacterial characteristics make it an attractive ingredient for products aimed at maintaining skin health and hygiene. Its potential to inhibit the growth of acne-causing bacteria and fungi presents opportunities for innovative acne treatments and skincare solutions (Kumar and Kumari, 2019).

Cinnamon's distinct warming sensation, when applied topically, enhances blood circulation and imparts a pleasant tingling effect, providing a unique sensorial experience in cosmetic products. This sensory dimension can significantly contribute to the overall appeal of skincare items. Moreover, cinnamon's natural fragrance, characterized by warm and spicy notes, offers an attractive alternative to synthetic fragrances, aligning with the consumer demand for natural scents in cosmetic formulations (Liu *et al.* 2023).

Intriguingly, cinnamon's incorporation in cosmetics aligns with the industry's commitment to sustainability, as it represents a renewable and environmentally friendly resource. By exploring the potential of cinnamon as a cosmetic ingredient, we can unlock new dimensions in the development of products that are not only efficacious but also in harmony with the broader ethos of green beauty (Nabavi *et al.* 2015). This report explores the

scientific evidence supporting the use of cinnamon in cosmetics with the diverse range of applications where it can be harnessed. It aims to shed light on the expanding role of cinnamon in the cosmetics industry and the potential it holds for innovation and formulation.

MATERIALS AND METHODS

Materials

Crude drug of Cinnamon Barks (*Cinnamomum burmanni* (Nees & T.Nees) Blume). Ethanol 96% as extraction solvents. Phytochemical screening reagent consisting: Folin-Ciocalteu, Liebermann-Burchard, Stiasny, Dragendorff. 2,2-diphenyl-1-picrylhydrazyl (DPPH) reagents. Mushroom derived tyrosinase, potassium phosphate buffer, -DOPA, *Cutibacterium acnes* ATCC 11827 *Staphylococcus aureus* ATCC 6538, and *Staphylococcus epidermidis* ATCC 12228 obtained from the bacterial collections of the Laboratory of Microbial Analysis, School of Pharmacy, Bandung Institute of Technology.

Plant collection, Extraction and Characterization

Cinnamon barks was provided by PT. Cosmax Indonesia. Prior to extraction step, the dried crude drug was powdered. The extraction was performed according to Indonesian Herbal Pharmacopoeia method, carried out with maceration using three times solvent change in each day. After 3 day the liquid extract was collected and concentrated using rotary evaporator. The characterization of the crude drug and the extract was performed by phytochemical analysis.

Determination of antioxidative activity with DPPH method

The assessment of antioxidative activity was accomplished through the utilization of the DPPH method. Initially, a DPPH solution was created, containing 50 µg/ml of DPPH in methanol. Subsequently, the absorbance of this DPPH solution was observed using a UV-visible spectrophotometer, employing a wavelength of 517 nm. As a standard reference, an ascorbic acid solution was meticulously prepared, containing 200 µg/ml of ascorbic acid in methanol. For the sample solution, varying volumes (12.5; 15; 20; 22.5; 25; and 30 µl) were combined with 125 µl of

methanol and 750 µl of the DPPH solution. This mixture was incubated for 30 minutes in a sealed, dark environment. The absorbance was then recorded using a UV-visible spectrophotometer at 517 nm. To establish a baseline measurement, a blank solution was prepared utilizing methanol. Each concentration underwent absorbance measurements three times. The calibration curve was generated based on the percentage of DPPH absorption in response to different concentrations of ascorbic acid solutions. The analysis of antioxidative activity in the sample solution was executed following the same procedure as the standard solution, with absorbance measurements being repeated six times for each extract. The antioxidative activity was determined through the linear regression equation derived from the ascorbic acid calibration curve and expressed as the antioxidant capacity equivalent of ascorbic acid per gram of extract (mg ascorbic acid equivalent antioxidant capacity (AEAC)/g of extract) (Scherer and Godoy, 2009).

Determination of Antimicrobial Activity

Antimicrobial activity testing was conducted utilizing the broth microdilution method, which was adapted from the CLSI guidelines (CLSI, 2020). To prepare the inoculation suspension, the broth culture was initially diluted with a medium solution in order to achieve a 0.5 McFarland standard, equivalent to a concentration of 5×10^5 CFU/ml. This suspension was further diluted at a ratio of 1:20 with the medium. Next, 0.01 ml of this suspension was introduced into each well of a 96-well microwell plate. As a point of reference, tetracycline, nystatin, and ketoconazole were employed as positive controls. The microbial inhibition profile of the isolated substance was assessed using a microplate reader. Absorbance values were determined by measuring the reduction in microbial culture absorption in the

presence of the isolate when compared to a mixture of medium and sample, at a wavelength of 625 nm.

Determination of Anti-Tyrosinase Activity

The assessment of tyrosinase inhibitory activity was performed in 96-well plates using a spectrophotometer, following a slightly modified from previous study (Masuda *et al.* 2005). This inhibitory activity was determined using the diphenolase mechanism with L-Dopa as the substrate. Kojic acid, a standard tyrosinase inhibitor, was dissolved in a phosphate buffer with a pH of 6.8, which also contained 5% DMSO. The enzyme concentration used was 300 units/ml, and absorbance readings were taken at a wavelength of 475 nm. Testing for tyrosinase inhibitory activity was carried out with concentrations of DN, DEA, and DE set at 1000 µg/ml. Subsequently, a series of 10 different concentrations were prepared from the selected sample to determine the IC₅₀ value.

RESULTS AND DISCUSSION

Crude drug and extract characterization

After subsequent maceration with 70% ethanol, the concentrated cinnamon bark extract was obtained with the yield of 25.58%. Several secondary metabolites were found in the cinnamon bark crude drug and cinnamon extract as described in the table 1. Flavonoid, Coumarine, and steroid/triterpenoids group were found both in the crude drug and ethanolic extract of cinnamon bark, whereas tannin and quinone were only found in the crude drug. The phytochemical profile of the extract is almost similar with previous study which use 96% ethanol as extraction solvent (Sirait *et al.* 2023). High flavonoid content in cinnamon bark was also reported by previous paper which highly support for the antioxidative feature of cinnamon extract (Al-Dhubiab BE, 2012).

Table 1. Phytochemical profile of the crude drug and ethanolic extract of Cinnamon Bark. (+) detected, (-) not detected

	Crude Drug	Extract
Alkaloid	-	-
Flavonoid	+	+
Tannin	+	-
Steroid/Triterpenoid	+	-
Quinone	-	-
Saponin	-	-
Coumarine	+	+

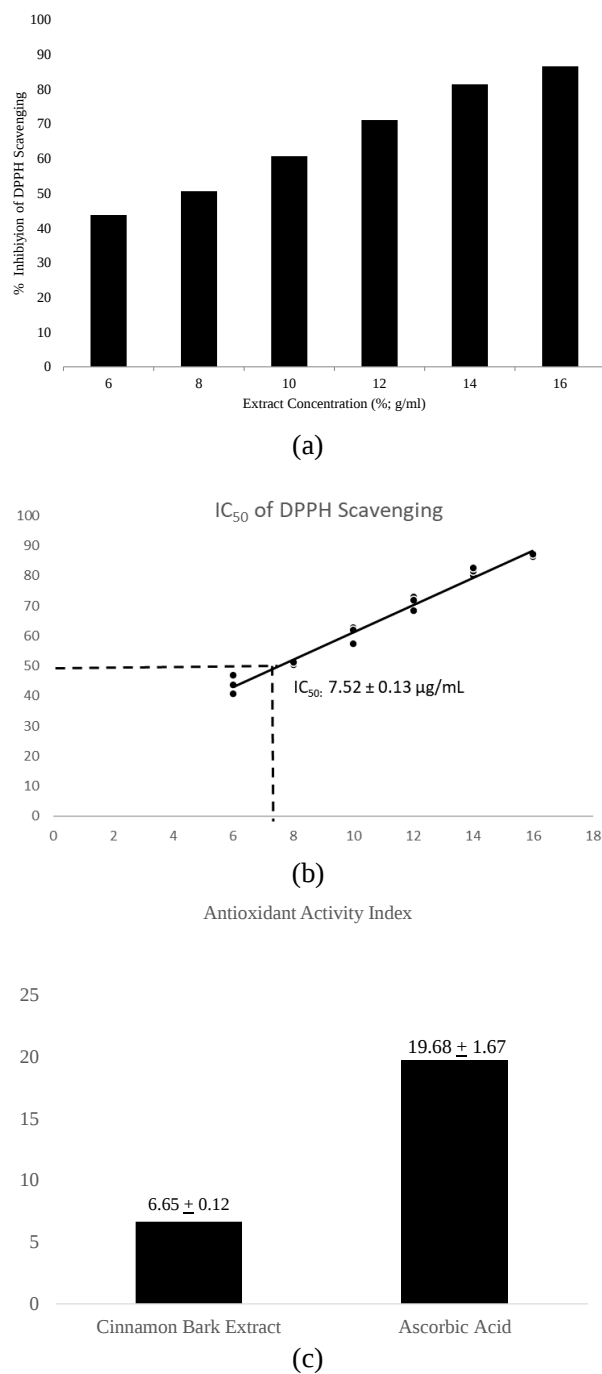


Figure 1. Antioxidant Activity of Cinnamon Bark Ethanolic Extract: (a). Increase of DPPH Scavenging Percentage toward concentration rise; (b). DPPH Scavenging IC₅₀ value of Cinnamon Bark; (c). Antioxidant Activity Index of Cinnamon Bark

DPPH scavenging assay was performed to study the antioxidative potential of cinnamon bark. Increase of DPPH scavenging rate was shown following concentration dependant manner as shown in the Fig. 1a. The ethanolic extract of Cinnamon Bark gave IC₅₀ value 7.52 ± 0.13 μg/mL. The result was

similar with previous study which compared the effect of solvent different to the antioxidant activity (Ervina *et al.* 2016). The IC₅₀ value of positive control used in the test was 2.54 ± 0.02 μg/mL, as described in the Figure 1b. Calculation of the Antioxidant Activity in the ethanolic extract of

cinnamon bark present the value of 6.65 ± 0.12 (Figure 1c). This value is categorized as a strong antioxidant group, following the consideration that established in the previous study by Scherer and Godoy (2009).

The evaluation of tyrosinase enzyme inhibition was performed on the ethanolic cinnamon bark extracts and the outcomes are presented in Table 2. Kojic acid served as the positive control for assessing tyrosinase inhibition. The IC_{50} value of cinnamon extract still much higher than the value produced by the positive control.

Antimicrobial properties of the extract were studied towards the microbes which commonly

found during skin inflammation especially on facial area. The bacteria used are *C. acnes*, *S. epidermidis*, and *S. aureus*. The antimicrobial test was performed following the methods from CLSI (2020) and the result is shown in the table 3. The ethanolic extract of cinnamon bark show proper potential towards *C. acnes* with Minimum Inhibitory Concentration of 1000 $\mu\text{g/mL}$. Higher concentration of both MIC and Minimum Bactericidal Concentration was found after the extract was challenged to *S. aureus* and *S. epidermidis*. This result is in line with the previous study about the analysis of antibacterial activity from *C. burmannii* plant (Altin *et al.* 2023).

Table 2. IC_{50} Tyrosinase Inhibition Assay from Ethanolic extract of Cinnamon bark.

Sample	IC_{50} (mg/mL)
Cinnamon Bark Ethanolic Extract	9.44 ± 0.26
Kojic Acid	0.03 ± 0.002

Table 3. MIC and MBC value of Ethanolic extract of Cinnamon bark towards several bacteria.

Microbe	MIC ($\mu\text{g/mL}$)	MBC ($\mu\text{g/mL}$)
<i>Cutibacterium acnes</i>	1000	> 2000
<i>Staphylococcus aureus</i>	2000	> 2000
<i>Staphylococcus epidermidis</i>	2000	> 2000

CONCLUSIONS

From this study, several biological activities from the ethanolic extract of Cinnamon bark were elucidated. The *C. burmannii* bark ethanolic extract showed strong antioxidant activity with IC_{50} of $7.52 \pm 0.13 \mu\text{g/mL}$. Eventough the activity towards tyrosinase inhibition bit far from the positive control (IC_{50} : $9.44 \pm 0.26 \mu\text{g/mL}$), the extract showed fair potential towards the inhibition of *C. acnes*, which known as the main bacteria found during facial skin inflammation. The results obtained from this study showed that the ethanolic extract of cinnamon bark may have proper potential for the formulation of topical maintenance product due its very strong antioxidant activity index and its activity towards *C. acnes*. Further advancement related to its physicochemical properties will be advantageous for the development of cosmetic products.

ACKNOWLEDGEMENT

We thank PT. Cosmax Indonesia for the Collaborative Study.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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