

THE OPTIMALIZATION OF EXTRACTION METHOD OF AVOCADO LEAVES (*Persea americana* Mill.)

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ABSTRACT

This study aims to determine the most effective extraction method to obtain bioactive compounds from avocado (*Persea americana* Mill.) leaves, which are known for their antioxidant and antibacterial activities. Four extraction methods were evaluated—maceration, digestion, Soxhlet extraction, and ultrasonic extraction—using methanol and water as solvents. Evaluation was based on yield and stock solution concentration. Results showed that ultrasonic extraction produced the highest yield with a stock concentration of 2.5% m/v, indicating superior extraction efficiency compared to the other methods. Maceration and Soxhlet extraction produced moderate values, while digestion produced the lowest stock solution concentration (0.9%). These findings indicate that ultrasonic extraction is a rapid and efficient technique for extracting bioactive compounds from natural materials, making it highly relevant for application in cosmetic and pharmaceutical product development.

Key words: Avocado leaves, extraction methods, bioactive compound, ultrasonic

INTRODUCTION

Indonesia is a country rich in natural resources, and avocado (*Persea americana* Mill.) is one of its notable agricultural products. As one of the leading avocado producers in Asia, Indonesia plays a significant role in the global avocado industry. According to data from the Central Bureau of Statistics (BPS), Indonesia's avocado production increased by 0.95% in 2023, reaching 874,046 tons compared to 865,780 tons in 2022 (BPS, 2022). This growth highlights the potential for greater utilization of avocado, particularly in industries such as cosmetics.

Avocado is a tropical fruit belonging to the Lauraceae family and is not only valued for its delicious fruit but also for its rich nutrient content. The fruit

contains monounsaturated fats, vitamins A, B1, B2, B3, B6, C, D, E, K, and essential minerals like calcium and iron (Dreher et al., 2013)(Nursila, 2023)(Senior, 2018). However, the benefits of avocado extend beyond the fruit; its leaves also contain valuable bioactive compounds such as flavonoids, phenols, saponins, tannins, and alkaloids. Research by Rahmah et al. (2023) has shown that avocado leaf extracts exhibit antioxidant activity with an IC₅₀ value of 9.24 µg/mL, which is higher than that of vitamin C (1.942 µg/mL) (Rahmah et al., 2023; Demesa et al., 2024). Furthermore, Purnamasari et al. (2024) demonstrated the antibacterial properties of avocado leaves, with a minimum inhibitory concentration (MIC) of 250 µg/mL against *Shigella dysenteriae* (Purnamasari et al., 2024). These properties position avocado leaves as promising natural ingredients for use in cosmetic products.

Extraction is an essential process for obtaining bioactive compounds from natural materials. The method chosen for extraction significantly influences the yield and purity of the extracted compounds. Several extraction techniques, including maceration, digestion, Soxhlet, and ultrasonic extraction, are employed in the cosmetic and pharmaceutical industries. Among these, ultrasonic extraction has recently gained attention due to its efficiency and rapid extraction capabilities. This method utilizes ultrasonic waves to enhance the extraction process by increasing the solubility of compounds from the plant matrix, thus making it a promising technique for obtaining high-quality natural extracts.

In this study, four extraction methods—maceration, digestion, Soxhlet, and ultrasonic extraction—were compared for their effectiveness in extracting bioactive compounds from avocado leaves. The purpose of this study was to identify the most efficient method for producing extracts that can potentially be used in cosmetic formulations, particularly as active ingredients for their antioxidant and antibacterial properties.

MATERIAL AND METHODS

Material

The materials used consisted of Avocado (*Persea americana* Mill.) leaves, aquadest (distilled water), and methanol p.a.

Methods

Preparation of Simplicia

Avocado leaves were cleaned, washed with water, and dried in an oven at ±50°C until completely moisture-free. Once dried, the leaves were pulverized using a blender and stored in a sealed container protected from moisture and light.

Maceration Method

Five grams of the powdered avocado leaves were placed into a glass jar. A solvent (methanol or water) was added in a ratio of 1:10 (w/v). The mixture was covered and left to stand for 24 hours, stirred occasionally. After maceration, the extract was filtered to separate the filtrate from the residue. The filtrate was evaporated slightly to remove excess solvent, producing a concentrated extract.

Digestion Method

Five grams of *simplicia* were placed in a beaker. The ethanol was added (1:10 ratio). The mixture was heated on a hot plate at 60–70°C for 1 hour with continuous stirring. The mixture was cooled and filtered. The filtrate was concentrated to obtain the digest extract.

Soxhlet Extraction Method

Five grams of powdered leaves were placed in a thimble. The Soxhlet apparatus was filled with ± 150 mL solvent. Extraction was carried out for 3–4 hours (± 8 –10 cycles). The obtained extract was evaporated to remove the solvent until concentrated.

RESULT AND DISCUSSION

In this study, four different extraction methods—maceration, digestion, Soxhlet, and ultrasonic extraction—were compared for their efficiency in extracting bioactive compounds from avocado (*Persea americana* Mill.) leaves. The extracts obtained from each method were evaluated based on visual appearance, odor, and stock concentration.

Among the four methods, ultrasonic extraction proved to be the most efficient. Ultrasonic extraction relies on cavitation energy generated by ultrasonic waves, which causes rapid pressure fluctuations in the solvent. This energy induces rupture of the plant cell walls, facilitating the efficient release of bioactive compounds (Yusoff et al., 2022). As a result, the ultrasonic extracts were noticeably darker than those obtained using other methods, suggesting a higher concentration of extracted compounds. The stock concentration obtained from ultrasonic extraction was the highest, measuring 2.5% m/v, which is significantly greater than those from the other methods. In contrast, maceration is a much milder and simpler extraction method. The plant material is soaked in the solvent for an extended period, and although this method is easy to perform, it lacks the energy input necessary for efficient extraction. As a result, the extract obtained through maceration was

relatively lighter in color and had a lower yield compared to the ultrasonic and Soxhlet extracts. The stock concentration achieved by maceration was 1.4% m/v, which was lower than both the ultrasonic and Soxhlet extractions. The Soxhlet extraction method, which provides heat and continuous solvent replacement, also yielded an effective extract. However, despite its efficiency, Soxhlet extraction carries the risk of thermal degradation, particularly for heat-sensitive compounds. The Soxhlet extract was darker than the maceration extract but still lighter than the ultrasonic extract. The stock concentration obtained using Soxhlet extraction was 2.0% m/v, which was higher than maceration but lower than ultrasonic extraction.

On the other hand, digestion—which involves heating the plant material with the solvent but without continuous cycling—proved to be a less efficient method. Although it allows for the extraction of bioactive compounds, digestion is more prone to the loss of thermo-labile compounds due to prolonged exposure to heat. This resulted in the lowest stock concentration (0.9%) among the methods tested, indicating that the digestion method was the least effective for extracting compounds from avocado leaves.

Despite the similar brownish-green color of the extracts from all four methods, the ultrasonic and Soxhlet extracts appeared darker, reflecting the higher concentration of bioactive compounds. In terms of odor, all the extracts retained the distinctive scent of avocado leaves, confirming that the extraction processes did not significantly alter the volatile compounds responsible for the characteristic aroma of the leaves.

Overall, ultrasonic extraction was the most efficient method, achieving the highest stock concentration of 2.5% m/v, which confirms its superiority over other methods like maceration, Soxhlet, and digestion. These results are consistent with previous studies that have shown that ultrasonic-assisted extraction enhances mass transfer and reduces extraction time, making it a highly effective and rapid technique for extracting bioactive compounds from plant materials. This makes ultrasonic extraction an ideal method for applications in the cosmetic industry, especially for obtaining natural antioxidants and other bioactive ingredients.

CONCLUSION

Among the four methods tested, ultrasonic extraction is the best technique for extracting bioactive compounds from avocado leaves, producing the highest stock concentration as 2.5%. This method is fast, efficient, and suitable for cosmetic formulation research

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