Journal of All Fields of Pharmacy International (JAFPI)
Volume 1, Edition 1, Year 2026
Journal Homepage: https://ejurnaljlm.com/index.php/JAFI/index
***Article type** : SHORT COMMUNICATION*

Extraction of Active Compounds from Fern Leaves (Pteridophyta folium) Using the Maceration Method with 95% Ethanol as Solvent

Nailah Qaniah Niode[1], Naylah Revalina Mokodompit[1], Fawwaz Maula[1], Azkiya Maghfira Putri Modeong[1], Nuraini Amalia Palilati[1], Mohamad Adam Mustapa[2], Wiwit Zuriati Uno[2], Rifka Anggraini Anggai[2], Abdullah Walangadi[2]

[1] *Pharmacy Students, Department of Pharmacy, Faculty of Sports and Health, Gorontalo State University, Gorontalo City, Indonesia*
[2] *Department of Pharmacy, Faculty of Sports and Health, Gorontalo State University, Gorontalo City, Indonesia*

**Corresponding Author. Email: nayaqaniah@gmail.com*

ABSTRAK

Maserasi merupakan salah satu metode ekstraksi yang banyak digunakan dalam bidang farmakognosi untuk menarik senyawa aktif dari bahan alam. Penelitian ini bertujuan untuk memahami prinsip kerja metode maserasi, mengetahui faktor-faktor yang memengaruhi proses ekstraksi, serta mengevaluasi hasil ekstraksi simplisia daun pakis (Pteridophyta folium) menggunakan pelarut etanol 95%. Metode yang digunakan yaitu maserasi dengan merendam 250gram serbuk daun pakis dalam 1000 mL etanol 95%, kemudian dilakukan pengadukan secara berkala dan penyaringan untuk memperoleh filtrat ekstrak. Hasil penelitian menunjukkan bahwa proses maserasi menghasilkan filtrat sebanyak 550 mL dengan warna hijau kehitaman pekat dan berat residu sebesar 443 gram. Warna ekstrak yang pekat menunjukkan bahwa senyawa metabolit sekunder dari daun pakis berhasil tersari ke dalam pelarut. Perbedaan volume pelarut sebelum dan sesudah ekstraksi dipengaruhi oleh penyerapan pelarut oleh simplisia, penguapan pelarut, dan cairan yang tertinggal pada residu. Berdasarkan hasil yang diperoleh, metode maserasi terbukti efektif untuk mengekstraksi senyawa aktif dari daun pakis karena mudah dilakukan, tidak memerlukan peralatan khusus, serta sesuai untuk senyawa yang bersifat termolabil. Faktor-faktor seperti ukuran partikel simplisia, jenis pelarut, lama perendaman, dan frekuensi pengadukan berpengaruh terhadap keberhasilan proses ekstraksi.

Keywords: *Maserasi; ekstraksi; daun pakis; etanol 95%; Pelarut*

Received:	***Accepted:***	***Online:***
11-06-2026	*16-06-2026*	*18-06-2026*

ABSTRACT

Maceration is one of the extraction methods widely used in pharmacognosy to isolate active compounds from natural materials. This study aimed to understand the working principle of the maceration method, identify the factors affecting the extraction process, and evaluate the extraction results of fern leaf simplicia (Pteridophyta folium) using 95% ethanol as the solvent. The extraction was carried out by macerating 250 g of powdered fern leaves in 1000 mL of 95% ethanol, followed by periodic stirring and filtration to obtain the extract filtrate. The results showed that the maceration process produced 550 mL of filtrate with a concentrated dark green color and a residue weight of 443 g. The intense color of the extract indicated that secondary metabolites from the fern leaves were successfully extracted into the solvent. The difference in solvent volume before and after extraction was influenced by solvent absorption by the simplicia, solvent evaporation, and residual liquid

retained in the residue. Based on the findings, the maceration method proved to be effective for extracting active compounds from fern leaves because it is simple to perform, does not require specialized equipment, and is suitable for thermolabile compounds. Factors such as particle size, solvent type, extraction time, and stirring frequency significantly influenced the success of the extraction process.

Keywords: *Maceration; extraction; fern leaves; 95% ethanol;Solvent*

Received:	Accepted:	Online:
2026-06-11	2026-06-16	2026-06-18

1. Introduction

Extraction is a separation process used to isolate active compounds from a material by applying a suitable solvent based on differences in the solubility of the components contained in that material [1]. The main objective of extraction is to obtain bioactive compounds in a more concentrated form, which can then be used for further analysis or for the development of pharmaceutical products. The success of the extraction process depends on several factors, including solvent type, particle size of the simplicia, temperature, extraction time, material-to-solvent ratio, and the extraction method used.

Based on temperature application, extraction methods can be classified into hot extraction and cold extraction. Hot extraction methods include reflux, Soxhlet extraction, and digestion, all of which use heat to increase the rate of mass transfer and accelerate the extraction process [2]. However, high temperatures may damage or degrade thermolabile active compounds. Therefore, not all materials are suitable for extraction using heat-based methods.

One of the most widely used cold extraction methods in pharmaceutical and natural product research is maceration. Maceration is an extraction method carried out by soaking simplicia in a solvent at room temperature for a certain period to extract the active compounds contained in the material [3].

During maceration, the solvent penetrates plant cells through the cell wall, dissolves the active compounds, and transports them out of the cells until concentration equilibrium is reached between the inside and outside of the cells. This process occurs based on the principles of diffusion and osmosis, which enable the transfer of active compounds from the material into the solvent [4].

The maceration method offers several advantages compared with other extraction methods. The process is relatively simple, easy to perform, does not require specialized equipment, and involves lower operational costs than modern extraction techniques. In addition, because maceration does not involve heating, it is suitable for extracting compounds that are sensitive to high temperatures, such as flavonoids and certain types of essential oils. Therefore, this method remains widely used in phytochemical research and the traditional medicine industry [5].

Despite its advantages, maceration also has several limitations. It requires a longer extraction time compared with modern extraction methods, such as Ultrasound-Assisted Extraction (UAE) and Microwave-Assisted Extraction (MAE). In addition, the use of large amounts of solvent may increase production costs and require a longer concentration process after extraction has been completed.

Based on the discussion above, research on the extraction of active compounds from fern leaves (Pteridophyta folium) using the maceration method is necessary to provide information on the effectiveness of maceration in extracting secondary metabolite compounds from fern leaves, which have potential use as raw materials for traditional medicine. This research is also important to determine the extraction yield and the factors that influence the success of the extraction process. The findings can serve as a basis for further studies on the development and utilization of fern plants as a source of natural materials with pharmaceutical value [6].

2. Methods

This study employed a laboratory experimental method using the maceration extraction technique on fern leaf simplicia (Pteridophyta folium). The equipment used included a stirring rod, measuring cylinder, analytical balance, spatula, glass jar, and stainless-steel container. The materials used consisted of fern leaf powder (Pteridophyta folium), 95% ethanol, 70% alcohol, aluminium foil, distilled water, filter cloth, and tissue paper.

A total of 250 g of fern leaf powder was weighed using an analytical balance and then placed into a maceration container. Subsequently, 1000 mL of 95% ethanol was added until all simplicia were completely immersed. The maceration container was covered with aluminium foil and sealed with a jar lid to prevent solvent evaporation and environmental contamination. The mixture was then stirred periodically during the maceration process to enhance contact between the simplicia and the solvent.

After the maceration process was completed, the mixture was filtered using filter cloth to separate the filtrate from the residue. The volume of the obtained filtrate was measured, while the residue was weighed using an analytical balance. The observation data were then analyzed descriptively based on the characteristics of the filtrate, the volume of extract obtained, and the weight of the residue after the extraction process.

3. Results and Discussion

a. Result

Table 1. Data on Fern Leaf Simplicia (Pteridophyta folium)

Sample	Simplicia Weight (g)	Amount of Filtrate (ml)
Fern Leaf Simplicia *(Pteridophyta folium)*	250	550 ml

b. Discussion

Based on the results shown in Table 1, the extraction of fern leaf powder (Pteridophyta folium) using the maceration method with 95% ethanol as solvent produced 550 mL of filtrate from an initial solvent volume of 1000 mL and 443 g of residue. These results indicate that the maceration process was able to extract active compounds contained in fern leaf simplicia through a diffusion mechanism, namely the movement of compounds from plant cells into the solvent until concentration equilibrium was reached.

The filtrate obtained was dark greenish-black in color. This color indicates that various secondary metabolite compounds present in fern leaves were successfully extracted into the ethanol solvent. Ethanol 95% was selected because it has good ability to dissolve polar and semi-polar compounds, such as flavonoids, tannins, phenolic compounds, and chlorophyll pigments. In addition, ethanol is relatively safe to use and can be easily evaporated during the extract concentration process.

The volume of filtrate obtained was lower than the initial solvent volume. This decrease may have been caused by solvent absorption by the simplicia powder during the soaking process, ethanol evaporation during handling, and the presence of solvent remaining in the residue after filtration. Meanwhile, the relatively high residue weight indicates that some structural components of fern leaves, such as fiber and ethanol-insoluble compounds, remained after the extraction process was completed.

The success of the maceration process is influenced by several factors, including the particle size of the simplicia, solvent type, soaking duration, and stirring frequency. The use of powdered simplicia aims to increase the contact surface area between the material and the solvent, allowing the extraction of active compounds to occur more optimally. Stirring during

the maceration process also helps increase the mass transfer of active compounds into the solvent, thereby improving the extraction results.

The findings of this study are consistent with previous studies reporting that maceration using ethanol solvent is effective in extracting secondary metabolite compounds from natural materials. Ethanol is a solvent that can effectively extract polar to semi-polar compounds, making it widely used in the extraction of medicinal plants [2]. In addition, the maceration method can produce extracts with relatively high active compound content, although it requires a longer extraction time compared with modern extraction methods [1].

The dark greenish-black color of the filtrate in this study also indicates the presence of chlorophyll and phenolic compounds that were successfully extracted into the solvent. This finding suggests that the extraction process was carried out effectively. Therefore, maceration using 95% ethanol can be considered effective for extracting active compounds from fern leaves (Pteridophyta folium) and has potential use as an initial stage in phytochemical research and the development of natural product-based formulations.

4. Conclusion

The maceration method can be used as an effective extraction technique to obtain active compounds from fern leaf simplicia (Pteridophyta folium) using 95% ethanol as the solvent. The practical results showed that the maceration process produced 550 mL of dark greenish-black filtrate from an initial solvent volume of 1000 mL, indicating that the secondary metabolite compounds in fern leaves were successfully extracted into the solvent. The success of the extraction process was influenced by several factors, including solvent type, particle size of the simplicia, soaking duration, and stirring frequency. The maceration method offers several advantages, such as a simple procedure, no requirement for specialized equipment, and suitability for thermolabile compounds. Therefore, this method can serve as an effective alternative for the extraction of natural materials for research purposes and the development of herbal products.

Acknowledgements

The authors would like to express their gratitude to the Natural Products Pharmacy Laboratory, Department of Pharmacy, Faculty of Sports and Health, Universitas Negeri Gorontalo, for facilitating the implementation of this practical work. The authors also extend their appreciation to the laboratory assistants for their guidance and direction throughout the practical activities, as well as to all parties who contributed to the preparation of this article.

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