Sarcouncil Journal of Biomedical Sciences

ISSN(Online): 2945-3666

Volume- 04| Issue- 05| 2025

Research Article

Received: 11-09-2025 | Accepted: 10-10-2025 | Published: 24-10-2025

# Chemical Composition, Antioxidant and inhibition α-Glucosidase Activity of (*Amomum villosum* Lour.) Essential Oil

***Ngo Xuan Luong*[1], *Dang Thi Thuy My*[2], *Dang Dinh Thanh*[3],*and Ngu Truong Nhan*[2]**

[1]*Hong Duc University, 565 Quang Trung Str, Hac Thanh, Thanh Hoa 40000, Vietnam*

[2]*Tay Nguyen University, 567 Le Duan Str, Dak Lak, 630000,Vietnam*

[3]*Buon Ma Thuot Medical University, 298 Ha Huy Tap Str, Dak Lak, 630000,Vietnam*

**Abstract:** The *Amomum villosum* is widely used to treat intestinal diseases, abdominal pain, helminth infections, digestion, stimulates digestive enzyme secretion, enhances appetite, reduces bloating, and indigestion. However, the chemical composition and biological properties of the essential oil of *Amomum villosum* collected in Thanh Hoa, Vietnam, have not been investigated. Gas chromatography-mass spectrometry (GC-MS) was used to identify the chemical composition of *Amomum villosum* essential oil. The 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and inhibition of *α*-Glucosidase activities of the essential oil, respectively. Experimental results revealed that all parts of the plant, including the leaves, stems, and roots, contain essential oil. Among them, the leaves exhibited the highest oil content, ranging from 1.0 to 4.0%, while the stems and roots showed comparatively lower yields. The major constituents of the essential oil obtained from different plant parts were α-pinene (11.6–22.0%) and β-pinene (6.6–48.1%), which are characteristic monoterpenes contributing to the distinctive aroma of the oil. The strong antioxidant and antibacterial effects of *Amomum villosum* essential oil were demonstrated with an $IC_{50}$ value of 6.91 ± 0.2 µg/mL and anti-*α*-glucosidase activities with an $IC_{50}$ value of 4.16 ± 0.32 mg/mL, respectively. Our results indicate that the essential oil of *Amomum villosum* collected in Thanh Hoa, Vietnam, has great potential in the pharmaceutical industry.

**Keywords:** Thanh Hoa, Amomum villosum, essential oil, antioxidant, antibacterial.

## INTRODUCTION

Amomum villosum belongs to a genus of medicinal plants with many valuable species, widely used in traditional medicine and as a flavoring agent (Do, H. B., *et al.*, 2003). The plant grows 1–2 meters tall, with a swollen green stem base. The leaves are lanceolate, measuring 15–30 × 4–8 cm, sessile, with a ligule 1–3 mm long. The inflorescence stalk is 4.0–7.0 cm in length, with bracts about 0.8–1.2 cm long. Flowers arise from the base of the stem. The calyx tube is narrowly funnel-shaped, 1.4–1.8 cm long. The corolla tube measures 1.6–2.0 cm, with lobes 1.4–1.6 cm long, white in color. The labellum is suborbicular, about 2.3–2.5 cm wide, white with a yellow midrib bearing reddish-purple spots, and its apex is 3-lobed. The filament is approximately equal to the anther length (5–6 mm); the anther is 3-lobed. The lateral staminodes appear as two ridges at the base of the labellum. The ovary is cylindrical, white-hairy. The capsule fruit is globose, 1.3–1.5 cm in diameter, green turning yellow when ripe, and covered with soft spines. The seeds are angular and aromatic (Do, T. L. 1999; Dao, L. P. 1995).

The flowering season occurs from April to June, and the fruiting season from June to September. The plant grows under humid forest canopies at elevations of 100–1,000 m. In the herb layer, it is commonly found together with species such as *Alpinia macroura*, *Alpinia menghaiensis*, *Amomum muricarpum*, *Amomum xanthioides*, *Piper sp.*, *Pronephrium megacuspe*, and *Athyrium boryanum*. The shrub layer includes *Goniothalamus sp.*, *Streblus sp.*, *Lasianthus sp.*, *Glycosmis craibii*, *Clausena sp.*, and *Boehmeria sp.* The tree layer consists of *Alphonsea tonkiensis*, *Knema sp.*, *Ficus sp.*, *Lagerstroemia sp.*, and *Goniothalamus macrocalyx* (Do, H. B., *et al.*, 2003; Nguyen, X. M. A. 2009).

This species is distributed sporadically in Vietnam, and also found in China, India, Thailand, Laos, Cambodia, and Myanmar (Nguyen, X. M. A. 2009). Currently, the domestic demand for dried fruits and seeds of *Amomum villosum* is increasing rapidly, particularly for pharmaceutical production and essential oil extraction (Le, T. H. 2015). *Amomum villosum* is recognized for its high medicinal value and has been traditionally used in folk remedies for centuries. Numerous studies have reported the chemical composition of *A. villosum*, with particular emphasis on its essential oil constituents (Nguyen, D. C. *et al.*, 2017; Dung, N. X. *et al.*, 1990; Do, N. D. *et al.*, 2015; Gilani, S. R. *et al.*, 2006).

Up to now, studies have also shown that the raw material from different regions and different extraction methods also greatly affect the content of *Amomum villosum*. Therefore, when testing its chemical activity, it is possible to discover different active constituents according to the above factors. This study aims to analyze and characterize the chemical composition and

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License



***Corresponding Author:** Ngu Truong Nhan

DOI- https://doi.org/10.5281/zenodo.17430615

biological properties *Amomum villosum* essential oil collected in Thanh Hoa, Vietnam, in support of its potential exploitation and effective utilization. Determination of the chemical composition of *Amomum villosum* essential oil was conducted using gas chromatography-mass spectrometry (GC-MS). The 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and the agar disc diffusion method were used to evaluate the antioxidant and antibacterial activities, respectively.

## MATERIAL AND METHODS

### Chemicals

Butylated hydroxytoluene (BHT), C7–C30 straight-chain hydrocarbons, reference chemicals for identification, Tween 80, and DPPH were obtained from Sigma-Aldrich Chemical Co. (St. Louis, MO, USA). Other chemical analytical grades, the culture media, and standard antibiotic discs were procured from Merck (Darmstadt, Germany) and Oxoid Ltd. (Basingstoke, Hampshire, UK), respectively.

### Plant Material

The *Amomum villosum* were collected from Thanh Hoa, Vietnam, in January 2023. A voucher specimen (No. SN-TH-01) was prepared and deposited at the Faculty of Natural Science and Technology, Hong Duc University, Thanh Hoa Provinve, Vietnam.

**Figure 1:** The *Amomum villosum* collected in Thanh Hoa Province.

### Extraction of Essential Oil

The *Amomum villosum* were collected and cleaned, cut into small pieces, and subjected to steam distillation for 4 hours by a Clevenger-type apparatus. The essential oil obtained was then dehydrated using anhydrous sodium sulfate and stored in a sealed vial at 10 °C in the dark prior to subsequent experiments.

### Analysis of Essential Oil by GC-MS

To analyze the composition of the essential oil from the of *Amomum villosum*, a Trace GC Ultra-ITQ900 system (Thermo Fisher Scientific, MA, USA) was used. Data were interpreted by MassFinder 4.0 software. The separation was performed on a fused silica capillary TG-SQC column (30 m × 0.25 mm i.d., 0.25 µm film thickness). The GC operational parameters included injector temperature 250 °C, detector temperature 260 °C, oven temperature program 60 to 260 °C at a heating rate of 4 °C/min, carrier gas helium at a flow rate of 1.0 mL/min, and sample injection volume 1 µL in split mode with a split ratio of 1:10. The mass spectrometer was operated in electron ionization (EI) mode with the following parameter values: ionization energy 70 eV, interface temperature 280 °C, ion source temperature 230 °C, MS quadrupole temperature 200 °C, and scan range 35–650 amu (Kitajima, J., & Ishikawa, T. 2003). The retention indices of the essential oil constituents were determined using an HP-5 MS column and standard C7–C30 straight-chain hydrocarbon reference standards (Sigma-Aldrich Chemical Company, USA). The mass spectra and retention indices of individual compounds were identified by comparing them with those in GC-MS libraries (National Institute of Standards and Technology-NIST 08 and Wiley 09th version) and/or with published data. The relative percentages of the identified compounds were calculated based on GC peak areas without applying correction factors.

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License



Publisher: SARC Publisher

**Antioxidant Assay**

The DPPH assay was used to evaluate the antioxidant activity of the essential oil from *Amomum villosum* leaf and stems (Choi, J. W. *et al.*, 2009).The essential oil was dissolved in methanol to different concentrations (0.3125, 0.625, 1.25, 2.5, 5.0, and 10 µg/mL), and the positive control BHT was mixed with 200 µL of a methanolic solution (containing DPPH radicals at a concentration of 150 µmol/L). The mixture was then vigorously shaken and left in the dark for 30 minutes to complete the reaction. The absorbance solutions were measured using a Shimadzu UV1800 spectrophotometer (Shimadzu Corporation, Japan) at 517 nm. A blank sample (a control solution without extract or BHT) was used for comparison. The scavenging ability of the essential oil was calculated as in Equation 1.

$$Scavenging\ acbility\ (\%) = \frac{A_{517}\ of\ control - A_{517}\ of\ sample}{A_{517}\ of\ control}\ x\ 100 \quad (1)$$

**Inhibition of α-Glucosidase Assay**

The anti-$\alpha$-glucosidase activity of *B. variegata* essential oil was evaluated according to the method of Sihvonen, *et al.*, (1999) (Hanh, D. T. *et al.*, 2023). Take 50 µL of solution prepared by dissolving essential oil in 0.1 M phosphate buffer (pH 6.8) with different concentrations (10, 5, 2.5, 1.25, and 0.625 mg/mL) containing 30 µL of 2U/mL $\alpha$-glucosidase solution, incubated at 37°C for 10 min. Then 50 µL of 2.5 mM *p*-nitrophenyl-$\alpha$-D-glucopyranoside solution in 0.1 M phosphate buffer (pH 6.8) was added and continued to be incubated at 37°C for 30 min. After incubation, the absorbance was measured at 405 nm using an ELISA (BIO-RAD iMark microplate reader). The measured results were compared with the control sample (containing only 50 µL of solvent). The α-glucosidase inhibition was calculated using equation 2.

$$Inhibition\ (\%) = \frac{A0 - A1}{A0}\ x\ 100\% \quad (2)$$

where A0 is the absorbance of the control sample (containing only solvent) at the initial time. A1 is the absorbance of the test sample (Sihvonen et al. 1999).

**Statistical Analysis**

All experiments were carried out in triplicate. Analysis of variance (ANOVA) and Statistica 5.5 software (StatSoft Inc., Tulsa, OK, USA) were utilized to analyze the results. The results are presented as the mean ± standard deviation (SD).

## RESULTS AND DISCUSSION

Essential oil was extracted from the leaves and stems of *Amomum villosum* hydrodistillation, with a 0.1-0.18% yield (w/w, based on fresh weight). The total ion chromatogram obtained from GC-MS analysis is shown in Figure 2,3 and 4.

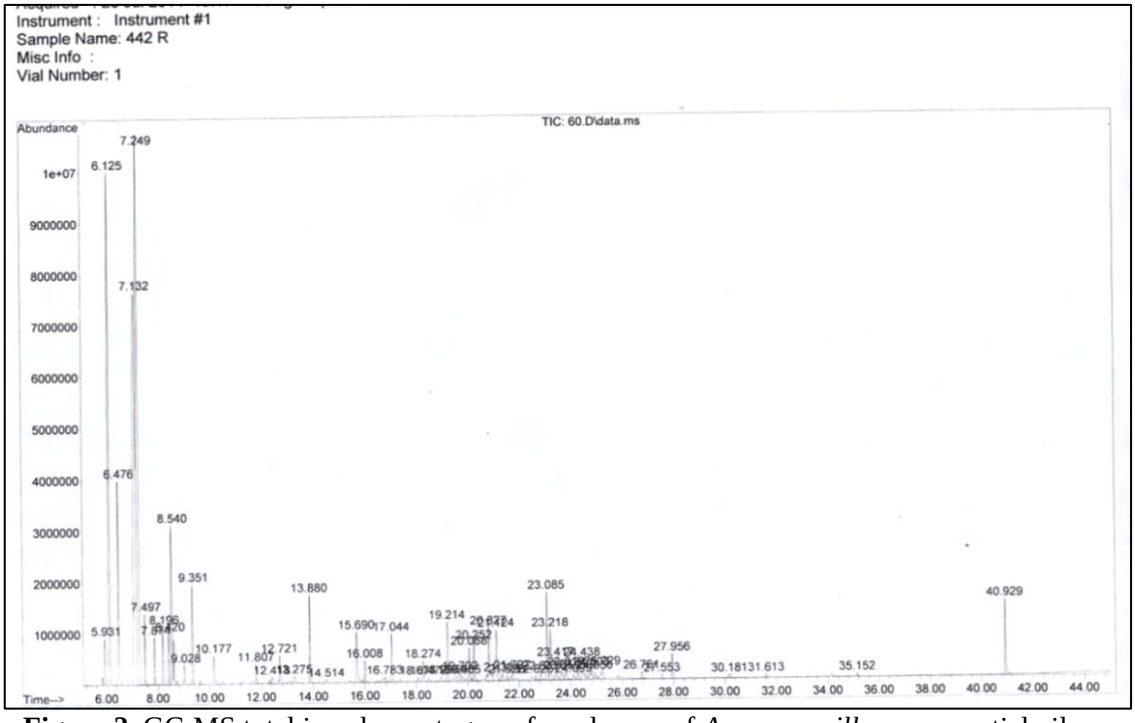


**Figure 2.** GC-MS total ion chromatogram from leaves of *Amomum villosum* essential oil.

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License



**Publisher: SARC Publisher**

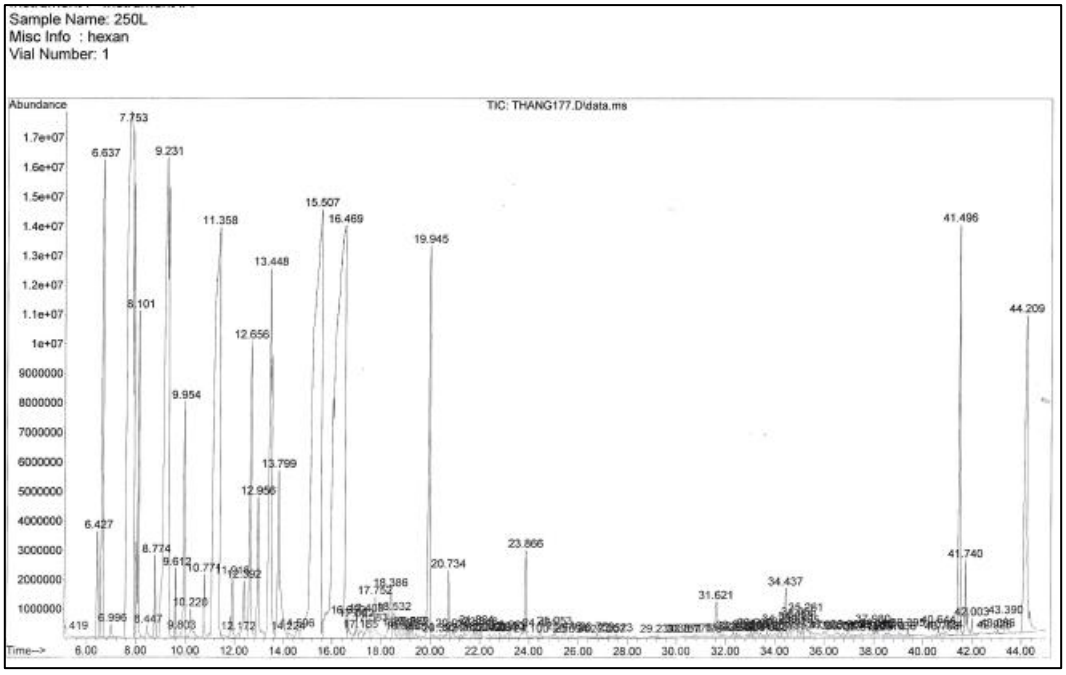


**Figure 3.** GC-MS total ion chromatogram from stems of *Amomum villosum* essential oil.

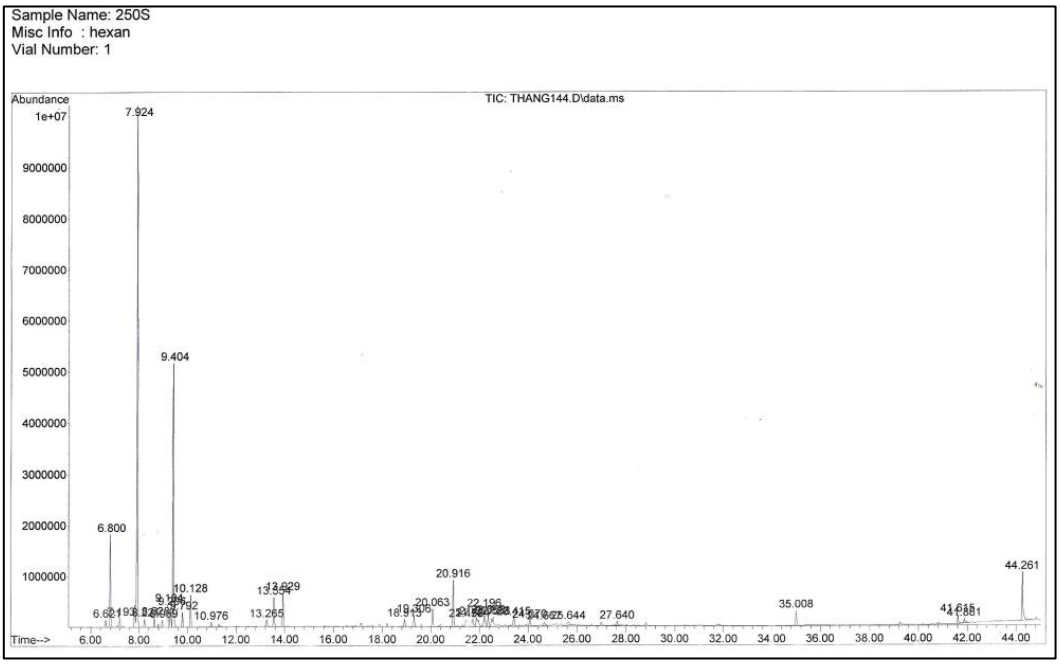


**Figure 4.** GC-MS total ion chromatogram from roots of *Amomum villosum* essential oil.

**Table 1.** Chemical compositions from stems *Amomum villosum* essential oil

| | | |
|---|---|---|
| *Amomum villosum* | Leaves | β-pinen (6.6%) và α-pinen (22.0%) |
| | Stems | β-pinen (48.1%) và α-pinen (16.0%) |
| | Roots | β-pinen (34.7%) và α-pinen (11.6%) |

All parts of the plant, including the leaves, stems, and roots, contain essential oils, among which the leaves have the highest content, ranging from 1–4%, while the stems and roots contain lower amounts. The main constituents of the essential oil in various plant parts, particularly in the bark, are α-pinene (11.6%–22.0%) and β-pinene (6.6%–48.1%). The fruits of *Amomum villosum* are used in traditional medicine as a digestive stimulant and to treat stomach pain, vomiting, enteritis, dysentery, and threatened miscarriage. The juice extracted from the rhizome is used to relieve coughs. The plant has a pungent taste and a warm nature, commonly employed to alleviate

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License

**Publisher: SARC Publisher**

abdominal pain, indigestion, nausea, diarrhea, and uterine disorders. The rhizomes are also used as a spice, and the whole plant yields essential oil of medicinal and aromatic value.

Based on the above comparisons and analyses, it can be affirmed that the essential oil extracted from *Amomum villosum* chemical profile, reflecting its unique ecological signature. It is particularly rich in oxidized sesquiterpenoids and nitrogen-containing heterocyclic compounds components that are rarely reported in samples from other regions. These compounds not only contribute to the oil's promising biological activities, such as anti-inflammatory, antioxidant, and antibacterial effects, but also serve as important indicators for guiding the standardization of cultivation zones. This highlights the high application potential of raw materials from the Central Highlands in the development of herbal medicines and natural cosmetic products.

**Antioxidant Activity of Amomum villosum Essential Oil**

The antioxidant activity was evaluted by the DPPH radical scavenging assay, with the results summarized in Table 2. The $IC_{50}$ value of *Amomum villosum* essential oil was determined to be 6.91 ± 0.2 µg/mL, compared to 6.1 ± 0.1 µg/mL for BHT, a well-known synthetic antioxidant. These results indicate that the essential oil of *Amomum villosum* collected in Thanh Hoa has strong antioxidant activity comparable to BHT, highlighting its potential as a natural antioxidant agent.

**Table 2.** Antioxidant activity of *Amomum villosum* essential oil

| Essential oil (mg/mL) | % Inhibition | | | $IC_{50}$ (mg/mL) |
|---|---|---|---|---|
| | 1 | 2 | 3 | |
| 30 | 96.21 | 94.53 | 95.16 | 6.91 ± 0.2 |
| 15 | 66.35 | 67.48 | 66.72 | |
| 7.5 | 51.75 | 52.67 | 52.18 | |
| 3.75 | 48.28 | 47.09 | 47.09 | |
| 1.875 | 43.51 | 42.59 | 42.67 | |
| BHT[a] | | | | 6.10 ± 0.1 |

**Butylated hydroxytoluene was used as positive control**

Glucosidase Inhibitory Activity of Amomum villosum Essential Oil

The *α*-glucosidase inhibitory activity of *Amomum villosum* essential oil was evaluated using spectroscopy, and the results are presented in Table 3.

**Table 3**. α-Glucosidase inhibitory activity of *Amomum villosum* essential oil

| Essential oil (mg/mL) | % Inhibiting | | | $IC_{50}$ (mg/mL) |
|---|---|---|---|---|
| | 1 | 2 | 3 | |
| 20 | 93.68 | 94.31 | 94.12 | 4.16 ± 0.32 |
| 10 | 63.87 | 64.79 | 67.13 | |
| 5 | 51.12 | 52.65 | 51.74 | |
| 2.5 | 39.36 | 38.09 | 38.43 | |
| 1.25 | 34.56 | 33.15 | 34.79 | |
| Acarbose[a] | | | | 0.013 ± 0.01 |

**Positive control for anti-*α*-glucosidase**

The results in Table 3 show that the *α*-glucosidase inhibitory activity of *Amomum villosum* essential oil increased from 33.15% to 94.31% as the concentration of the essential oil increased from 1.25 to 20 mg/mL, indicating that the oil can inhibit *α*-glucosidase. However, this activity is not very strong. The $IC_{50}$ results showed that the *α*-glucosidase inhibitory activity of *Amomum villosum* essential oil ($IC_{50}$ = 4.16 ± 0.32 mg/mL) is lower than that of the positive control, acarbose, with an $IC_{50}$ value of 0.013 mg/mL.

## CONCLUSION

This study is the first to investigate the essential oil from the of *Amomum villosum* collected in Thanh Hoa, Vietnam. GC-MS analysis identified a diverse chemical composition.

All parts of the plant (leaves, stems, and roots) contain essential oils, with the leaves showing the highest content, ranging from 1.0–4.0%, while the stems and roots contain lower amounts. The major components of the essential oil in different parts of the plant, particularly in the bark, are α-pinene

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License



**Publisher: SARC Publisher**

(11.6%–22.0%) and β-pinene (6.6%–48.1%). The essential oil exhibited notable biological activities, demonstrating strong antioxidant activity with an $IC_{50}$ value of 6.91 ± 0.2 μg/mL, surpassing the reference compound, BHT (6.1 ± 0.1 μg/mL). Additonaly, the essential oil also exhibited strong anti-*α*-glucosidase activities with an $IC_{50}$ value of 4.16 ± 0.32 mg/mL. These findings underscore the potential of *Amomum villosum* essential oil as a natural resource for pharmaceutical applications particularly in antioxidant and *α*-glucosidase therapies.

## REFERENCES


1. Do, H. B., et al. “Medicinal plants and animals used in Vietnam.” *Science and Technics Publishing House, Hanoi, 2* (2003).*645–648).*
2. Do, T. L. “Vietnamese medicinal plants and remedies.” *Medical Publishing House, Hanoi*, 8th ed., (1999): 400–402.
3. Dao, L. P. “Study on several species named Amomum in Northern Vietnam [Doctoral dissertation].” (1995).
4. Nguyen, X. M. A., Dinh, B. P., & Hoang, V. “A study on the essential oil of Amomum biflorum Jack. Proceedings of the 3rd National Conference on Ecology and Biological Resources, Institute of Ecology and Biological Resources.” *Vietnam Academy of Science and Technology, October 22*, (2009).
5. Le, T. H. “Characteristics and distribution of *Amomum* species in Nghe An Province.” *Journal of Science and Technology*, 9 (2015):19–23.
6. Nguyen, D. C., Phan, T. B., Nguyen, H. T., & Nguyen, C. C. “Extraction and identification of the chemical composition of *Amomum villosum* essential oil in Huong Ho, Huong Tra, Thua Thien Hue. “*Journal of Agricultural Science and Technology*, 1.1 (2017):27–36.
7. Dung, N. X., Phuong, D. L., Leclercq, P. A., & Tam, N. T. “Chemical composition of essential oil from Vietnamese.” *Amomum xanthioides* Wall. *Tap Chi Duoc Hoc (Vietnamese Journal of Pharmacy),* (1990): 17–19.
8. Do, N. D., Le, T. H., Le, T. M. C., Doan, M. D., & Mai, V. C. “Volatile compounds from leaves and roots of *Amomum xanthioides* Wall. ex Baker in Pu Mat National Park, Nghe An Province.” *Proceedings of the 6th National Scientific Conference on Ecology and Biological Resources*, (2015):1078–1082.
9. Gilani, S. R., Shahid, I., Javed, M., Mehmud, S., & Ahmed, R. "Antimicrobial activities and physico-chemical properties of the essential oil from Amomum subulatum." *Int J Appl Chem*, 2.2 (2006): 81-86.
10. Kitajima, J., & Ishikawa, T. "Water-soluble constituents of Amomum seed." *Chemical and pharmaceutical bulletin* 51.7 (2003): 890-893.
11. Choi, J. W., Kim, K. H., Lee, I. K., Choi, S. U., & Lee, K. R. "Phytochemical constituents of Amomum xanthioides." *Natural Product Sciences* 15.1 (2009): 44-49.
12. Sahingil, D. "GC/MS-olfactometric characterization of the volatile compounds, determination antimicrobial and antioxidant activity of essential oil from flowers of calendula (Calendula officinalis L.)." *Journal of Essential Oil Bearing Plants* 22.6 (2019): 1571-1580.
13. Hanh, D. T., Ngu, T. N., Bao, P. H., Nguyen, N. P., Trong, P. V., Loan, L. T., ... & To, D. C. "Chemical Composition and Biological Activities of Essential Oil from Plectranthus amboinicus Collected in Dak Lak, Vietnam." *Tropical Journal of Natural Product Research* 7.11 (2023).
14. Sihvonen, M., Järvenpää, E., Hietaniemi, V., & Huopalahti, R. "Advances in supercritical carbon dioxide technologies." *Trends in Food Science & Technology* 10.6-7 (1999): 217-222.


**Source of support:** Nil; **Conflict of interest:** Nil.

**Cite this article as:**

Luong, N. X., My, D. T. T., Thanh, D. D. and Nhan, N. T. "Chemical Composition, Antioxidant and inhibition *α*-Glucosidase Activity of (*Amomum villosum* Lour.) Essential Oil." *Sarcouncil Journal of Biomedical Sciences* 4.5 (2025): pp 1-6.

Copyright © 2022 The Author(s): This work is licensed under a Creative Commons Attribution- NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0) International License



**Publisher: SARC Publisher**