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# Chemical Composition in Essential Oils of *Schefflera octophylla* L. Harvested in Hai Duong Province, Vietnam

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This study aims to determine the chemical composition of essential oils extracted from *Schefflera octophylla* L. harvested in Pha Dong commune, Chi Linh district, Hai Duong province, Vietnam. To determine the concentration of volatile components, GC - MS was performed. The results showed that the content of volatile substances occupied 97.07% of essential oils. Some main ingredients having medicinal properties were myrcene (9.0%), *cis*-β-elemene (6.67%), *E*-caryophylene (β-caryophylene) (24.91%), α-selinene (6.30%), β-selinene (7.29%). This study opens new potentials in the application of chemical ingredients in the fields of pharmaceuticals, cosmetics, agriculture and in some therapeutic activities.

**Keywords:** ***Schefflera octophylla*** **L., Araliaceae, Essential oil, Vietnam.**

## INTRODUCTION

Recent trends in the consumption pattern favor food products, pharmaceuticals, cosmetics of natural and non-toxic origin, which can minimize the introduction of chemicals into the body and protect consumer health. Therefore, plants that give essential oils of high applicability have been well studied improve their use values [1-6]. The chemical composition of essential oils includes terpenoids and oxygen-containing terpenoids such as alcohols, aldehyde, ketone, ester and acid. Despite the abundance of constituents in essential oils, only a few key constituents put the value and create a characteristic aroma for essential oils.

Among widely used essential oils, *Schefflera octophylla* is the species that lacks comprehensive studies that profile aroma-forming components in its essential oil. Meanwhile, the need for information and data on the components of the characteristic odor in *S. octophylla* essential oil is also stressed due to its increasing use in food flavoring and cosmetics. The genus Schefflera is the largest genus of the Araliaceae family, consisting over 200 species distributed in tropical and subtropical regions, a large number of which are situated in northen provinces of Vietnam. Several studies have profiled chemical compositions of the essential oils of *Schefflera octophylla via* gas chromatography coupled to mass spectrometry (GC/MS), suggesting that the location from which the samples were collected may influence the oil composition. In general, the *Schefflera octophylla* essential oil was primarily constituted by β-caryophyllene, pinene, myrcene, humulene, cubebene, elemene, carotatoxin and caryophyllene oxide [7], which have been found with different contents. In addition, the Schefflera genus has been found to contain triterpenes, triterpenoid glycosides and saponins [8], of which triterpenoids were the major components [9]. In this study, the hydrodistillation process to extract essential oil from the leaves of *Schefflera octophylla* and identify the composition of the essential oil by GC-MS analysis is exempted.

## EXPERIMENTAL

**Plant material:** *Schefflera octophylla* was collected from Pha Dong, Chi Linh district of Hai Duong province, Vietnam (21° 7′14″N 106°19′20″E) in October 2019. Raw materials used for distillation were of uniform quality, fresh and free from pests and diseases and collected under dry conditions to ensure uniformity in the survey samples.

**Extraction of essential oil of *Schefflera octophylla* L.:** The extraction of essential oils from *Schefflera octophylla* was done by hydrodistillation in a Clevenger-type device. The distillation process was carried out by boiling 1850 g of plant material, where average extraction time was about 3 h. The yield is expressed in mL per g of raw material. The resulting essential oil is dried with anhydrous sodium sulfate and then stored at low temperatures (below 4 ºC) in dark bottles before use. Productivity is calculated using the following eqn. 1:

$$\text{Yield of essential oil } (\%) = \frac{\text{Volume of essential oil obtained (mL)}}{\text{Amount of raw materials used (g)}} \quad (1)$$

**Gas chromatography-mass spectrometry analysis:** To perform GC-MS analysis of the essential oils, an Agilent Technologies HP7890A GC was employed. The instrument was equipped with a mass spectrum detector (MSD) Agilent Technologies HP5975C and a DB-XLB column (60 m × 0.25 mm, film thickness 0.25 µm, Agilent Technologies). Temperature of the injector and detector was 250 ºC and 280 ºC, respectively. The temperature profile of column was initiated from 40 ºC to 140 ºC at 20 ºC/min, followed by an increase to 270 ºC at 4 ºC/min. Helium carrier gas was used with the flow rate of 1 mL/min. Splitting was was used to inject the samples with the split ratio of 100:1 and 1 µL of essential oils was injected. The MSD conditions included ionization voltage of 70 eV, emission current of 40 mA, acquisitions scan mass range of 35-450 amu under full scan. For determination of retention time indices, the retention times of a homologous *n*-alkane series were used as a reference. Component content was calculated based on the GC peak area (MSD response) without correction.

## RESULTS AND DISCUSSION

The average extraction yield of *Schefflera octophylla* essential oils was approximately 0.162%. This performance is comparable to that obtained for the same species studied in at Shatin (Hong Kong) region, whose yield was 0.16% [9]. Regarding organoleptic properties, the *Schefflera octophylla* essential oil was clear transparent, light yellow, slightly spicy taste, characteristic aroma. These properties are similar to the properties of commercial *Schefflera octophylla* essential oil.

The chromatogram (Fig. 1) indicated there are a total of 37 different retention times, corresponding to 37 compounds, accounting for 97.07% of *Schefflera octophylla* essential oil content. The components having the highest points of 6.92, 19.74, 20.64, 22.67, 22,93 have a relatively large intensity, suggesting that they are high-content ingredients such as myrcene (9.0%), *cis*-β-elemene (6.67%), *E*-caryophylene (β-caryophylene) (24.91%), α-selinene (6.30%), β-selinene (7.29%), respectively. The remaining components have relatively low intensity, indicating negligible content of the respective component in the essential oil (Table-1). On the other hand, some components have retention times close to each other, indicating that they can be isomers of each other. Examples of peaks of

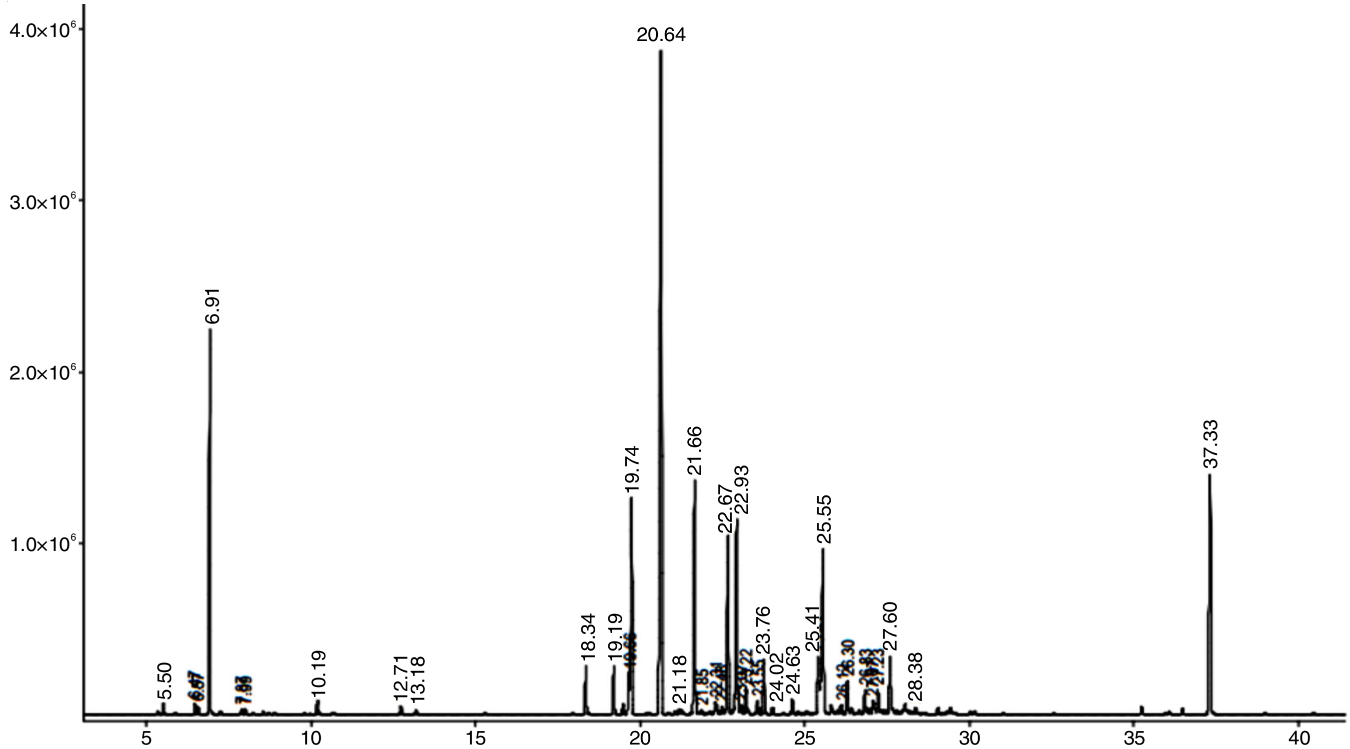


Fig. 1. Total chromatograms of the pomelo essential oils obtained by GC–MS analysis

TABLE-1
CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF *Schefflera octophylla* L BY GC-MS

| No. | Peak | R.T. | Hit (%) | Chemical name | Integral | % |
|---|---|---|---|---|---|---|
| 1 | 5.50 | 930 | 77 | α-Pinene | 1293957 | 0.24 |
| 2 | 6.47 | 970 | 77 | Sabinene | 1298315 | 0.25 |
| 3 | 6.57 | 974 | 86 | β-Pinene | 1024790 | 0.20 |
| 4 | 6.92 | 988 | 94 | Myrcene | 47770531 | 9.00 |
| 5 | 7.87 | 1022 | 75 | *o*-Cymene | 606260 | 0.11 |
| 6 | 7.99 | 1026 | 61 | β-Phellandrene | 750482 | 0.14 |
| 7 | 10.19 | 1099 | 88 | Linalool | 2010053 | 0.38 |
| 8 | 12.71 | 1176 | 81 | Terpinen-4-ol | 1348051 | 0.25 |
| 9 | 13.18 | 1190 | 60 | α-Terpineol | 618798 | 0.11 |
| 10 | 18.34 | 1347 | 89 | α-Cubebene | 7357265 | 1.38 |
| 11 | 19.19 | 1374 | 98 | α-Copaene | 7712921 | 1.44 |
| 12 | 19.66 | 1388 | 87 | β-Cubebene | 898418 | 1.26 |
| 13 | 19.74 | 1391 | 88 | *cis*-β-Elemene | 29611686 | 6.67 |
| 14 | 20.64 | 1420 | 82 | E-Caryophylene (β-Caryophylene) | 132763672 | 24.91 |
| 15 | 21.18 | 1437 | 45 | Aromadendrene | 731649 | 0.14 |
| 16 | 21.66 | 1453 | 99 | α-Humulene | 40157917 | 7.65 |
| 17 | 21.85 | 1459 | 100 | allo-Aromadendrene | 779119 | 0.20 |
| 18 | 22.31 | 1474 | 100 | β-Chamigrene | 3039173 | 0.62 |
| 19 | 22.48 | 1480 | 88 | Germacrene D | 1393428 | 0.28 |
| 20 | 22.67 | 1485 | 59 | β-Selinene | 32651333 | 6.30 |
| 21 | 22.93 | 1494 | 84 | α-Selinene | 37641725 | 7.29 |
| 22 | 23.07 | 1498 | 56 | α-Muurolene | 1292626 | 0.36 |
| 23 | 23.22 | 1504 | 54 | Germacrene A | 3760916 | 0.87 |
| 24 | 23.56 | 1515 | 87 | γ-Cadinene | 2748764 | 0.57 |
| 25 | 23.76 | 1522 | 45 | δ-Cadinene | 10066195 | 1.88 |
| 26 | 24.02 | 1531 | 95 | *trans*-Cadina-1,4-diene | 1159293 | 0.22 |
| 27 | 24.63 | 1552 | 0 | unknown (79, 220, RI 1552) | 2727692 | 0.51 |
| 28 | 25.41 | 1578 | 69 | Spathulenol | 10315419 | 2.01 |
| 29 | 25.55 | 1583 | 81 | Caryophyllene oxide | 28661352 | 7.07 |
| 30 | 26.12 | 1602 | 60 | β-Oplopenone | 1896287 | 0.39 |
| 31 | 26.30 | 1609 | 80 | Humulene Epoxide II | 5709615 | 1.14 |
| 32 | 26.83 | 1628 | 29 | 1-epi-Cubenol | 4327217 | 0.88 |
| 33 | 27.07 | 1636 | 60 | Caryophylla-3(15),7(14)-dien-6-ol | 3238284 | 0.70 |
| 34 | 27.23 | 1642 | 48 | epi-α-Cadinol (τ-cadinol) | 4110671 | 0.89 |
| 35 | 27.60 | 1655 | 0 | unknown (81, 222, RI 1655) | 11520720 | 2.16 |
| 36 | 28.38 | 1683 | 69 | epi-α-Bisabolol | 917555 | 0.17 |
| 37 | 37.33 | 2037 | 100 | Z-Falcarinol (Carotatoxin) | 44750383 | 8.43 |
| | | | | Total | | 97.07 |

such components are peaks of 22.67, 22.93 or peak of 18,34, 19,19, 19.66. The obtained essential oil a large content of monoterpenes and sesquiterpenes. This is reflected by the abundance of pinene, phellandrene, myrcene, limonene, germacrene, caryophyllene and others. The terpenes existing in the essential oil of plant species have been demonstrated to exhibit strong antimicrobial activity [10-13].

In addition, Yeung *et al*. [9] reported that *Schefflera octophylla* essential oil consists of 27 compounds that comprise 80.9% of essential oils. Among them, main ingredients in the oil consisted of β-pinene (22.24%), β-myrcene (3.01%), dodecanal (4.02%), β-caryophyllene (5.61%), germacrene D (3.56%) and limonene (3.61%). Kitajim and Tanaka [14] found that the leaves of *Schefflera octophylla* in Japan contained two triterpenoid glycosides, which were O-α-L-rhamnopyranosyl and 3-epo-betutinin 3-O-β-D-glucopyranoside. Sung and Adam [15] also discovered a new sulphated triterpene glycoside, in dry barks of *Schefflera octophylla*. From the spectral data, structure of the new component was defined as 3-*epi*-betulinic acid 3-O-sulphate 28-O-[α-l-rhamnopyranosyl(1→4)-O-β-D-gluco-pyranosyl(1→6)]-β-D-glucopyranoside [15]. The variation and differences in the chemical composition of essential oils was correlated with the climatic conditions, growth factor as well as the genetic variation, thus creating different chemical components.

Monoterpenes and sesquiterpenes (Fig. 2) are the volatile compounds widely utilized as fragrants thanks to their pleasant odour. In the current study, it was found that β-caryophyllene occupied a significant part of *Schefflera octophylla* essential oil composition. The compound were found to exhibit several biological activities such as anti-inflammatory, antibiotic, antioxidant, anticarcinogenic and local anaesthetic activities. β-Caryophyllene also consists of woody and spicy smell, which enables them to be used in manufacture of fragrance [16]. The compound was also discovered to promote anticancer activity of α-humulene, which could be attributable to the cytotoxicity

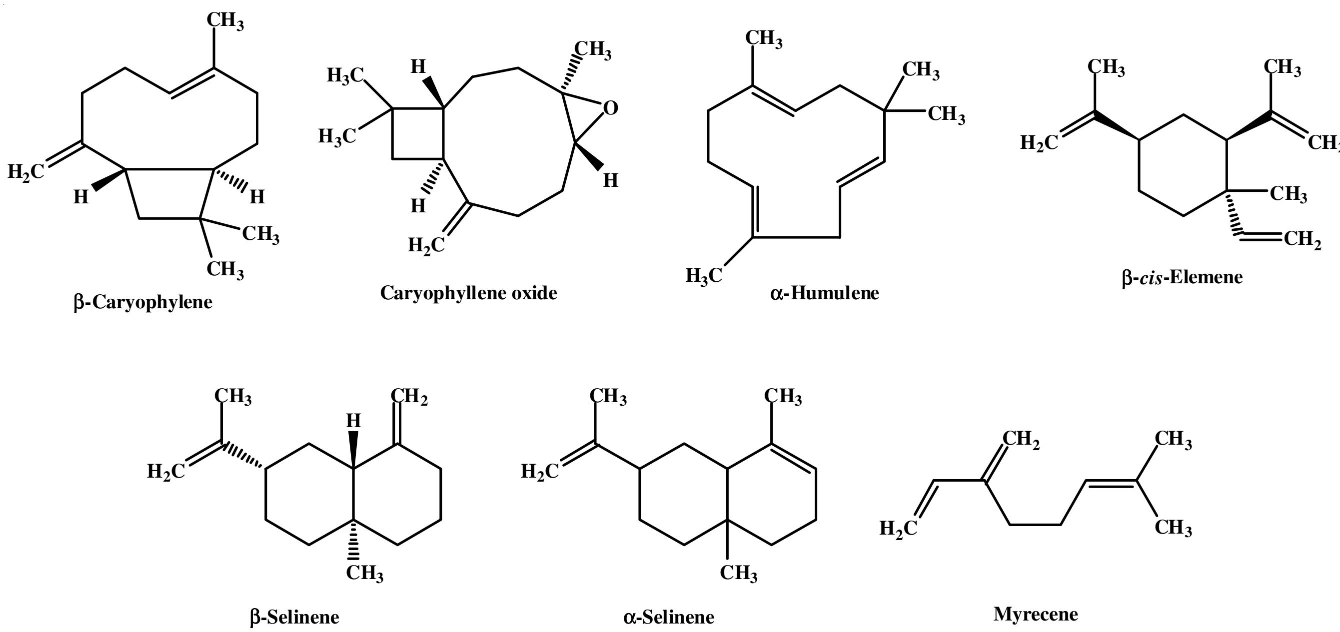


Fig. 2. Major components of *Schefflera octophylla* essential oil

of α-humulene [17]. This suggests that the essential oil from *Schefflera octophylla* could have different antibacterial, antifungal and anti-cancer abilities depending on its chemical composition.

## Conclusion

In this study, extraction of *Schefflera octophylla* essential oil was conducted . The optimized steam distillation process gave an essential oil yield of 0.162%. The main component of essential oil is determined by GC-MS method including myrcene, *cis*-β-elemene, *E*-caryophylene (β-caryophylene), α-selinene and β-selinene.The percentage of the main ingredients in essential oils is affected by seasonal changes, species, climate and extraction techniques.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this article.

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