# Chemical Composition of Melaleuca Cajuputi Powell

**Zainon Mat Sharif, Alifah Farhana Kamal, Nurul Jannah Jalil**

***Abstract- Essential oil extracted from Melaleucagenus has been widely used worldwidefor many purposes. Most of the its has been reported as the source of phytochemical compound where mostly have anti-inflammatory, antiulcer, antioxidant, antimicrobial and insecticide properties. Thus, three objectives that have been highlighted in this study are (1) to extract essential oil (cajuput oil) from fresh leaves of MelaleucacajuputiPowell using simple steam distillation,(2) to determine the chemical components of MelaleucacajuputPowell essential oil using GCMS and (3) to compare the chemical compound and its percentage with the previous study.Results found that there were 41 chemical compounds that have been identified. The chemical compounds were monoterpenes such as α-terpinolene, α-pinene, sabinene, 4-terpineol and γ-terpinene. The highest chemical compounds found were caryophyllene (20.16%), α-terpinolene (17.0%),α-humulene (11.91%), β-elemene (7.62%) and γ-terpinene (5.62%). In previous research, 1,8-cineole chemical compound was foundhowever, in this study a different chemical compound found, it was caryophyllene, this is due to different geographic area.As a conclusion, most of the compounds found was aromatic, antibacterial andinsecticide properties.***

***Keywords- Essential Oil Cajuput, MelaleucaCajuputiPowell ,Myrtacea, Phytochemical, Insecticide.***

## I. INTRODUCTION

Melaleuca species comes from Myrtaceae family is a enormous genus and represent more than 250 species [1]. Some Melaleuca species are repleted with essential oils and are used for therapeutic purposes, insecticides and cosmetics [2]. *Melaleuca cajuputi* Powell also referred to as M. leucadendron and is popularly known by gelam, white wood (kayu putih), weeping tea tree or weeping paperback which is a member of the Myrtaceae Family. It occurs naturally in tropical regions such as Myanmar, Indonesia, and Northern Australia. In Malaysia, it can be found in the marsh forests between the edge of the sea beaches and the mangroves, particularly in the states of Kedah, Malacca, Negeri Sembilan, Kelantan and Terengganu [3]. *Melaleuca cajuputi* Powell grows up to 33 m in height and has a slender crown. The tree is usually single-stem but may develop to multiple stem.It has recognizedcharacteristic for its pure-white papery bark and have thin strips come off an outer layer.

**Revised Manuscript Received on September 22, 2019**.

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The leaves are grayish-green, range 4 to 10 cm long, 2 cm wide, and rigid shape. The leaves also are very scented and have a soothing smell. It haswhitish-pink or purple flowers when blooms. Even it has adistinctive ivory-white stamens andlook like“bottlebrush” spikes 16 cm (6 in) long. The seeds are tightly encircle and attached. Stems surrounded with greyish-brown woody capsuled.

*Melaleuca cajuputi* Powell leaves could be used as cajuput oil through simple steam distillation.Cajuputi oil has no color or pale yellow.Its will emit an odour like camphor (menthol) with slight bitter taste, this odor will chase away the mosquitoes and it characteristics was better than grass root oil. With the low evaporation, it also could kill mite and lice. In medication with special prescibe usage, it is useful to clear out mucus and cure bronchitis.It was also reported that the water from boiled leaves could cure the ache and jaundice. Whilst, the young leaves could be eaten as vegetable. Its was found that the fiber is short, between 0.855-0.952 mm lengths. *M. Cajuputi* is not fit for pulp manufacturing due to unbleaching fiber yielded 39 % and difficult to bleach [4].

### Composition compound contribution

An essential oils can be obtained from different parts of the plants including the flowers, leaves, gums, seeds, roots, steams, bark and wood. The aroma characteristic comes from active compoundterpenes and their derivatives extracted from *Melaleuca cajuputi* Powell leaves. The functioneventually shifted from medicals to primary use, such as a flavor and fragrance ingredient [5]. The superiority of essential oils are depends on itsrespective sources. Most of its are stable and contain natural antioxidants. Although some are more than 90 percent solublity in alcohol, it hasalso have poor water due to active compound terpenes that contribute to their poor water solubility. It is infered that most of the essential oil has its purpose in medicinal field[6].

Extraction is the dissociation separation of active compound of a plant using particular solvents through normal procedure [7]. There are a few common conventional methods for example soxhlet extraction and maceration. However, the method are continuously being modifiedsuch as microwave assisted extraction (MAE), ultrasound-assisted extraction (UAE) or sonication andSupercritical fluid extraction (SFE). The meticulous evaluation need to be done for selection of proper extraction.It is to preserve the biomolecules in the plants.

Although many of essential oils have been discovered, there are lack of study on *Melaleuca cajuputi* Powell . There are still a lot of chemical compound differences could be

found due to difference environmental condition.Thus, the objective of the current research was to extract essential oil from *Melaleuca cajuputi* Powell by using steam distillation.In addition, to determine the chemical compound of *cajuputi*Powell oil using GCMS and to compare the chemical compound and its percentage with the previous study.In this report, the researchers present the percentages of five major chemical compound in essential oil via method steam distillation.

## II. METHOD

### Extraction of essential oils

*Melaleucacajuputi*Powell leaves were collected from area UNITEN, Kajang Selangor (2.9768º N, 101.7337º E) in Peninsular Malaysia located 20 km southeastern of downtown Kuala Lumpur. The leaves specimen was used using simple steam distillation with some modification to extract essential oil. The chemist stated that, the composition of essential oil regularly changes in different parts of plant. Based on previous research, a lot of oil produce from leaves*cajuputi* powell . Reference [8] reported that the sources of essential oils comes from leaves and stem of Melaleuca give strong aroma and used for medicinal application or even for cancer treatment. Clevenger type apparatuses which were comprised with 500ml to 100 ml round bottomed distillation flask and condenser were setup. The packed leaves were then transferred into the distillation flask and covered with distilled water and heated at 100ºC. The mixture of oil and water was allowed to settle for 1 hour. The quantity of the leaves used is half from the amount of the distilled water. The water was slowly drawn off and temperature less than 10 degree Celsius was controlled to get clear oil concentrate. The remained oil layer were slowly collected into tube after 4 hours extraction. Lastly, pure essential oils was collected by using hand portable centrifuge.

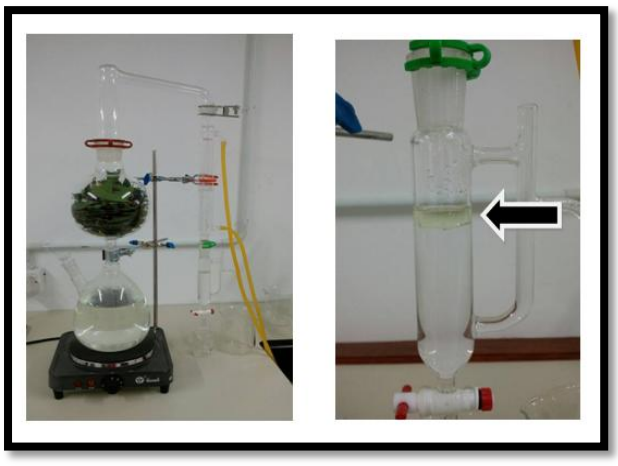

**Fig. 1 Extract essential oil (cajuput oil) from fresh leaves of *Melaleucacajuputi*Powell by using steam distillation.**

### Analysis of chemical constituents

For further study, the sample of essential oils wassent to the National Poison Centre (PRN) for chemical profiling by using gas chromatography-mass spectrometry (GC-MS). Briefly in preparing the sample, 0.5ml essential oil was diluted with 2ml diethyl ether and 50µℓ of 0.5M HCL. Then, after discard top layer, 50µℓ of 5M NaOH and 2ml Isopropanol:chloroform (1:4) were added and lastly reconstitute with 100µℓMeOH. The diluted 1µℓ sample was then injected into HP-5 crosslinked 5% phenyl methyl siloxane fused silica capillary column, 30 x 0.25mm x 0.25µm film thickness for analysis with a GC-MS intrument (Hewlett Packard 6890 series Gas Chromatograph with 5973N Mass Selective Detector and Chemstation Data System). The operation setting were as follows: the injection temperature was 280ºC. Helium was applied as a carrier gas and in splitless injection mode. For dectection, an electron ionisation system with ionisation energy of 70eV was used. The chemical constituents of each essential oil were obtained by searching each peak and computed from GC peak areas (%).

## III. RESULT AND DISCUSSION

### Steam Distillation Extraction

Essential oil yields obtained by steam distillation extraction are presented in figure 1. Maximum extraction yield obtained using this method was 0.1% concentration at 4 hours of extraction. The essential oilcolourwas pale yellow mobile liquid(by visual observation). The scent of essential oil extracted via steam distillation was strongly woody and good smell at 4 hours extraction. Steam distillation method is easy and less expensive because they use water as solvent [9]. The steam distillation method required 4 hours at 100ºC to achieve maximum oil recovery.Essential oil with 10% concentration works better than 5% concentration. Reference [10] also mentioned that concentration of essential oil affect the repellency activity.*Melaleuca cajuputi* Powell leaves essential oils comprises a number of different types of complex constituents. So their analysis and separation are performed by gas chromatography-mass spectroscopy (GC-MS). The method has been established as fast and efficient separation technique of volatile substances [11].

### Chemical profiling

The compositions of volatile fractions of essential oils were determined by using gas chromatography-mass spectrometry (GC-MS) sent to National Poison Centre (PRN).

**Table. 1 Percent Composition Of Melaleuca Cajuputi Powell Essential Oils**

| Number | Compound | Percetage of Total |
|---|---|---|
| 1. | Caryophyllene | 20.16% |
| 2. | α-Terpinolene | 17.00% |
| 3. | α-Humulene | 11.91% |
| 4. | β-Elemene | 7.62% |
| 5. | γ-Terpinene | 5.62% |
| 6. | α-Thujene | 5.29% |
| 7. | 4-Terpineol | 4.32% |

| | | |
|---|---|---|
| 8. | 1R-α-Pinene | 3.00% |
| 9. | α-Copaene | 2.92% |
| 10. | Bicyloelemene | 1.82% |
| 11. | 10-Methylanthracene-9-carboxaldehyde | 1.46% |
| 12. | 7-Epi-Amiteol | 1.90% |
| 13. | l-Phellandrene | 1.86% |
| 14. | Benzene, 1-methyl-2-(1-methylethyl)- | 1.67% |
| 15. | 1,2-Dimethyl(2.2)paracyclophan-1-ene | 1.55% |
| 16. | Sabinene | 1.44% |
| 17. | β-Myrcene | 1.32% |
| 18. | 2-β-Pinene | 1.26% |
| 19. | Benzene, 1,2-dimethoxy-4-(1-propenyl)- | 0.23% |
| 20. | α-Terpinene | 1.10% |
| 21. | l-Limonene | 1.03% |
| 22. | Farnesol, acetate | 0.88% |
| 23. | Octadecanoic acid | 0.78% |
| 24. | Octadecane | 0.76% |
| 25. | Camphene | 0.63% |
| 26. | Benzyl Benzoate | 0.55% |
| 27. | Calacorene | 0.43% |
| 28. | 2'3'4' Trimethoxyacetophenone | 0.40% |
| 29. | Eicosane | 0.30% |
| 30. | n-Hexadecanoic acid | 0.13% |
| 31. | Linoleic acid | 0.12% |
| 32. | Squalene | 0.07% |
| 33. | Farnesol | 0.06% |
| 34. | Nonadecane | 0.06% |
| 35. | 2-Nonadecanone | 0.05% |
| 36. | Nonadecane | 0.05% |
| 37. | Tetracosane | 0.04% |
| 38. | Pentacosane | 0.04% |
| 39. | Heptadecylheptafluorobutyrate | 0.04% |
| 40. | Trans-α- Bisabolene | 0.02% |
| 41. | unidentified | 0.11% |
| | total | 100.00% |

Results in table 1 shows percentage of relative area in chromatogram which are 41 chemical compounds that have been identified and several are monoterpenes such as α-terpinolene, α-pinene, sabinene, 4-terpineol and γ-terpinene. The highest compounds found are caryophyllene (20.16%), α-terpinolene (17.0%), α-humulene (11.91%),β-elemene (7.62%) and γ-Terpinene (5.62%). The chemical compositions slightly different among the oils from leaves collected in various sites.

Although most of the previous study found high yield of 1,8-cineole[12], this research found differentcompound name caryophyllene in the highest percentage. It is similar with study that no 1,8-cineole or contained very lowquantity (< 3%) of this compound in those areas [13]. Nevertheless, it was reported that active compound 1,8-cineole can cause skin irritation even in low quantities. As a consequence, oils with low levels of this compound are safe for consumer [14], [15].

Moreover, α-pinene (3.00%), limonene (1.03%), α-terpinene (1.10%), and 4-terpineol (4.32%) found in M.cajuputi leaf essential oil also known to exhibit insecticidal activity. The study by [16] also supported that they found α-pinene, limonene, α-terpinene and α-terpineolwith reading 4.26%, 2.91%, 4.44% and 1.09% respectively.From the result, few chemical peak found was unidentified but in small percentages (0.11%). However, other study in Thailand, unidentified compound was the highest percentages (28.37%) compared with other compounds.

Figure 2 shows chromatogram of cajuput essential oil with the column temperature of 50ºc for 5 minutes, then a ramp with an increase of 25ºC/ minute up to 300ºC, finally leaving the temperature constant for 10 minutes. It is necessary to start with low temperature to allow the separation of the most volatile ones whereas it ended at high temperature to achieve the elution of the heaviest terpenoids [17].

The differences of essential oils in chemical constituents depend on many factors such as climaticchanges and soils type. Geographic variation also affected the chemical composition of oils from leaves [13]. Reference [18] claimed that thefactor influencing the qualityessential oils include variety of plant species, cultivatingprocess, maturation plants, plant storage and methods of extraction. Even though it is, there are some of combination chemicals presented in essential oils are responsible for the repellent activity against mosquito.

In million times ago, extraction of essential oil from plants have been used in food preservation, pharmaceuticals, subtitute medicine and natural therapies, perfumes, cosmetics, aromatherapy, phototherapy, spices and nutrition. Most essential oils act as antibacterial, antifungal, antiviral, and insecticidal and antioxidant properties. The phytochemical existence in the essential oil indicated the presence of saponins, tannins, alkaloids, flavonoid, terpenoid and steroid. From the result, 0.13 % of hexadecanoic acid present in this essential oils. Thus these possess antioxidant activities [19].The mixture of active phytochemical compound usually have demonstrated bioactive properties. In this study, the*Melaleuca cajuputi* Powell leaves act as an antibacterial, anti-inflammatory, anodyne properties and insecticide properties. It is also used as cooking flavor and as a scented aroma agent in the soaps, cosmetics, detergents and perfumes [16], [20]. Cajuput oil also used for easing headache, toothache, rheumatism, convulsions and as insect repellent [21].

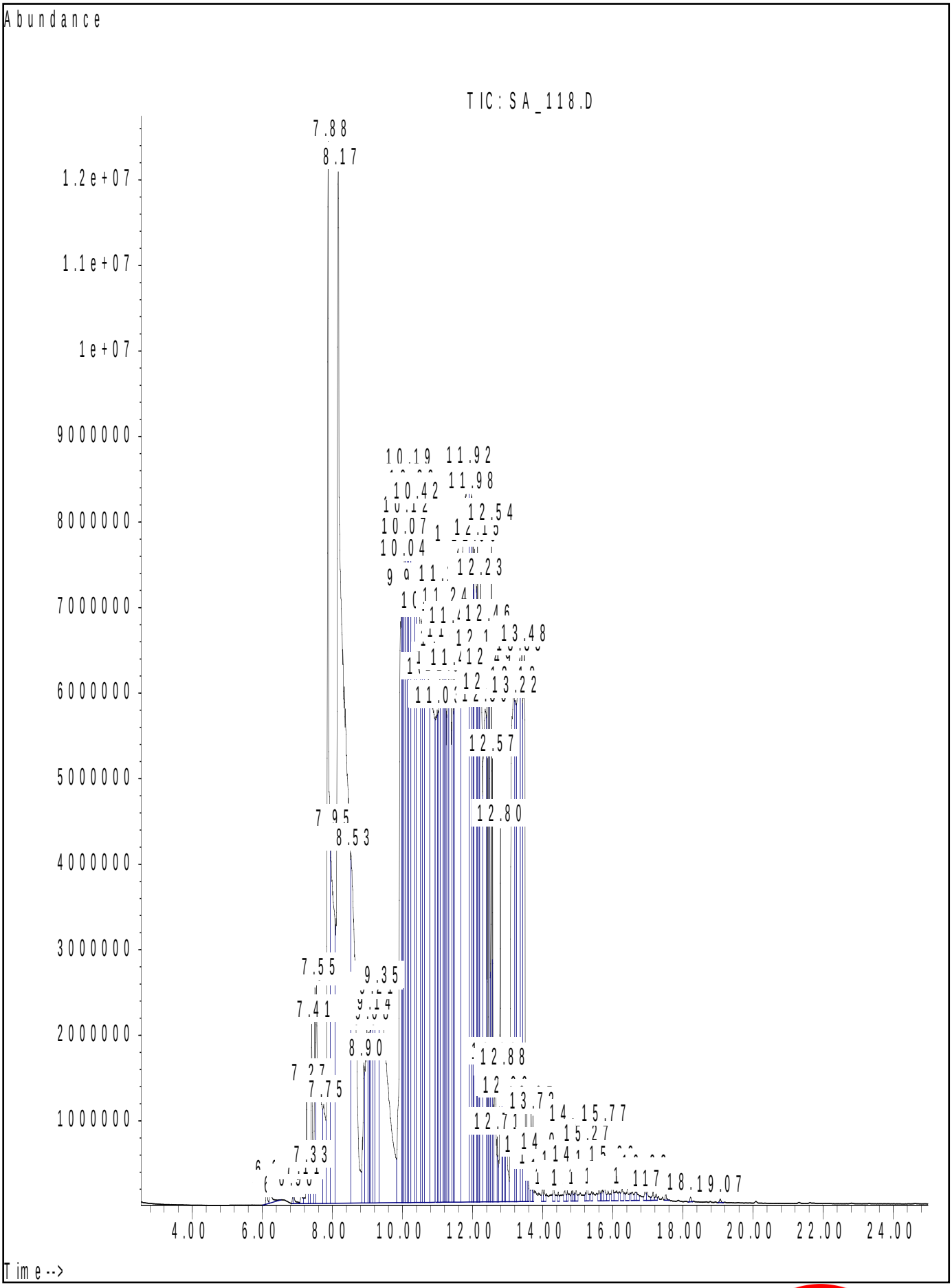


**Fig. 2 Integrated Total Ion Chromatogram**

## IV. CONCLUSION

As a conclusion, extraction of essential oils from *Melaleucacajuputi*Powell leaves was prepared using steam distillation. The volatile compounds were analyzed by GC-MS. Most of the active compounds found are varies based on their geographic area. The chemical analysis shows some valuable constituents of *M.Cajuput*essential oil such as caryophyllene, hexadecanoic acid and terpinolene. Its advantages are aromatic that have antibacterial and insecticide properties. This study could contribute to Melaleuca knowledge for its uses and health consumption. This study on the efficacy of essential oil extract as plant-based pesticides, has observed that essential oil may require huge approach or frequent application compared to synthetic pesticides.

## ACKNOWLEDGMENT

The authors would like to thank National Poison Centre (PRN) for their support and Innovation and Research Management Centre (iRMC), Universiti TenagaNasional (UNITEN), and for giving permission to publish this paper.

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