



University of Basrah
Pharmacy collage
Pharmacognosy Department



**The benefits and medicinal uses of essential oil
extract of *Callistemon viminalis* leaves**



By

Ahmed Shanan Musa

Huda Abd Alameer Jama

Supervised by: Ass.Lec. Ola Adil ALsaad

Abstract

The essential oils of *Callistemon viminalis* leaves were extracted by the hydrodistillation technique using a Clevenger apparatus and gave 1 mL/100 gm of dry weight. The Gas Chromatography/Mass Spectrometry (GC/MS) analysis revealed that the chemical composition of the essential oil of *C. viminalis* leaves were comprised of 46 compounds and the main compounds were Eucalyptol (72.12) followed by .alpha.-Pinene (10.49) , 3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, (R)- (3.91) , .alpha.-Phellandrene (1.21) , o-Cymene (1.18) and n-Hexadecanoic acid (1.18) , While the remaining 40 compounds were less than 1% each.



Introduction

The aromatic plants are rich sources for secondary chemical products and their derivatives. For thousands of years, even today, about 80% of the world's population relies predominantly on plants and plant extracts for health care and sources for clinically useful drugs¹. Essential oils are highly volatile, aromatic yields obtained from plants. Due to their volatility, they can easily be extracted by the method of steam distillation from different natural sources.² In ancient Rome, Greece and Egypt, the essential oils and extracts have been used as perfumes, food flavors, deodorants and pharmaceuticals³. Essential oils due to their better potencies and no side effects on human and environment can be utilized as substitutes to artificially synthesized chemical preservatives.⁴

Callistemon species belonging to family Myrtaceae are widely used for forestry, ornamental horticulture, essential. Approximately 10 of the approximately 38 species that make up the genus *Callistemon* are indigenous to the Indian subcontinent. *C. viminalis* may be found all over the world; however, it is most prevalent in tropical climates, such as those found in South America, Asia, Australia, and Sri Lanka.⁵⁻⁶ This plant is used to treat a wide variety of medical conditions, including but not limited to stomach problems, skin infections, and respiratory issues⁷. *C. viminalis* is extremely important to a number of different industries, including ornamental horticulture⁸. *C. viminalis* also showed importance in Traditional Chinese medicine for treating hemorrhoids⁹⁻¹⁰. Bacteria cause serious infections in humans as well as other animals, thus; the medicinal and herbal plants have assumed greater importance in recent days, due to the tremendous potential that they offer in formulating new drugs against many diseases and illnesses that affect the humankind¹¹.

The Gas Chromatography/Mass Spectrometry (GC/MS) instrument separates chemical mixtures (the GC component) and identifies the components at a molecular level (the MS component). It is one of the most accurate tools for analyzing environmental samples. (GC/MS) testing is widely known as the 'gold standard' in the chemical analysis of essential oils. In a nutshell, a (GC/MS) analysis identifies the various constituents in an essential oil and lists how much of each constituent is present as a percentage.¹² Gas chromatography is the best technique to identify essential oils components specially when using mass spectrometer as detector connected to compounds data base software.¹³

Classification

Kingdom : Plantae

Subkingdom : Tracheobionta

Super division: Spermatophyta

Division : Magnoliophyta

Class : Magnoliopsida

Subclass : Rosidae

Order : Myrtales

Family : Myrtaceae

Genus : *Callistemon*

Species : *Callistemon viminalis*

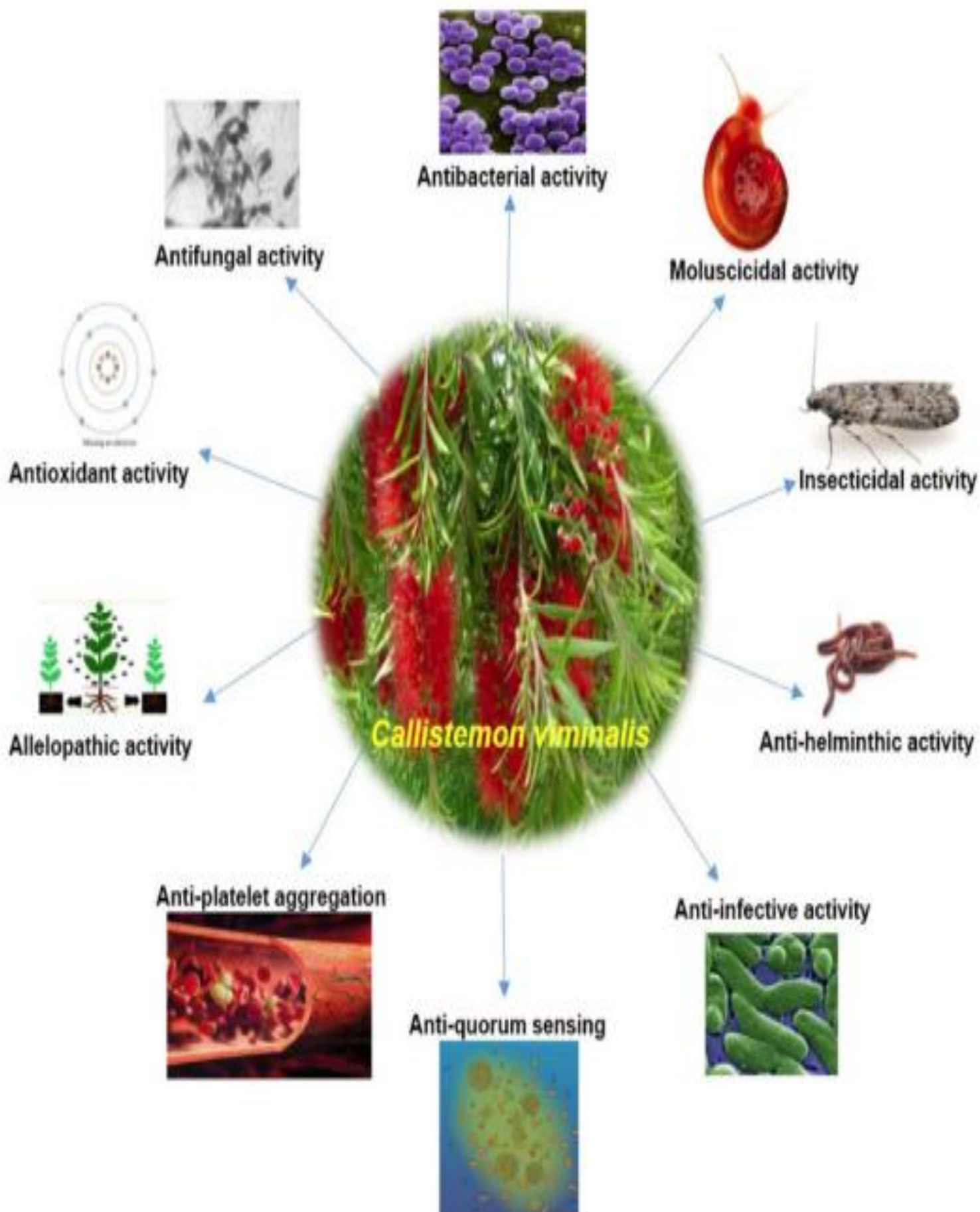
Common name

- Weeping Bottlebrush
- Red Cascade



Biological activities

- *C. viminalis* is an important medicinal plant, commonly used for traditional healing. This medicinal plant is also used in medical conditions like stomachaches, skin infections, and respiratory condition ¹⁴.
- *C. viminalis* is widely used for ornamental horticulture, essential oil production, forestry, windbreak plantings and degraded-land reclamation ¹⁵.
- Among its various uses *C. viminalis* also exhibits in-vitro antihelmintic activity against earthworms, tapeworms, hookworms ¹⁶
- It has been seen that *C. viminalis* provides effective control of *Ephestia kuehniella* by exerting negative effects on its immune cells ¹⁷.
- It has been seen that *C. viminalis* provides extracts from flowers and leaves showed antibacterial activity against Gram-positive bacteria ⁵⁻¹⁷. For example, it was found that *Staphylococcus aureus* (*S. aureus*) causes superficial skin lesion and food poisoning¹⁸. *Pseudomonas aeruginosa* (*P. aeruginosa*) is a nosocomial pathogen accounting for a significant percentage of hospital-acquired infections and health care centers because there are a little effective antimicrobial agents against it¹⁹.
- It also possess weed control property, so act as bio-indicators for environmental management ²⁰.
- *C. viminalis* is edible, and its leaves act as tea substitute and have a delightfully refreshing flavour and fragrance ²¹.
- The hot drink of *C. viminalis* has been used for the treatment of gastroenteritis, diarrhea and skin infections. This plant has ahemostatic property related to its astringent function in that it can halt the flow of internal bleeding, such as from ulcers, by constricting blood vessels ¹⁴⁻²².
- Fruits, bark and leaves of *C. viminalis* have shown molluscicides against *Biomphalaria alexandrina* snails ²³.
- Recent reports and experiments disclosed bottle brush as molluscicidal, bio-repellents for land leeches, insecticidal and anti-helmintic ²⁴⁻²⁵
- In addition to antioxidant and hepatoprotective activity ²⁶, it also possesses anti-thrombin activity ²⁷.
- It is also known to reinforce the immune system and protect from chronic diseases of vital organs like heart, brain and other organs of the body ²⁶.



Chemical constituents

C. viminalis leaves contain essential oils , triterpenoids, flavonoids, saponins, phenolics and high concentration of polyphenols and alkaloids , traces of steroids and tannins.

Plant collection

Leaves of *C. viminalis* were collected from the garden in Pharmacognosy department in Pharmacy college / University of Basrah , we collected the plant in flowering time of the plant . Then we dried it away from the sun (air drying) and grind it when full dried , after that we put it in plastic bag until use it .

Material and methods

Tools:

- Cylinder
- Funnel
- Beaker
- Round flask
- Spatula

Instrument:

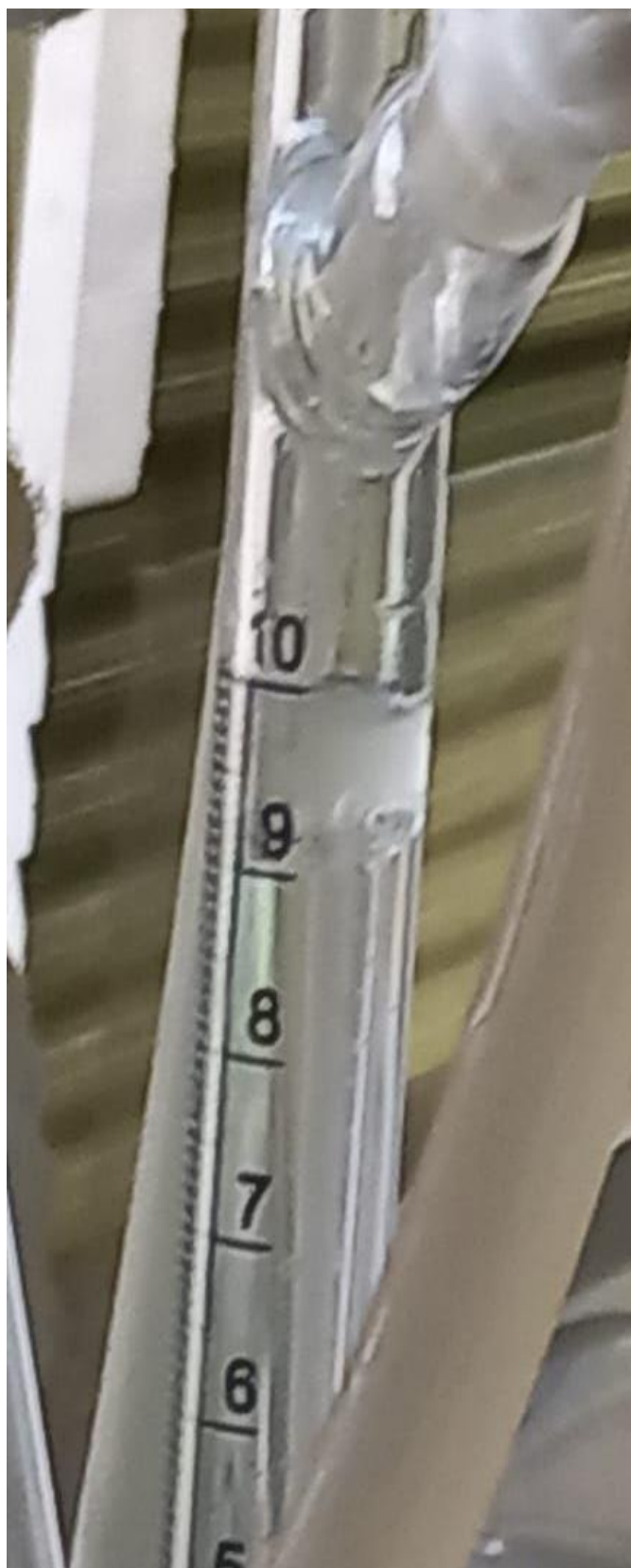
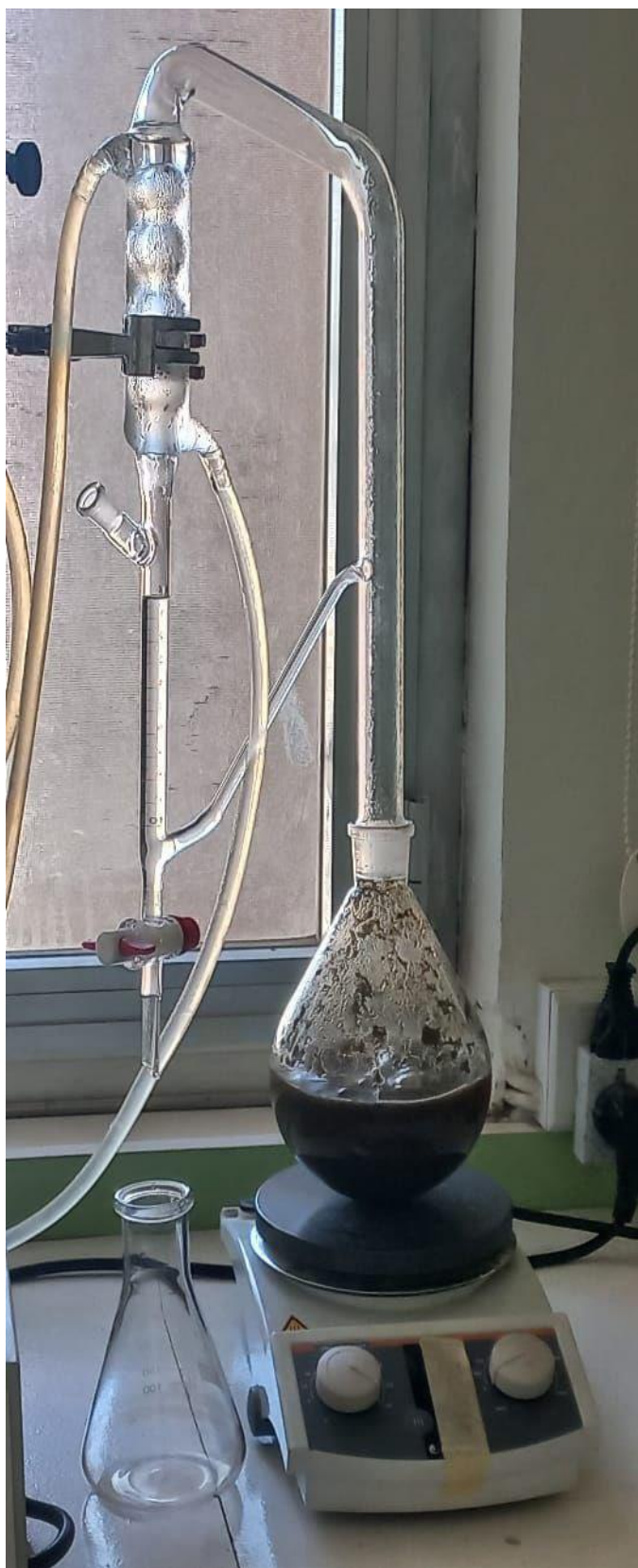
- Balance
- Clevenger
- Grinder

Material

- Distilled water

Preparation of extraction

The essential oils of *C. viminalis* leaves were extracted by the hydro distillation technique using a Clevenger apparatus by taking 50 gm. of the plant's leaves powdered and extracted by using 500 ml of D.W using Clevenger for 3 hours on (80-100)°c ,then collect the essential oil and keep it in tightly closed and dark glass containers or wrapped in aluminum foil and stored in the fridge on 4°c until use it.



Result and discussion

The essential oils of *C. viminalis* leaves were extracted by the hydrodistillation technique using a Clevenger apparatus and gave 1 mL/100 gm of dry weight.

The GC-MS analysis revealed that the chemical composition of the essential oil of *C. viminalis* leaves were comprised of 46 compounds and the main compound was Eucalyptol (72.12) followed by .alpha.-Pinene (10.49) , 3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, (R)- (3.91) , .alpha.-Phellandrene (1.21) , o-Cymene (1.18) and n-Hexadecanoic acid (1.18) , While the remaining 40 compounds were less than 1% each.

The results were identical to those mentioned by ²⁸ and were as follows Eucalyptol (41.17%) area and Alpha-Pinene (4.53%) area.

In addition to the similarity of the results with study of ²⁹ that revealed the principal components of the essential oils from the leaves were Eucalyptol (84.60%) and α -pinene (10.28%).

In comparison with a study of the essential oil of *C. viminalis* leaves ; Fourteen components were identified in the essential oil, as the results did not show compatibility in some compounds ; the major components were 1,8-cineole (64.53%) and α -pinene (9.69%).¹⁵

In comparison with another study that showed a difference in compounds, The major components obtained are: 1, 8 Cineol (54.99%); α -pinene (16.1%); α -terpineol (8.02%), P-Cymene (5.25%).³⁰

There are differences in the yield and profile of the essential oil constituents, which could be attributed to many environmental factors viz. latitude, geographical distribution etc.³¹ Yield and composition of essential oils in plants, can be affected by a number of factors, included physiological variations, environmental conditions, geographic variations, genetic factors and evolution temperature, and soil type, among others.²⁹



Peak Report TIC

Peak#	R.Time	Area	Area%	Name
1	3.092	2273967	0.75	Decane, 1-fluoro-
2	3.322	323979	0.11	3-Pentanone, 2,4-dimethyl-
3	5.880	173492	0.06	Octaethylene glycol monododecyl ether
4	6.401	1229422	0.40	.alpha.-Phellandrene
5	6.570	31889513	10.49	.alpha.-Pinene
6	7.607	1563071	0.51	.beta.-Pinene
7	8.052	666596	0.22	trans-1,4-Cyclohexanedimethanol, bis(heptafluorobutyrate)
8	8.373	3693948	1.21	.alpha.-Phellandrene
9	8.728	199679	0.07	.gamma.-Terpinene
10	8.814	3582949	1.18	o-Cymene
11	9.090	219314882	72.12	Eucalyptol
12	9.623	270217	0.09	.beta.-Ocimene
13	9.889	1095073	0.36	.gamma.-Terpinene
14	10.733	430894	0.14	Cyclohexene, 1-methyl-4-(1-methylethylidene)-
15	10.981	1606787	0.53	Linalool
16	11.958	834718	0.27	Bicyclo[3.1.1]heptan-3-ol, 6,6-dimethyl-2-methylene-, [1S-(1.alpha.,3.alpha.,5.alpha.)]-
17	12.721	542133	0.18	Isoborneol
18	13.017	259619	0.09	Hexadecane, 1,1-bis(dodecyloxy)-
19	13.106	2266796	0.75	Terpinen-4-ol
20	13.448	11899430	3.91	3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, (R)-
21	19.920	2790418	0.92	Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-, [1R-(1R*,4Z,9S*)]-
22	20.421	474358	0.16	Aromandendrene
23	20.735	437567	0.14	Humulene
24	20.912	399189	0.13	Aromandendrene
25	21.769	412567	0.14	1H-Cycloprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1aR-(1a.al
26	21.906	600403	0.20	7-Isopropyl-7-methyl-nona-3,5-diene-2,8-dione
27	22.637	483257	0.16	6-Isobutyryl-2,2,4,4-tetramethylcyclohexane-1,3,5-trione
28	23.238	222331	0.07	(1aR,4S,4aR,7R,7aS,7bS)-1,1,4,7-Tetramethyldecahydro-1H-cyclopropa[e]azulen-4-ol
29	23.337	439434	0.14	2-Acetylbenzoic acid
30	23.456	1321115	0.43	1H-Cycloprop[e]azulen-7-ol, decahydro-1,1,7-trimethyl-4-methylene-, [1aR-(1a.alpha.,4
31	23.528	1724567	0.57	Caryophyllene oxide
32	23.596	759283	0.25	Ledol
33	23.683	356732	0.12	Globulol
34	23.720	378976	0.12	2-Naphthalenemethanol, decahydro-.alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2.al
35	23.829	577769	0.19	(1R,3E,7E,11R)-1,5,5,8-Tetramethyl-12-oxabicyclo[9.1.0]dodeca-3,7-diene
36	23.933	216231	0.07	Z-4-Octadecen-1-ol acetate
37	24.006	672027	0.22	2-Naphthalenemethanol, decahydro-.alpha.,.alpha.,4a-trimethyl-8-methylene-, [2R-(2.al
38	24.107	500107	0.16	Longipinocarveol, trans-
39	24.485	478777	0.16	7-Hydroxy-1,3-dimethyl-1H,8H-pyrido[2,3-d]pyrimidine-2,4,5-trione
40	24.947	179323	0.06	2-Acetylmethylamino-5,5-dimethyl-5,6-dihydro-4H-benzothiazol-7-one
41	25.185	351566	0.12	.alpha.-Phellandrene, dimer
42	25.312	635861	0.21	Didodecyl phthalate
43	25.442	919194	0.30	Nonahexacontanoic acid, propyl ester
44	25.583	700522	0.23	Octadecanoic acid, 9,10-dihydroxy-, methyl ester, bis(trifluoroacetate)
45	25.706	3575387	1.18	n-Hexadecanoic acid
46	25.924	359062	0.12	1-Ethyl-1-hexadecyloxy-1-silacyclohexane
		304083188	100.00	

References

- [1] Jennifer S, Boehmeb A, Setzer N. Biological activities of essential oils from Monteverde, Costa Rica. *Nat Prod Commun* 2007; 12(2): 1212-1219.
- [2] Hyldgaard M, Mygind T, Meyer RL. Essential oils in food preservation: mode of action, synergies, and interactions with food matrix components. *Front Microbiol.* 2012;3:12.
- [3] Baris O, Gulluce M, Sahin F, Ozer H, Kilic H, Ozkan H, et al. Biological activities of the essential oil and methanol extract of *Achillea biebersteinii* Afan. (Asteraceae). *Turk J Biol* 2006; 30: 65-73.
- [4] Naeem, A. ; Abbas, T. ; Ali, T.M. ; Hasnain, A. Essential oils: brief background and uses. Remedy Publications LLC. 2018 ,1 (1), 1.
- [5] Srivastava, S.; Ahmad, A.; Syamsunder, K.; Aggarwal, K.; Khanuja, S. Essential oil composition of *Callistemon viminalis* leaves from India. *Flavour Frag. J.*, 2003, 18(5), 361-363.
- [6] Abdelhady, M.I.; Motaal, A.A.; Beerhues, L. Total phenolic content and antioxidant activity of standardized extracts from leaves and cell cultures of three *Callistemon* species. *Am. J. Plant. Sci.*, 2011, 2, 847.
- [7] Abd J. Studying of antibacterial effect for leaves extract of *Callistemon viminalis* in vitro and vivo (urinary system) for rabbits. *J. Kerbala Univ.* 2012;8:246–254.
- [8] Ahmed A.H. Phytochemical and cytotoxicity studies of *Callistemon viminalis* leaves extract growing.
- [9] Ji, T. Traditional chinese medicine pills for treating hemorrhoid. CN 101352524 A. 2009, 20090128.
- [10] Islam MR, Ahamed R, Rahman MO, Akbar MA, Al-Amin M, Alam KD, et al. In vitro antimicrobial activities of four medicinally important plants in Bangladesh. *Eur J Sci Res* 2010; 39(2): 199- 206.
- [11] Pradeep P, Leena P, Bohra A. Antibacterial potential of *Cedrus deodara*. *Adv Plant Sci* 2003; 16(11): 479-482.
- [12] Srivastava, S.; Ahmad, A.; Syamsunder, K.; Aggarwal, K.; Khanuja, S. Essential oil composition of *Callistemon viminalis* leaves from India. *Flavour Frag. J.*, 2003, 18(5), 361-363.

- [13] Hadi M, Hameed I. Uses of Gas Chromatography-Mass Spectrometry (GC-MS) Technique for Analysis of Bioactive Chemical Compounds of *Lepidium Sativum*: A review. *Research Journal of Pharmacy and Technology*. 2017;10(11):4039
- [14] Afrah, J.A. Studying of antibacterial effect for leaves extract of *Callistemon viminalis* in vitro and vivo (urinary system) for rabbits. *J.Kerb. Uni.*, 2012, 10(2), 246-254.
- [15] Salem, M.Z.M.; Ali, H.M.; El-Shanhorey, N.A.; Abdel-Megeed, A. Evaluation of extracts and essential oil from *Callistemon viminalis* leaves: Antibacterial and antioxidant activities, total phenolic and flavonoid contents. *Asian Pac. J. Trop. Med*. 2013;6:785–791. doi: 10.1016/S1995-7645(13)60139-X.
- [16] Garg, S.; Kasera, H. Anthelmintic activity of the essential oil of *Callistemon viminalis*. *Fitoterapia*, 1982, 53(5/6), 179-181.
- [17] Ghasemi, V.; Yazdi, A.K.; Tavallaie, F.Z.; Sendi, J.J. Effect of essential oils from *Callistemon viminalis* and *Ferula gummosa* on toxicity and on the hemocyte profile of *Ephestia kuehniella* (Lep.: Pyralidae). *Archives. Phytopath. Plant. Prot.*, 2014, 47(3), 268-278.
- [18] Lotifpour F, Nazemiyeh N, Fathi-Azad F, Garacei N, Arami S, Talat S, et al. Evaluation of antibacterial activities of some medicinal plants from North-West Iran. *Iran J Basic Med Sci* 2008; 11: 80-85.
- [19] Abu-Shanab B, Adwan G, Abu-Safiya D, Jarrar N, Adwan K. Antibacterial activities of some plant extracts utilized in popular medicine in Palestine. *Tur J Biol* 2004; 28: 99-102.
- [20] Oyedeji, O.O.; Lawal, O.A.; Shode, F.O.; Oyedeji, A.O. Chemical composition and antibacterial activity of the essential oils of *Callistemon citrinus* and *Callistemon viminalis* from South Africa. *Molecules*, 2009, 14(6), 1990-1998.
- [21] Zubair, M.; Hassan, S.; Rizwan, K.; Rasool, N.; Riaz, M.; Ziaulhaq, M.; Defeo, V. Antioxidant potential and oil composition of *Callistemon viminalis* leaves. *Sci. World. J.*, 2013, 1-8.
- [22] Mubarak, E.E.; Mohajer, S.; Ahmed, I.; Taha, R.M. Essential oil compositions from leaves of *Eucalyptus camaldulensis* Dehn. and *Callistemon*

viminalis originated from Malaysia. IACSIT Press, Singapore. IPCBEE. 2014. 70. 27

[23] Gohar, A.; Maatooq, G.T.; Gadara, S.R.; Aboelmaaty, W.S.; Elshazly, A.M. Molluscicidal activity of the methanol extract of *Callistemon viminalis* (Sol. Ex Gaertner) G. Don Ex Loudon fruits, bark and leaves against *Biomphalaria alexandrina* snails. Iran. Iran J. Pharm. Res., 2014, 13(2), 505-514.

[24] Nath, D.; Das, N.; Das, S. Bio-repellents for land leeches. Def. Sci. J., 2002, 52(1), 73-76.

[25] Ndomo, A.; Tapondjou, L.; Ngamo, L.; Hance, T. Insecticidal activities of essential oil of *Callistemon viminalis* applied as fumigant and powder against two bruchids. J. Appl. Entomol., 2010, 134(4), 333-341.

[26] Eldib, R.; Elshenawy, S. Phenolic constituents and biological activities of the aerial parts of *Callistemon viminalis* (Sol. Ex Gaertner) G. Don ex Loudon. Bulle. Facul. Pharm., 2008, 46, 223- 235.

[27] Chistokhodova, N.; Nguyen, C.; Calvino, T.; Kachirskaia, I.; Cunningham, G.; Howardmiles, D. Antithrombin activity of medicinal plants from central Florida. J. Ethnopharm. 2002, 81(2), 277-280.

[28] Asaad, A.Y. In Vitro Antimicrobial Activity of Essential Oil Derived from *Callistemon viminalis* Aerial Part. Al-Kindy College Medical Journal 2023;19 (1), 69-71.

[29] Sales, T.A.; Cardoso, M.D.G.; Guimarães, L.G.D.L.; Camargo, K.C.; Rezende, D.A.D.C.S.; Brandão, R.M.; Souza, R.V.; Ferreira, V.R.F.; Marques, A.E.; Magalhães, M.L.; Nelson, D.L. Essential oils from the leaves and flowers of *Callistemon viminalis*: Chemical Characterization and Evaluation of the Insecticide and Antifungal Activities. American Journal of Plant Sciences, 2017, 8, 2516-2529.

[30] Khubeiz, M.J.; Mansour, G. Chemical composition and antimicrobial activity of essential oil of *Callistemon viminalis* from the south Syria. International Journal of ChemTech Research, 2016,9(6), 242-250.

[31] Simmons D, Parsons RF (1999). Variation in the morphology and volatile leaf oils of *Eucalyptus yarraensis* (Myrtaceae), a disjunct rare species in Victoria. Aust. Syst. Bot. 12: 157- 167.