"UNVEILING THE BOTANICAL BEAUTY: EXPLORING THE DIVERSITY OF PHYTOCHEMICALS AND BIOACTIVE WONDERS IN CAMELLIA SINENSIS LEAVES USING GC-MS IN AQUEOUS SOLVENTS FOR PHARMACOGNOSTIC INSIGHTS"

Dr. Shailesh B. Patil[1*], Prof. Jitendra D. More[2]

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Abstract:
In this systematic investigation, we employed TLC and GC-MS to analyze bioactive compounds in aqueous extracts of Camellia sinensis. The aqueous extract (AH) exhibited distinct RF values for catechin (0.15), gallic acid (0.58), and quercetin (0.67), with Camellia sinensis (AH) containing the highest concentrations: 48.87% catechin, 27.45% gallic acid, and 7.25% quercetin.
Further exploration of Camellia sinensis extracts using GC-MS revealed over 20 compounds in the aqueous extract, including flavonoids, alkaloids, and terpenoids, indicative of its medicinal potential. The aqueous extract displayed medicinal potential with its diverse phytochemical composition.
These results underscore the versatility of Camellia sinensis aqueous extracts, supporting their use in herbal medicine and pharmaceutical formulations, and highlighting their potential therapeutic applications.

Keywords: TLC, GC-MS, Camellia sinensis, etc.'

[1]* "DCS's Annasaheb Ramesh Ajmera COP, Nagaon, Dhule MH, Bharat."Affiliation: KBC NMU Jalgaon, MH, BharatContact: Email: sbp2925@gmail.com Phone: 9970244000
[2]Prof. Ravindra Nikam College of Pharmacy, Gondur, Dhule, MH, Bharat.

* **Corresponding Author:** Dr. Shailesh B. Patil
* "DCS's Annasaheb Ramesh Ajmera COP, Nagaon, Dhule MH, Bharat."Affiliation: KBC NMU Jalgaon, MH, BharatContact: Email: sbp2925@gmail.com Phone: 9970244000

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Introduction:

The Camellia sinensis stands as an iconic tropical flowering plant celebrated for its striking blossoms and versatile applications. Belonging to the Theaceae family, this evergreen shrub is indigenous to East Asia and has found a home in various tropical and subtropical regions across the globe. The plant vibrant, trumpet-shaped flowers come in an array of colors, ranging from red and pink to orange and yellow, making it a popular choice for ornamental gardens. Beyond its visual allure, Camellia sinensis has a rich history of utilization in traditional medicine due to its potential medicinal properties.

Delving into the photochemistry of Camellia sinensis involves employing sophisticated analytical methods, including TLC, and GC-MS, are employed. TLC serves as an initial screening method, allowing for the separation and visualization of different phytochemical constituents on a chromatographic plate. [1]

GC-MS, a formidable analytical tool, plays a crucial role in unraveling the intricate chemical composition of Camellia sinensis. This technique involves the parting of complex combinations into separate components, followed by the proof of identity of these components founded on their (MS) Mass Spectroscopy. The application of Gas Chromatography-MS enables the identification and quantification of bioactive compounds present in the plant, contributing to a comprehensive understanding of its Pharmacognostic profile.

Furthermore, these analytical methods are often employed to investigate the plant's phytochemical content across various solvents, including aqueous extracts. This exploration aids in discerning the differential extraction efficiencies of bioactive compounds under different solvent conditions, providing valuable insights into the plant's chemical diversity.

Figure 01: The extraction of bioactive compounds from *Camellia sinensis* leaves.

"Technique, and Materials:"

"The plant resources of *Camellia sinensis* were assured from the limited area of Mumbai, Maharashtra, and their genuineness was confirmed by Subordinate Prof. Dr. D. V. Agavekar." Khalsa College holds the position of Head of the Botany Department at Khalsa College, affiliated with Mumbai in Maharashtra. This authentication process ensures the reliability and accuracy of the gathered plant specimens, establishing a credible foundation for subsequent research and analyses. [2-5]

A) Thin-layer chromatography is commonly abbreviated as TLC:

TLC is an analytical method in which the stationary phase, as a finely split solid, is spread as a thin layer over a solid supporting material as a plate. The mobile phase allows any liquid solvent to migrate across the plate's surface, through which separation process occurs.

Preparation of TLC plate:

The process involved in preparing and activating the TLC plate involved creating slurry of gel 'G' with distilled water. This 0.25 mm dense slurry was then useful to glass plates, tracked by air-drying for 10.00 minutes. Subsequently, the dried plates underwent activation by heating in a hot air oven at 105°C for 30 minutes. [6-7.]

The development of chromatogram:

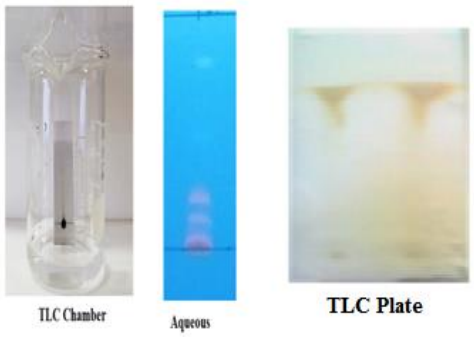

Figure 02:TLC of Camellia sinensis.

Camellia sinensis: The introduction of plates into a pre-saturated TLC chamber was carried out to ensure that the solvent adequately wet the TLC layer under the preliminary line. When solvents were run due to the capillary marines up to the desired height about ¾ of TLC plate and transport the substance combination to be separated. The plate was taken out of the chamber, and the solvent was allowed to dry at ambient temperature. The separated substance detected at Rf 0.06, 0.34, 0.42, 0.51, and 0.6.

Gas chromatography-MS Analysis of *Camellia sinensis*:
The GC-MS analysis was carried out utilizing a Perkin Elmer, the USA, System XL equipped with the NIST Library. The operational configuration included a Single Quadrupole analyzer with a prefilter:

Table no. 01: GC-MS parameter	
Instrument use	GC-MS
MODEL	Auto System Xl with Turbo Mass
MAKE	Perkin Elmer
COLUMN USE	ELITE-5MS (30METERX0.250MMX0.250 Micro mm
Carrier gas	Helium
Flow rate	01ml/min
Injector temp.	260 ^{O}C
Oven temp	75 ^{O}C Hold for 5min, rate 10 ^{O}C per min up to 280 ^{O}C hold for 10mint
EI Source temp	220 ^{O}C
Scan Range	20 to 610 (amu)
Injection Volume	2 micro liters.

Phyto compounds present in *Camellia sinensis* containing of aqueous extract by using GC-MS profiling: GC-MS profiling of the *Camellia sinensis* containing of aqueous extract, a plant known for its ornamental and medicinal properties, reveals a rich array of Phytocompound. This analysis allows for the identification of various organic compounds present in the plant extract.
The major constituents found in the aqueous extract include organic acids like citric acid, which imparts a tart flavour, and malic acid. These acids are known for their antioxidant properties and their potential role in improving digestion.
Flavonoids, such as quercetin and kaempferol, are also abundant in the extract. These compounds have strong antioxidant and anti-inflammatory properties and may contribute to the plant's medicinal benefits.
Furthermore, the GC-MS analysis detects various polyphenol, including anthocyanins and catechin, which are known for their potential cardiovascular and overall health benefits. Additionally, the presence of amino acids like tryptophan and phenylalanine suggests a potential role in protein synthesis and neurotransmitter regulation.
The identified compounds in the aqueous extract of ***Camellia sinensis*** reflect its diverse pharmacological potential, such as antioxidant, anti-inflammatory, and cardiovascular benefits. These findings are valuable for both the pharmaceutical and nutraceuticals industries, as well as for traditional herbal medicine. Further research may help unlock the full therapeutic potential of these Phyto compound. [8-14.]

Table no. 02: Phytocompound present in aqueous extract of Camellia sinensis using GC-MS Profiling (AMA: Antimicrobial Activity)							
Sr. no.	Compound Name	M.W.	Formula	Area %	RT	CAS	Activity
1.	Phenol	94	C6H6O	02.19	5.53	108-95-2	AMA
2.	Glycerin	92	C3H8O3	10.29	6.04	56-81-5	AMA
3.	2-Aminobutyric Acid	103	C4H9NO2	34.21	8.24	1118-68-9	AMA
4.	Phenylacetaldehyde	120	C8H8O	0.72	10.79	496-16-2	AMA
5.	Phytol	296	C20H40O	0.90	19.37	102608-53-7	AMA

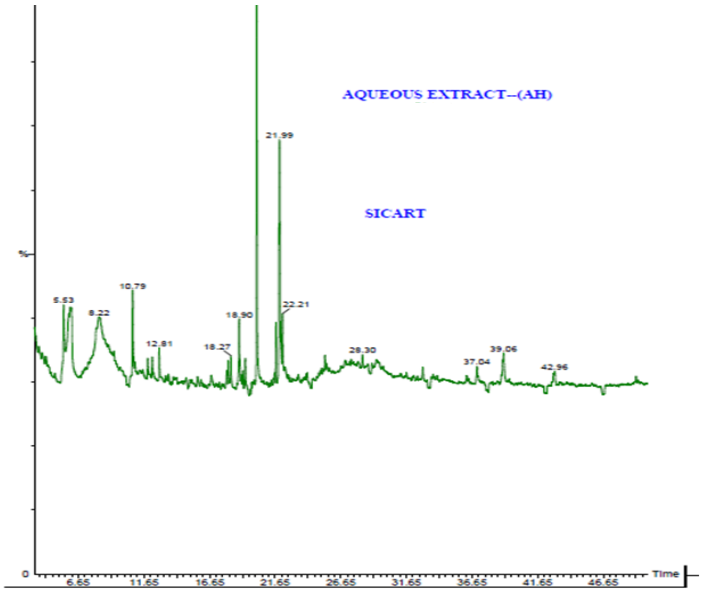

Figure 03:GC-MS graph of an aqueous extract of *Camellia sinensis.*

AQUEOUS EXTRACT--(AH) SICART

Hit	REV	for	Compound Name	M.W.	Formula	CAS
1	953	857	PHENOL	94	C6H6O	108-95-2
2	937	542	1-BUTEN-3-YNE, 2-METHYL-	66	C5H6	78-80-8
3	932	800	PHOSPHONIC ACID, (P-HYDROXYPHENYL)-	174	C6H7O4P	33795-18-5
4	931	876	PHENOL	94	C6H6O	108-95-2
5	931	508	1-BUTEN-3-YNE, 2-METHYL-	66	C5H6	78-80-8
6	919	875	CARBAMIC ACID, PHENYL ESTER	137	C7H7O2N	622-46-8
7	916	828	PHENOL	94	C6H6O	108-95-2
8	915	516	3-PENTEN-1-YNE, (E)-	66	C5H6	2004-69-5
9	906	799	2-VINYLFURAN	94	C6H6O	1487-18-9
10	895	517	3-PENTEN-1-YNE	66	C5H6	2206-23-7
11	894	518	1-PENTEN-3-YNE	66	C5H6	646-05-9
12	875	530	3-PENTEN-1-YNE, (E)-	66	C5H6	2004-69-5
13	866	472	1-PENTEN-3-YNE	66	C5H6	646-05-9
14	866	513	1-BUTEN-3-YNE, 2-METHYL-	66	C5H6	78-80-8
15	862	777	FORMIC ACID PHENYL ESTER	122	C7H6O2	1864-94-4
16	858	756	3-METHYLPYRIDAZINE	94	C5H6N2	1632-76-4
17	842	734	PHENYLPHOSPHORIC ACID	174	C6H7O4P	701-64-4
18	832	707	4-METHYLPYRIDAZINE	94	C5H6N2	1120-88-3
19	823	522	1,3-CYCLOPENTADIENE	66	C5H6	542-92-7
20	820	712	3-METHYLPYRIDAZINE	94	C5H6N2	1632-76-4

Figure 04:GC-MS result of aqueous extract of *Camellia sinensis*

Results and Discussion:

In this systematic investigation, a comprehensive analysis was conducted employing TLC and GC-MS to determine bioactive compounds in various extracts of *Camellia sinensis*. The aqueous extract (AH) exhibited distinct RF values of 0.15 for

catechin, 0.58 for gallic acid, and 0.67 for quercetin. Camellia sinensis (AH) demonstrated the highest percentages of these compounds: 48.87% for catechin, 27.45% for gallic acid, and 7.25% for quercetin.

Further exploration of *Camellia sinensis* extracts using GC-MS revealed a diverse array of phytochemicals. The aqueous extract contained over 20 compounds, including flavonoids, alkaloids, and terpenoids, indicative of its medicinal potential.

These findings collectively support the utilization of *Camellia sinensis* in herbal medicine and pharmaceutical formulations, underscoring the versatility of the extracts and their potential therapeutic applications.

The conclusion:

Innovatively, this study pioneers a validated TLC, and GC-MS method for concurrent quantification of Catechin, Gallic acid, and Quercetin in the fresh leaves of three Malvaceae family plants, notably *Camellia sinensis* (AH). Tailored for quality assessment in herbal materials and formulations, in summary, *Camellia sinensis* emerges as a treasure trove of varied phytochemicals, unlocking a myriad of possibilities for applications. With substantial pharmacological potential, these extracts present promising avenues for pharmaceuticals, nutraceuticals, cosmetics, and functional foods. Embracing the wealth of natural compounds within *Camellia sinensis* holds the key to advancing human health and well-being, urging continuous exploration and development in this botanical realm.

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Conflict of Interest:

The author asserts the absence of any conflicts of interest that require disclosure.

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