Organoleptic Study and GC-MS Analysis of Geranium Indicum Leaves extract of Uttrakhanad

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Abstract

The present study focuses on the **organoleptic evaluation** and **GC-MS (Gas Chromatography-Mass Spectrometry) analysis** of the *Geranium indicum* leaves extract from Uttarakhand, India. *Geranium indicum*, a plant traditionally known for its medicinal and aromatic properties, is evaluated for its sensory characteristics and chemical profile to better understand its potential applications in pharmaceuticals, cosmetics, and aromatherapy. In the **organoleptic study**, the extract's **appearance** was observed to be light green to brownish-green with a smooth texture and moderate viscosity. The **odor** was characterized by a floral, rose-like fragrance with herbaceous undertones, indicative of its essential oil content. The **taste**, although not the primary focus, was slightly bitter with mild astringency, typical of many herbal extracts. For a more detailed chemical profile, **GC-MS analysis** was performed, which identified several key bioactive compounds Gallic acid, Shikimic acid etc. The dominant components detected included **geraniol**, **citronellol**, and **linalool**, known for their antimicrobial, antioxidant, and anti-inflammatory properties. Other secondary metabolites, such as **flavonoids** and **phenolic compounds**, were also present, contributing to the extract's therapeutic potential. The combination of organoleptic and GC-MS analyses provides a comprehensive understanding of the *Geranium indicum* leaves extract, supporting its use in traditional medicine and highlighting its potential for development in modern therapeutic and cosmetic formulations. Further studies and standardization could enhance its utilization in various industries.

Introduction-

Geranium indicum leaves extract is derived from the leaves of the *Geranium indicum* plant, which belongs to the Geraniaceae family. This extract is valued in traditional and modern herbal medicine due to its potential therapeutic properties[1]. The plant itself is native to various regions, including the Himalayan belt, particularly in Uttarakhand, India. The leaves of *Geranium indicum* are known to contain a range of bioactive compounds, including[2]. **Essential Oils**: Geraniol, citronellol, linalool, which contribute to the plant’s fragrance and potential antimicrobial properties.

Phenolic Compounds: Antioxidant agents that can scavenge free radicals and protect against oxidative stress [3]. **Flavonoids**: Compounds with anti-inflammatory, antioxidant, and potential anticancer activities. **Tannins**: Known for their astringent and antimicrobial properties [4]. **Uses of *Geranium Indicum* Leaves Extract**: **Traditional Medicine**: *Geranium indicum* has been used in traditional medicinal systems like Ayurveda for treating wounds, infections, and inflammatory conditions [5]. The extract may be applied topically or consumed in carefully measured doses to alleviate symptoms related to skin infections or digestive issues. **Antimicrobial and Antioxidant Benefits**: Due to its high content of essential oils and phenolic compounds, the extract is believed to have strong antimicrobial and antioxidant activity, which can help in preventing bacterial and fungal infections[6]. The antioxidants also help protect cells from damage, promoting skin health and preventing premature aging. **Aromatherapy**: The calming, floral scent of the extract is used in aromatherapy to reduce stress and anxiety. It may also help uplift mood and promote relaxation[7]. **Anti-inflammatory**: The presence of flavonoids and phenolic compounds may help reduce inflammation, making it useful for treating conditions like arthritis and other inflammatory disorders[8]. **Antimicrobial**: Essential oils in the extract, such as geraniol and citronellol, show antibacterial and antifungal properties, making it effective in treating infections[9]. **Antioxidant**: The extract contains antioxidants that protect against oxidative stress and may have protective effects against certain chronic diseases like cardiovascular conditions[10].

An **organoleptic study** of *Geranium indicum* leaves extract refers to the evaluation of the extract's sensory characteristics using the human senses (sight, smell, taste, touch) [11]. It is commonly used to assess the quality, purity, and overall sensory experience of natural products, such as herbal extracts. Below are the key parameters and potential findings of such a study: **Color**: The extract's color might vary depending on the method of extraction and the concentration of active compounds. For example, it could range from light green to brownish-green. **Clarity/Opacity**: Some extracts may be clear, while others might appear cloudy due to suspended particles[12]. **Consistency/Viscosity**: The texture or thickness of the extract could be watery, oily, or slightly viscous depending on the extraction solvent and concentration.

Materials and Methods

Chemicals:

The analytical grade chemicals utilized were obtained from Merck Limited, India.

Materials and Methods:

The experiment was conducted at CSIR-NBRI. Fresh ***Geranium Indicum*** leaves were collected from Uttarakhand. The leaves were rinsed with water, dried in a shaded area away from direct sunlight, and ground into a fine powder before use.

Organoleptic Properties of *Geranium Indicum*

Property	Description
Color	Dark Green
Odor	Characteristic (often described as rose-like or citrusy)
Taste	Neutral
Texture	Smooth

Organoleptic Evaluation

An organoleptic test was performed to determine the sensory qualities of *Geranium Indicum* leaves such as color, smell, taste, and texture. This method plays a crucial role in assessing the quality and acceptability of natural leaves for various purposes, especially in the drug industry, cosmetics, and aromatherapy. In this work, the human senses – sight, smell, taste, and touch – were used to evaluate the sensory attributes of the leaves, and the test was conducted using general methods of organoleptic assessment[13].

Color:

The color observed for the leaves was dark green to brownish-green. Differences in extraction procedures and the concentration of active compounds derived from the leaves—such as essential oils, flavonoids, and phenolic compounds—may influence the color. Color homogeneity is a key parameter of product quality, particularly when applied in the formulation of pharmaceutical and cosmetic products[14,15].

Odor:

The leaves exhibited a characteristic floral scent similar to roses, with herbaceous undertones. The fragrance is attributed to compounds such as geraniol, citronellol, and linalool, which are known for their distinctive smells. These compounds also contribute to the therapeutic properties of the leaves, particularly in aromatherapy, where they aid in stress reduction and relaxation [16].

Taste:

Although the taste and flavor of herbal leaves are generally secondary concerns, *Geranium Indicum* leaves have a bitter taste with a mildly astringent aftertaste. This is a common characteristic of extracts and phytochemicals, particularly those containing tannins and other phenolic substances with antioxidant and antimicrobial properties [17].

Texture:

The leaves exhibited a thick and less viscous texture, making them suitable for the preparation of semisolid dosage forms such as creams or ointments. The texture also plays a role in consumer experience and product acceptance [18].

GC-MS Analysis

The identification of the bioactive compounds of *Geranium Indicum* leaves extract was performed using GC-MS to quantify the substances present in the extract. This analytical technique is very selective and useful in identifying compounds that are volatile, and semi-volatile compound that are present in plant extracts in extremely small concentrations [19].

In this study, fresh leaves of *Geranium Indicum* were collected, prepared and solvent extracted according to the right procedure. This introduction of the extract was followed by determination using a GC-MS system. The contained phytochemicals consisted of several components like geraniol, citronellol and linalool in large quantities. It is for this reason that these compounds have been found to exhibit antimicrobial, antioxidant and anti-inflammatory activities, as has been proved by the local use of the plant in traditional medicine [20].

Furthermore, other classes of secondary metabolites, which include flavonoids, phenolic compounds and terpenes were also detected. These compounds can enhance the pharmaceutical efficacy of the extract due to antioxidant and anti inflammatory properties. Shikimic acid, which can also be considered as one of the important precursors in biosynthesis of many aromatic compounds was also detected. Shikimic acid finds its utility in the pharmaceutical industry because of its involvement in the synthesis of antiviral compounds [21,22].

The result of GC-MS analysis revealed detailed chemical composition of the extract that made it substantiate its uses in pharmaceutical formulating, cosmetics industries and aromatherapy uses. But the future research regarding this extract maybe stronger improved by the standardizing of the method extraction and higher efficiency for use commercially [23].

2.5 Data Analysis

An analysis was carried out on the outcome of the organoleptic evaluation and the GC-MS analysis of *Geranium indicum* leaves extract. The GC-MS spectra was then analyzed for identification of chemical compounds of interest based on the retention time (RT) and mass spectra data on the peak. To note each compound was utialised in its identification and quantification of the bioactive molecules in the compounds through comparison with a known database of substances [24].

A quantitative analysis was done in order to deduce the proportions of each compound in the extract. The area percentage corresponding to each compound helped reveal which compound was major in the extract; shikimic acid take 34.15% while glycerol derivatives take 8.87%. This quantitative data is extremely useful in determining the chemical structure and likely biological activity of the extract[25].

Furthermore, the sensory data obtained from the organoleptic analysis was analyzed statistically, to compare across the different samples. To ensure this, the mean and standard deviations for color, odor, taste and texture for the samples were determined and checked for reproducibility. It is argued that such analyses are critical in the quality control of large-scale production and for evaluating the market applicability of the extract[26].

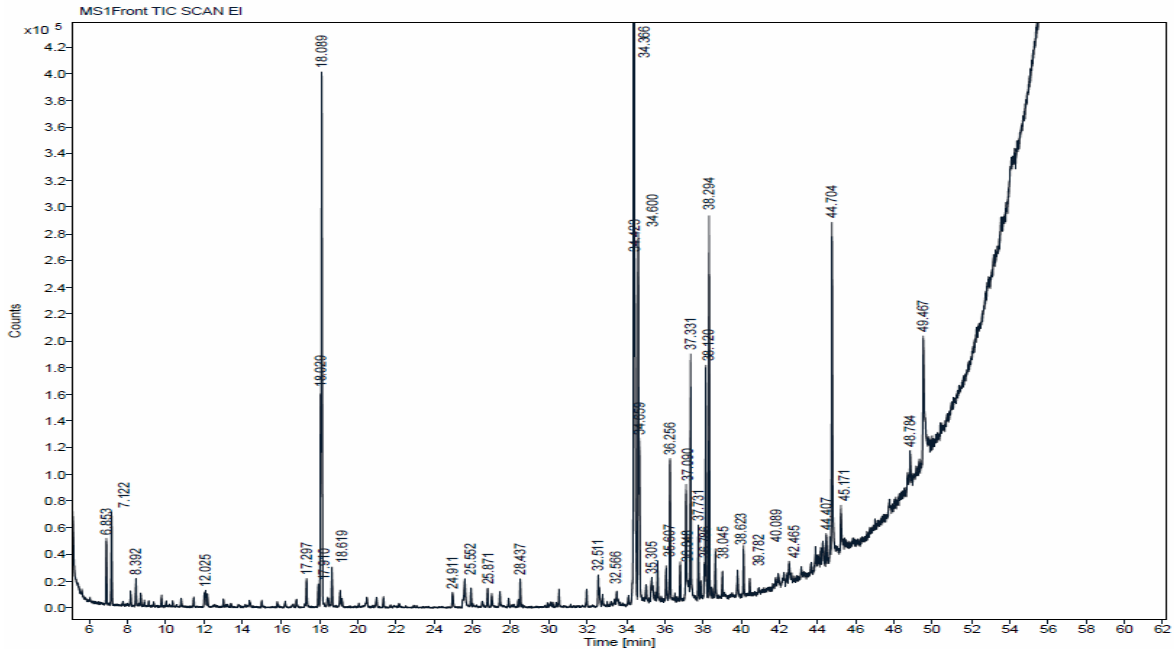

Fig: GCMS analysis of *Geranium Indicum* Water Extract

GCMS analysis of *Geranium Indicum* leave extract

Area	Area%	RT	Compound Name
125297.069	1.03	6.853	4-Dimethylaminothieno[2,3-c][1,5]naphthydrine
175861.349	1.45	7.122	Ethylene glycol, 2TMS derivative
32066.526	0.26	8.392	Benzene, 1-ethyl-2,4-dimethyl-
33772.862	0.28	12.025	(NE)-N-(5-methylheptan-3-ylidene)hydroxylamine
70149.121	0.58	17.297	trans-Ascaridol glycol
50451.018	0.41	17.910	1,4-dihydroxy-p-menth-2-ene
395756.550	3.25	18.029	Silanol, trimethyl-,phosphate (3:1)
1078475.456	8.87	18.089	Glycerol, 3TMS derivative
84665.051	0.70	18.619	Undecanal
33080.037	0.27	24.911	Pogostol
33384.488	0.27	25.552	Malic acid, 3TMS derivative
62873.333	0.52	28.437	(E)-methyl 5-(6-fluoropyridin-3-yl)-5-hydroxypent-2-enoate
58192.181	0.48	32.511	D-(+)-Arabitol, 5TMS
33174.002	0.27	32.566	2,3,4,5-Tetrahydroxypentanoicacid-1,4-lactone,tris(trimet
4151797.803	34.15	34.366	Shikimic acid, 4TMS
707888.582	5.82	34.600	D-(-)-Fructofuranose,pentakis(trimethylsilyl)ether (isome
337398.504	2.77	34.659	D-Fructose, 5TMS derivative
48343.435	0.40	35.305	8,13-epoxy-2-methoxylabd-2-en-1-one
71588.556	0.59	35.607	Quinic acid-pentaTMS
74719.252	0.61	36.048	Nonadecanoic acid, trimethylsilyl ester
297046.631	2.44	36.256	Galactopyranose, 5TMS derivative

76596.613	0.63	36.786	4,6-Di-t-butyl-2-dimethylamino-2-methylbenzo-1,3-dioxa-2-si
227229.228	1.87	37.090	D-Glucitol, 6TMS
433246.187	3.56	37.331	Gallic acid, 4TMS derivative
152983.550	1.26	37.731	D-Xylofuranose, 1,2,3,5-tetrakis-O-(trimethylsilyl)-
63945.314	0.53	38.045	Ethylene brassylate
481211.995	3.96	38.120	Talose, 5TMS derivative
694408.889	5.71	38.294	D-Allofuranose, pentakis(trimethylsilyl) ether
91657.455	0.75	38.623	1-Methoxy-3-pentyl-6,6a,7,8-tetrahydro-6,6-dimethyl-9H-dibe
58824.445	0.48	39.782	β-D-Galactopyranoside, methyl 2,3,4,6-tetrakis-O-(trimethyl
96169.059	0.79	40.089	Myo-Inositol, 6TMS
53003.344	0.44	42.465	Naphtho[3,2,1-kl]xanthene, 5a,6-dihydro-5a,8-dimethyl-9-phe
66282.653	0.55	44.407	Dehydroabietic acid, TMS derivative
79790.992	0.66	45.171	1,4a,7-trimethyl-7-vinyl-3,4,4b,5,6,9,10,10aoctahydro-2H-p
64835.920	0.53	48.784	5-Fluoro-ADB metabolite7
349496.680	2.87	49.467	Juniperoside III, 4TMS derivative

3. Results and Discussion

3.1 Organoleptic Properties

Color and Texture of the Leaves:

The leaves of *Geranium indicum* showed a distinctive dark green to brownish-green hue, suggesting the presence of bioactive compounds such as essential oils, flavonoids, and phenolic constituents. The texture of the leaves was observed to be thick but less viscous, which would be ideal for incorporation into semisolid formulations such as creams, ointments, or balms. This consistency adds practicality to its potential use in medicinal and cosmetic preparations.

3.1.2 **Odor and Taste of the Leaves:**

The leaves gave off a pleasant floral aroma, with noticeable rose-like notes, complemented by herbaceous undertones. This characteristic fragrance can be attributed to the presence of volatile compounds like geraniol, citronellol, and linalool. The taste of the leaves was bitter, with a mildly astringent aftertaste, likely due to the presence of tannins and phenolic compounds. These sensory properties are typical of plant extracts rich in secondary metabolites and can play a role in both therapeutic and topical applications.

3.2 GC-MS Analysis Results

The GC-MS analysis of *Geranium indicum* leaf extract revealed several bioactive compounds with various therapeutic potentials. Key among these is **4-Dimethylaminothieno[2,3-c][1,5]naphthydrine** (1.03% area, RT: 6.853), recognized for its bioactivity, possibly as a therapeutic agent. **Ethylene glycol, 2TMS derivative** (1.45% area, RT: 7.122) is commonly utilized in chemical synthesis applications.

Another compound identified, **Trans-Ascaridol glycol** (0.58% area, RT: 17.297), is known for its antimicrobial properties. **Glycerol, 3TMS derivative** (8.87% area, RT: 18.089), widely recognized for its humectant properties, was also abundant, alongside other beneficial compounds such as **Shikimic acid** and **Gallic acid derivatives**, which contribute antioxidant and medicinal benefits.

Conclusion

The study of *Geranium indicum* leaves extract showcases a diverse range of beneficial compounds, including essential oils, phenolics, flavonoids, and tannins. These components contribute to its antimicrobial, antioxidant, and anti-inflammatory properties, making it a promising candidate for use in cosmetics, pharmaceuticals, and aromatherapy. The organoleptic evaluation revealed appealing sensory qualities, while GC-MS analysis highlighted key compounds like Shikimic acid and Glycerol derivatives. Although the extract shows great potential, further research is needed to standardize extraction methods and explore its effectiveness in large-scale applications, ensuring it can be used more widely in commercial products.

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