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GC-MS Analysis of Extracted Essential Oil of *Piper betle L.*

Dr. Urmila Sarkar[1], Sensei Surendra Sawardekar[2]
[1]*Assistant Professor, Department of Botany, Kirti M. Doongursee College of Arts, Science and Commerce, Dadar, Mumbai 400028, India*
[2]*Assistant Professor, Department of Botany, Kirti M. Doongursee College of Arts, Science and Commerce, Dadar, Mumbai 400028, India*

Abstract: ***The Piper betle L. plant leaves contain aroma. A strong sense of aromatic constituents determines the enrichment of an essential oil components to be present in a plant part. The extracted oil by hydro-distillation method was analyzed through GC-MS method. A total 19 volatile components qualitatively and quantitatively by GC-MS. The research experiment of detecting components is observed to be effective to utilize in the food and cosmetic industry in the field of research and development aspects. The presence of compounds shows the phytochemical foundation for the use of extracted oil in the field of applied food industry and cosmetic industry. The research successfully concludes on identifying the components effective for the applications for a wide range of research experiments.***
Keywords: GC-MS, Piper betle leaves, essential oil, volatile components.

I. INTRODUCTION

The presence of aromatic or volatile compounds in the plant leaves plays a vital role in biotic and abiotic factors interactions of the plant. These volatile compounds are also known to be an essential oil or ethereal oil. Unlike fatty acids which is composition of a mixture of various non-volatile components, the essential oil lead in helping the plant to perform various functions such as protection from pathogens, insects, attracting of pollinating agents, reduction in transpiration losses etc. Thus a concentrated scent or aroma produced by the plant leads the essence of the plant functional aspects relating to its ability of containing essential substance.
The living plant materials producing the essential component is of a direct biological origin. Research have shown the use of *Piper betle L.* in traditional medicine (Vandana D., Shalini T., 2014) practice. Hence once extracted can be easily utilized for the beneficial use in various fields as per the requirements and the methodologies. Researchers have defined essential oil to be an oily or volatile liquid which is harvested from the aromatic part of the plant. However, there are innumerable cultivars of *Piper betle* plant of which 12 cultivars (Laskhmi A., K.G.A. Kumaratunga & Kalyani D., 2004) are itself found in Sri Lanka. The plant has found to be known as a 'green medicine' (D. Pradhan., Dr. K. A. Suri *et al.*, 2013) based upon the efficacy of its applications. The product is obtained by a steam distillation or by a hydro-distillation technique.
These volatile compounds are persistent in an odour for a longer period of time. Due to its prior beneficial applications in various sectors especially cosmetics sectors a wide use of an essential oil is of great demand in the market. While research studies on the volatile components have also shown as eugenol (A.K. S. Rawat, R.D. Tripathi *et. al.*, 1989) and acetyl-eugenol (Bhanu P., Ravi S., *et.al.*, 2010) as major component found in *Piper betle* leaves amongst many cultivars. The use of raw plant leaves turned into an effective product by extraction of essential oil makes uplifts the applications for the plant to be in demand for fulfillment of required desired products.
A *Piper betle L.* is a perennial root climber belonging to a family Piperaceae (Guenther 1952), The plant is known by different names in different countries. While in India it is known commonly known in different names to as per the local's language; such as Nagavalli, Nagarvel, Saptaseera, Paan, Gillauri, Kasar etc. Due to its vast consumption rate worldwide it is a demanded plant for its leaves which are consumed after lunch or dinner and many times in religious occasions etc. The edible leaves have nutritional benefits along-with an enrichment of vitamins in it. The plant leaves rich in aroma holds a great beneficial aspect of essential components. Though India holds a large domain in production of raw leaves in the market the extraction and use of an essential oil ponders an important aspect for the research and development.
The current research experiment is completed to study presence of volatile components in the betle leaves through GC-MS. The extracted oil contains effective proportion of the components.

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II. MATERIAL AND METHOD

The extracted oil by a hydro-distillation method was dissolved in ethanol and the sample was tested for GS-MS

III. RESULT AND DISCUSSION

The result of peaks generated by GC-MS is presented in Figure 1.1 and the listed components created through the standard library is presented in Figure1.2

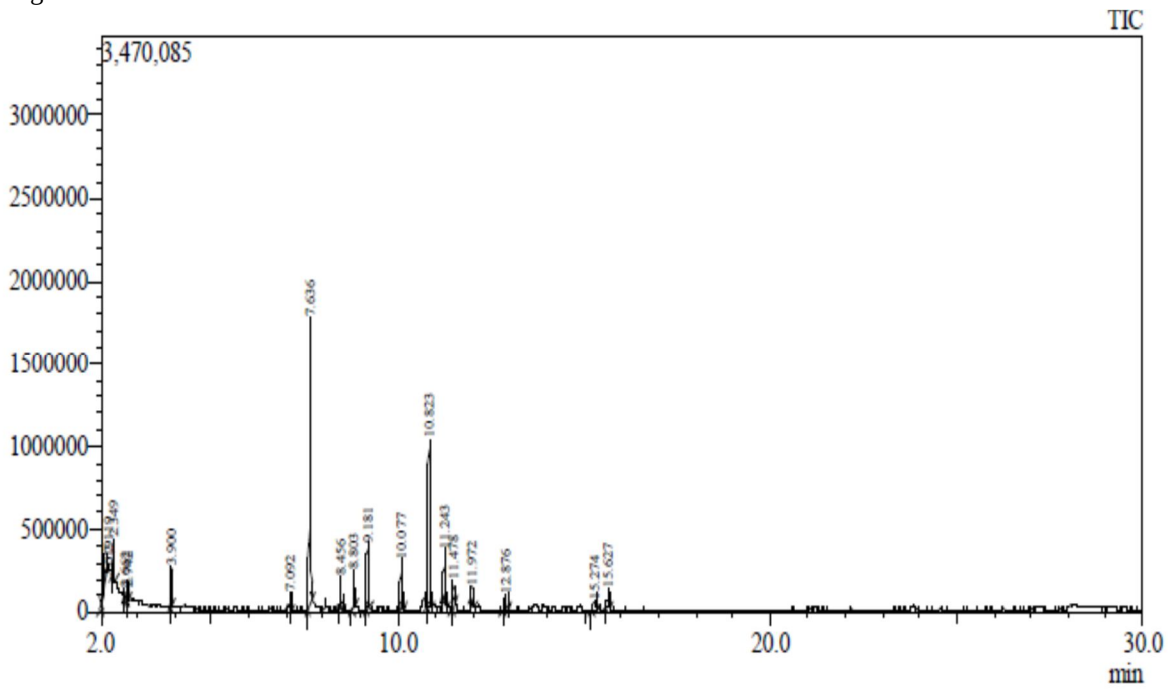


Figure: 1

Peak Report TIC

Peak#	R.Time	Area	Area%	Height	Name
1	2.019	119003	0.81	167382	1-(5-Bicyclo[2.2.1]heptyl)ethylamine
2	2.119	316959	2.15	157192	.beta.-Phellandrene
3	2.349	336470	2.28	239435	.gamma.-Terpinene
4	2.662	76462	0.52	47834	Cyclohexene, 1-methyl-4-(1-methylethylidene)-
5	2.742	114448	0.78	67884	1,6-Octadien-3-ol, 3,7-dimethyl-
6	3.900	425170	2.88	232669	Terpinen-4-ol
7	7.092	193299	1.31	86063	Cyclohexene, 4-ethenyl-4-methyl-3-(1-methylethen
8	7.636	4850835	32.91	1735861	Phenol, 2-methoxy-3-(2-propenyl)-
9	8.456	519808	3.53	189312	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methyle
10	8.803	608481	4.13	224155	Methyleugenol
11	9.181	1069208	7.25	394021	Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-met
12	10.077	820265	5.57	293952	Humulene
13	10.823	2992514	20.30	1014979	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-me
14	11.243	920604	6.25	316095	.gamma.-Elemene
15	11.478	422978	2.87	158179	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methyle
16	11.972	159690	1.08	78343	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1
17	12.876	254931	1.73	86716	.gamma.-Elemene
18	15.274	225107	1.53	59682	Cubenol
19	15.627	312831	2.12	111397	.alpha.-Cadinol
		14739063	100.00	5661151	

Figure 1.2

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The description of the application of the components from the generated qualitatively and quantitatively in the essential oil of Piper betle L. is given below in Table 1.1

Sr. No.	Components	% area	Use
1	1-(5-Bicyclo[2.2.1]heptyl)ethylamine	0.81	Flavoring substance: beverages, confectionery, chewing gum, frozen dairy, puddings, jam, jelly, meat products, hard & soft candy, soups.
2	beta.-Phellandrene	2.15	Flavoring substance (peppery minty slightly citrusy): Home air fresheners, candles with a fragrance, insect resistance, used in pharmaceutical as expectorant.
3	.gamma.-Terpinene	2.28	Anti-oxidant, anti-inflammatory, anti-microbial, Flavoring substance : baked goods, beverages, chewing gum, frozen dairy, pudding, meat products, soft and hard candy.
4	Cyclohexene,1-methyl-4-(1-methylethylidene) : [Terpinolene]	0.52	Flavoring substance or adjuvant :Baked goods, beverages, chewing gum, frozen dairy, puddings, hard and soft candy
5	1,6-Octadien-3-ol, 3,7-dimethyl- [Linalool]	0.78	Cleaning agent: soaps, detergents, shampoos and lotions. Anti-microbial and anti-fungal, insect repellent.
6	Terpinen-4-ol	2.88	Anti-inflammatory, anti-oxidant, Therapeutic agent : anti-cancerous, Flavoring agent : mints, used in spicy and fruity citrus, Cleaning agent : body lotions, shampoos, soaps
7	Cyclohexene, 4-ethenyl-4-methyl-3-(1-methylethenyl)-1-(1-methylethyl)-	1.31	Flavoring agent
8	Phenol, 2-methoxy-3-(2-propenyl)-	32.91	Flavoring agent, perfumes, essential oils products, antiseptic, anti-inflammatory and anesthetic.
9	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-	3.53	Flavoring agent
10	Methyleugenol	4.13	Flavoring agent: baked goods, jellies, beverages, candy, puddings, relishes, ice-cream, perfumes, cleaning agent : detergents, massage oils.
11	Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-	7.25	Flavoring agent
12	Humulene	5.57	Anti-bacterial, anti-inflammatory, anti-tumor, insect-repellent.
13	1,6-Cyclodecadiene [germacrene]	20.30	Flavoring agent and anti-microbial
14	.gamma.-Elemene	6.25	Insect-repellent, essential oil products.
15	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-	2.87	Flavoring and fragrance agent
16	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)- [Cadinene]	1.08	Anti-oxidant, anti-cancerous, flavoring agent: edible ices including sherbet, processed fruit, cereals and cereals products, bakery, spies and salad products, beverages, composite foods, meat and meat products,
17	.gamma.-Elemene	1.73	Insect-repellent, essential oil products.
18	Cubenol	1.53	Anti-oxidant, anti-inflammatory.
19	.alpha.-Cadinol	2.12	Anti-fungal, possible remedy for drug resistant tuberculosis.

Table: 1.1

The peaks observed in Figure:8 and Figure: 9 with the description in a Table :18 presents the highest % of area covered to be of 32.91% for the component *Phenol, 2-methoxy-3-(2-propenyl)-* Which has the properties of

- ✓ Flavoring agent
- ✓ Perfumes
- ✓ essential oils products
- ✓ antiseptic
- ✓ anti-inflammatory
- ✓ anesthetic

While the 2nd highest % area of peak observed to be of 20.30% for the component ***1,6-Cyclodecadiene [germacrene]*** which has the properties

- ✓ Flavoring agent
- ✓ Anti-microbial

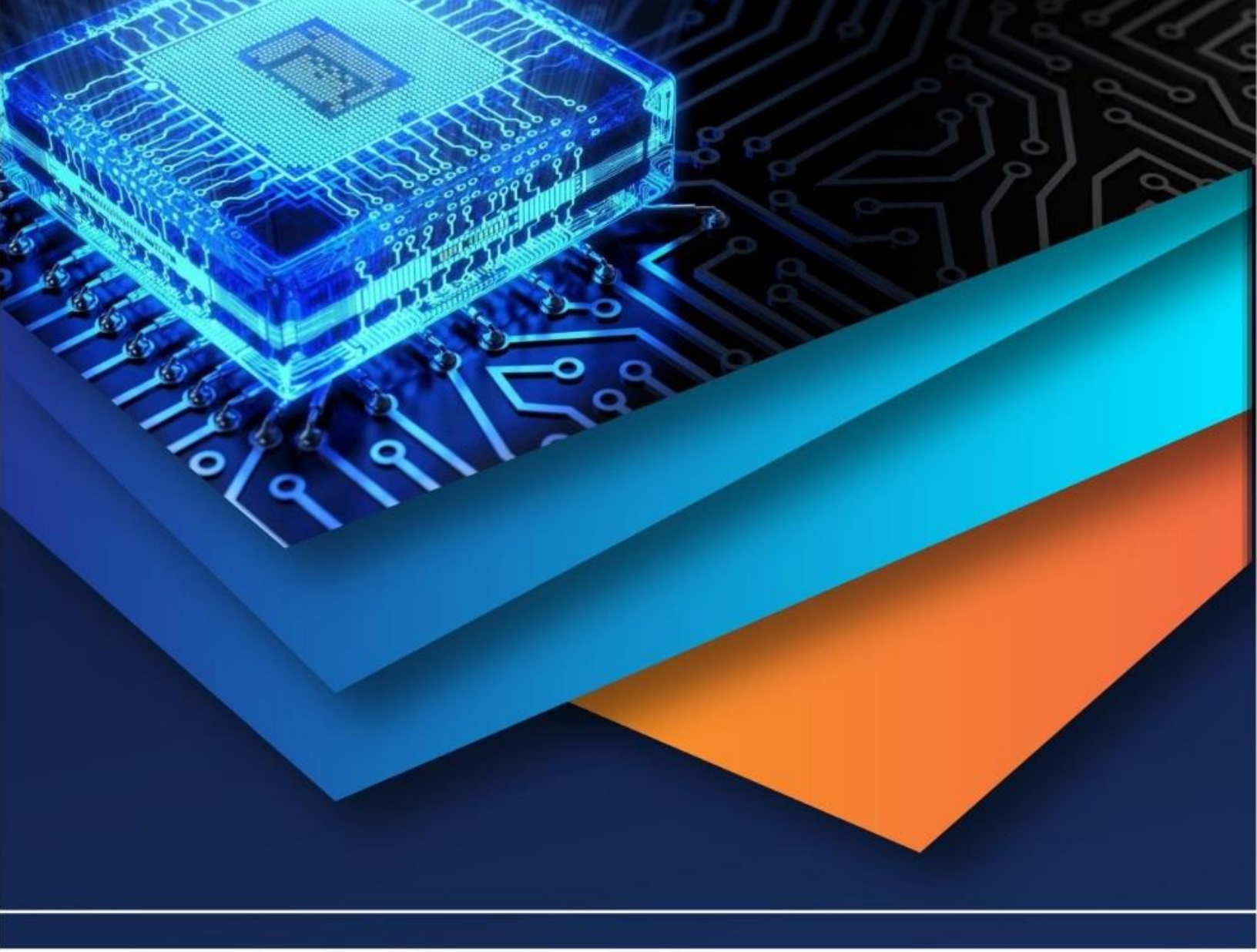
IV. CONCLUSION

The results of GC-MS represent more or less the total number of components enriched in the functional food properties and the nutraceutical aspect uplifting the efficacy of use of ***Piper betle L.*** extracted oil for an allied application of foods, cosmetics and microbial industries.

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