Extraction of Essential oil from aromatic plants

Sanjay L. Bhagat[1], V. C. Renge[2],Harshad Wankhade[3]
[2,3]Department of Chemical Engineering
College of Engineering &Technology, Akola,Maharashtra
[1]Department of Chemical Engineering,PVP Institute of Technology
Budhgaon, Sangli.Maharashtra

The pharmacological properties of essential oil extracted from plants have been focused as interest from both academia and pharmaceutical industry. In addition, the insecticidal activities of essential oil are of interest to agricultural scientists and agree businesses. Essential oil is now widely used as natural insecticidal, cosmeceuticals and aroma therapeutic agents. The plant Hyptis suaveolens is a potent medicinal herb and a well known medicinal plant in herbal world. The plant is commonly known as Wilayati tulsi belongs to the family Lamiaceae and is an ethnobotanically important medicinal plant. .In Solvent extraction method large amounts of drug can be extracted with a much smaller quantity of solvent. This affects tremendous economy in terms of time, energy and consequently financial inputs. It is also reported that the plant Hyptis suaveolens possesses the inflammation and wound healing property. It also possesses the anti-ulcer activity in gastric region also.

Key words- Hyptis suaveolens, solvent, extract

INTRODUCTION

With increasing public interest in herbal medicine and Natural products, there has been an increasing interest in essential oil extracted from various herbs and aromatic plants. This interest is to discover their multifunctional properties in addition to their classical role as food additives and fragrances. Newly discovered properties of essential oil include antibacterial, antifungal, antioxidant and anti-flammatory activities.

The pharmacological properties of essential oil extracted from plants have been focused as interest from both academia and pharmaceutical industry. In addition, the insecticidal activities of essential oil are of interest to agricultural scientists and agree businesses. Essential oil is now widely used as natural insecticidal, cosmeceuticals and aroma therapeutic agents.

A large number of plant species contain volatile chemical compounds which can be extracted as essential oil. Different methods are used to separate these oil from various plants material. Although it seems relatively simple to isolate such oil, the composition of oil may vary to a large extent depending upon the extraction methods used. The history of plants being used for medicinal purpose is probably as old as the history of mankind. Extraction and characterization of several active phyto-compounds from these green

factories have given birth to some high activity profile drugs. The potential natural anticancer drugs like vincristine, vinblastine and taxol can be the best example

Recent years have shown a growing popularity and faith in the use of herbal medicine worldwide. This may be because of the realization that modern synthetic drugs have failed to provide a "cure all" guarantee to most of the human diseases with often producing undesirable side effects, which at the end turnout to be more problematic than the actual disease itself. The herbal medicine provides a ray of hope through its cocktail of phyto-compounds, which are believed to act in a synergistic manner, providing excellent healing touch with practically no undesirable side effects, provided its quality is assured off. The modernization of herbal medicine has also raised quite a more than a few eyebrows in matters related to safety and quality of herbal medicine. In other words, the standardization and quality aspect of herbal medicine becomes a high profile issue. At present, however quality and safety related problems seems to be overshadowing the potential genuine benefits associated with the use of herbal medicine. The problem roots to the lack of high performance, reliable extraction, analytical techniques and methodologies for establishing a standard therapeutic functionality for herbal medicines. Extraction forms the first basic step inmedicinal plant research because the preparation of crude extracts from plants is the starting point for the isolation and purification of chemical constituents present in plants. Yet the extraction step remains often a neglected area, which over the years has received much less attention and research. An efficient or incomplete technique means considerable constraint on the throughput of any method and involves a significant additional workload to staff (3). The traditional techniques of solvent extraction of plant materials are mostly based on the correct choice of solvents and the use of heat or/and agitation to increase the solubility of the desired compounds and improve the mass transfer. Usually the traditional technique requires longer extraction time thus running a severe risk of thermal degradation for most of the phyto-constituents (4). The fact that one single plant can contain up to several thousand secondary metabolites, makes the need for the development of high performance and rapid extraction methods an absolute necessity (5). Keeping in pace with such requirements recent times has witnessed the use and growth of new extraction techniques with shortened

Extraction time, reduced solvent consumption, increased pollution prevention concern and with special care for thermolabile constituents. Novel extraction methods including microwave assisted extraction (MAE), supercritical fluid extraction (SCFE), pressurized solvent extraction (PSE) have drawn significant research attention in the last decade. If these techniques are explored scientifically, can prove out to be an efficient extraction technology for ensuring the quality of herbal medicines worldwide.

Essential oils are composed of a wide range of bioactive chemical compounds. They traditionally found application as flavour, fragrances and medicinal aroma. Today, the essential oils are sought-after for innumerable applications starting from markers for plant identifications to base for semi-synthesis of highly

complex molecules. The extraction of highly delicate essential oils from plants remains a crucial step in all these applications. There are two problems to overcome in the extraction from solid plant materials: that of releasing the essential oil from solid matrix and letting it diffuse out successfully in a manner that can be scaled-up to industrial volumes. Towards this end, an innovative volatiles extraction unit was conceived, designed and developed that used thin layer.

Essential oil:

Essential oil has a complex compound containing from a few dozen to several hundred constituents, especially hydrocarbon and oxygenated compounds are responsible for the characteristics odour and flavour. An essential oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils, ethereal oils or aetherolea, or simply as the "oil of" the plant from which they were extracted, such as oil of clove. An oil is "essential" in the sense that it carries a distinctive scent, or essence, of the plant The properties of individual components in the oil composition are different from the trace levels to over 90%.

The aroma oil is the result of the combination of the aromas of all components include two groups is composed of terpenes and terpenoids and the other of aromatic and aliphatic constituents, all characterized by low molecular weight.

Trace components are important since they give the oil a characteristics and natural odour, thus it is important that the natural properties of components is maintained during extraction of essential oil from plants by any procedure.

Essential oil composition can vary according to geographic and genetic factors, even though the same botanic species is involved- a phenomenon known as chemical polymorphism. When this occurs a terminology can be used where the Latin name is followed by the name of the chemical component most characteristic for that particular race of the plant ie. Its chemo typeeg. Thymus vulgaris linalool Thymus vulgaris thymol.

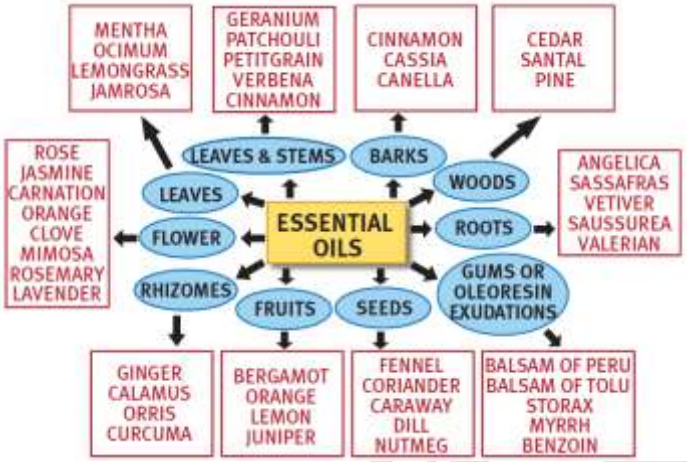
The major subclasses or families of terpene essential oil constituents are listed in Table below

■ Table :1 Properties of essential oil families

Compounds	Description	Properties
Hydrocarbons	Contain only carbon and hydrogen atoms	Stimulant, decongestant, antiviral, antitumour
Alcohols	Contains a hydroxyl group (OH) attached to the terpene structure	Antimicrobial, antiseptic, tonifying, spasmolytic
Sesquiterpene alcohols		Anti-inflammatory, anti-allergenic
Phenols	Hydroxyl group attached to a benzene ring	Antimicrobial, irritant, immune stimulating
Aldehydes	Terpenoids with a carbonyl group (C=O) and hydrogen bonded to a carbon	Spasmolytic, sedative, antiviral

Cyclic aldehydes	Aldehyde group attached to a benzene ring	Spasmolytic
Ketones	Contains a carbonyl group bonded to two carbon atoms	Mucolytic, cell-regenerating, neurotoxic
Esters	Condensation product of acid and alcohol	Spasmolytic, sedative, antifungal
Oxides	Has an O bridging 2 or more carbons	Expectorant, stimulant
Coumarins		UV sensitising, antimicrobial
Sesquiterpenes		Anti-inflammatory, antiviral

Sources of Essential oil



(Fig:1-Sources of Essential oil)

Hyptis Suaveolence

Fig:2 Hyptis Suaveolence

- Family Labiatae; Lamiaceae.
- Habitat: Native to tropical America. Distributed throughout India.
- Ayurvedic: Tumbaaka (provisional synonym).
- Folk: Gangaa Tulasi, Vilaayati Tulasi, Bhunsari

Hyptis suaveolens, (pignut or chan) is a very well known pseudo-cereal plant in the Latin American region, being approximately 2 meters high, having branches and long, white piliferous stems. Its flowers are purple or white, its leaves oval, wrinkled and pointed. It is native to the American continent, in warm and semi-warm regions. The plant Hyptis suaveolens is a potent medicinal herb and a well known medicinal plant in herbal world. The plant, Hyptis suaveolens commonly known as Wilayati tulsi belongs to the family Lamiaceae and is an ethnobotanically important medicinal plant. Almost all parts of this plant are being used in traditional medicine to treat various diseases. The leaves of

H. suaveolens have been utilized as a stimulant, carminative, galactogogue and as a cure for parasitic cutaneous diseases. Crude leaf extract is also used as a relief to colic and stomachache. Leaves and twigs are considered to be antispasmodic and used in antirheumatic, anti inflammatory, antifertility agents and also applied as an antiseptic in burns, wounds, and various skin complaints .The plant contains some potent chemical constituents such as carbohydrate, phenols, tannins, flavonoids, saponins, steroids, alkaloids, cardiac glycoside etc, which is responsible for its various medicinal activities. It is also reported that the plant Hyptis suaveolens possesses the inflammation and wound healing property. Duodenal ulcer is also an inflammation associated with wound in duodenum. So it is presumed that plant Hyptis suaveolens may also possesses the anti-ulcer activity in gastric region also.

Table.2. Various traditional, Ethnomedicinal, and other uses of Hyptis Suaveolence

Sr no	Plant name	Type of use	Plant part	Report activity
1	HYPTIS SUAVEOLENCE(L) POIT	Traditional use	Leaves	Stimulant,Carminative,sudotific,cure,galactogogue,parasitific,
2		Ethnomedicinal uses	Essential oil of leaves	Antifungal,antibacterial, anticonvulsantactivity
3			Plant	Respiratory, track infections,cold,fever
4			Seed	Dysuria and urinary complaints, nervous & visceral disorder
5		Other uses	Plant	Anthelmintic and antiflammatory, antimicrobial, antiplastmodic, Antioxidant, woundhealing

Stained sample

Fig :3.Various Methods of Extraction of Essential oil from aromatic plants

A wide range of technologies is available for the extraction of active components and essential oils from medicinal and aromatic plants. The choice depends on the economic feasibility and suitability of the process to the particular situation. The various processes of production of medicinal plant extracts and essential oils are reviewed are as follows:

I. Hot Continuous Extraction (Soxhlet)
II. Ultrasound Extraction
III. Supercritical Fluid Extraction

Table:3 .Some common solvents used for extraction for medicinal and aromatic

Solvent	**Boiling Point ^{0}C**	**Miscibility with H_2O**	**Threshold limit values, ppm**
Acetone	56	∞	1000
Acetic Acid	116-117	∞	10
Ethyl Acetate	77	80%	400
Benzene	80	<0.01%	25
2- Butanol	79.5	19%	2200
Cyclohexene	80.7	<0.01%	300
Dichloromethane	39.7	1.3%	2200
Chloroform	61	8%	50
Carbon tetrachloride	76.77	0.8%	10
Hexane	69	<0.01%	-
Ethanol	78	∞	1000
Ethyl ether	34.6	1.2%	400
Petroleum Ether	30-50	-	500
Propanotriole	290	∞	-
Methanol	64.7	∞	200
1-propanol	91	M	400

2-propanol	82.4	M?	400
Toluene	110.6	0.06	100
T= <0.01%; * with decomposition; M miscible; ∞ completely miscible.			

Experimental Procedure

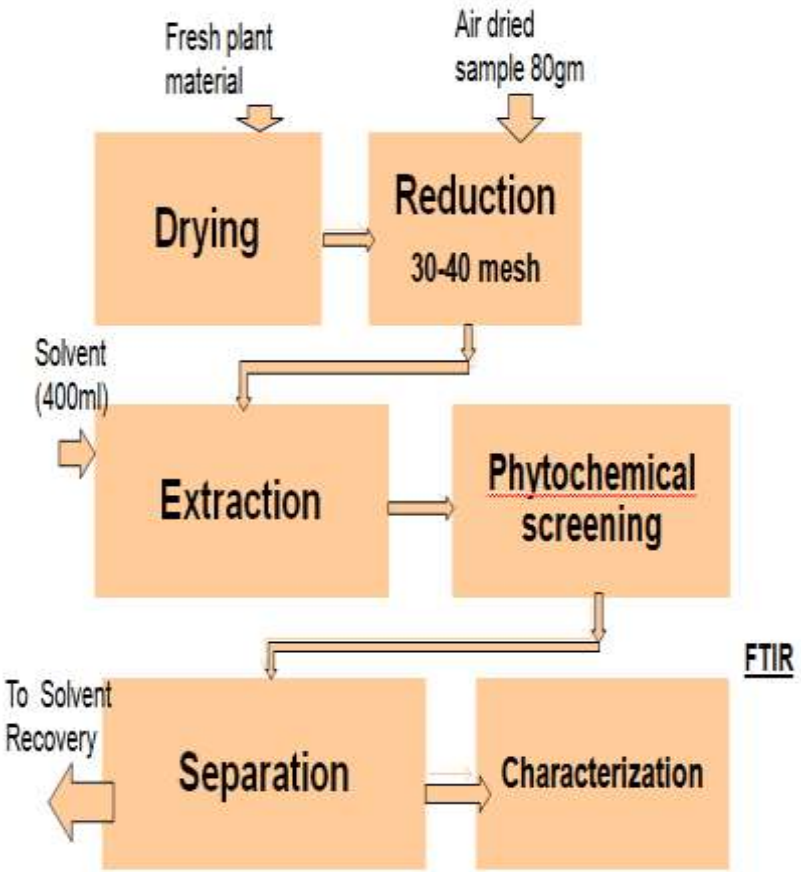


Fig 4-Experimental steps involved in extraction of essential oil

Result and Discussion

Since occurrence of the aromatic weed is abundant, and it can be cultivated or collected wild very easily, along with the potentially important seed oil and proteins, the rich mono- and sesquiterpenes can be better utilised in the aroma industry as co-products of H. suaveolens.Essential colourless oil yields varied from 0.09-0.41% .

Special Application found based on contents of phytochemicals:

1. In-vitro physicochemical assays characterize most of volatile matter in oil as antioxidants.
2. In eukaryotic cell, essential oil can act as pro-oxidants affecting inner cell membranes.
3. They also exhibit cytotoxic effects on living cells but usually non-genotoxic.

4. Content of tannins shows utilization topically for treatment burns

References

1. Indian medicinal plants: C.P.Khare (pg 320-321),
2. Extraction technologies for medicinal and aromatic plants: S.S.Handa, Gennaro Longa,
3. Mass Transfer Operation by Roebrt E. Treybal.
4. Introduction to Chemical Engineering Thermodynamics J.M.Smith
5. Banthorpe: D.V. 1991, Classification of Terpenoids and general procedure for their characterization.
6. Research paper on Wound healing activities of Hyptis Suaveolence (INT journal of pharma tech jul 2009),
7. Research paper on phytochemical and pharmacological investigation of the protective effects of plants H.Suaveolence (journal of global pharma tech
8. Repellent activities and phytochemical charecterization of essential oil(april 2012 British journal of pharmacology and tech
9. Research paper on microwave Extraction by Balasundaram Ramanadhan
   October 2005 Department of Agricultural and Bioresource Engineering University of, Saskatoon.
10 Review article on Microwave Assisted Extraction Pharmacognosy Reviews Vol 1, Issue 1, Jan-May, 2007
11 Additions to the flora of Marathwada region of Maharashtra, India
   S.P. Gaikwad 1, R.D. Gore 2 & K.U. Garad 3