Original Article

Lemon Grass: A Review Article Depicting Its Extraction And Properties

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Abstract

Cymbopogon citratus belonging to the family Gramineae is an herb worldwide known as lemongrass. The prefix lemon owes to its typical lemon like odour, due to presence of citral a cyclic monoterpene.Lemongrass has phytoconstituents such as tannins, flavanoids, alkaloids, and various essential oils in this herb. Secondary active metabolites of a number of components have also been implicated in the varied pharmalogical effects of this plant. The name Cymbopogon comes fromthe Greek word "kymbe –pogon," which means "boat-beard". *Cymbopogon citratus*, a perennial fragrant grass native to South India and Sri Lanka, is now widely grown throughout tropical America and Asia. The essential oil is extracted from freshly cut and slightly dried leaves, which are used medicinally, Pharmacological propertiesof *Cymbopogon citratus* are extensively explored, however, research suggests that other species may prove helpfulpharmaceutically. This review aims to discuss various aspects of lemongrass oil in respect of its properties and extractive procedure along with it identification methods. Lemon grass tea contains several biocompounds in its decoction, infusion and essential oil extracts. Anti-oxidant, anti-inflammatory, anti-bacterial, anti-obesity, antinociceptive, anxiolytic and antihypertensive evidences of lemongrass tea were clearly elucidated to support initial pharmacological claims. The compounds identified in *Cymbopogon citratus* are mainly terpenes, alcohols, ketones, aldehyde and esters. Some of the reported phytoconstituents are essential oils that contain Citral , Citral , Nerol Geraniol, Citronellal, Terpinolene, Geranylacetate, Myrecene and Terpinol Methylheptenone. Appreciable activity was observed against various isolates of Candida and clinical isolates of *Aspergillus fumigatus, Microsporum gypseum* and *Trichophyton mentagrophyte*. Citral is a combination oftwostereoisomeric monoterpene aldehydes; the trans isomer geranial is in predominance to the cis isomer neral.

Thispaper reviews recent information on extraction methods of lemongrass essential oil, its chemical composition depending on the origin of the plant, bioactivity of the oil constituents as well as potential application as a food preservative.

Keywords: - Lemon grass, Extraction, Identification, Properties and Isolation

INTRODUCTION

The essential oil of the plant is used in flavour, fragrancing and aromatherapy, medicinal tea, culinary herb(1) and treatment for skin diseases(2). It is known as a source of ethno medicines(3) . *C. citratus*is used in different parts of the world in the treatment of digestive disorders, fevers, menstrual disorder, rheumatism and other joint pains(4) . This species belongs to the Gramineae family, which comprises approximately 500 genus and 8,000 herb species.Lemon grass is a tufted perennial grass growing to a height of 1meter with numerous stiff leafy stems arising from short rhizomatous roots.(5) The use of whole herbs and extractives has remained the main approach of folk medicine practitioners in the treatment of ailments and debilitating diseases. They usually claimed that such whole herbs and extractives are efficacious against several ailments and diseases without recourse to scientific proofs.(6) A strong lemon fragrance, a predominant feature of this grass, is due to the high citral content of its oil. The redolence of the oil enables its use in soaps, detergents, etc. As a good source of citral, it finds an application in the perfumery as well as food industries. It is also the starting material for the manufacture of ionone's, which produce Vitamin A.(7) It grows in the sub-tropical and tropical regions of the world due to its wide uses in the cosmetics, food, pharmaceutical, agriculture and flavor industries. Large scale cultivation of Cymbopogon grasses occurs in the sub-tropics and tropics. Due to the presence of higher content of aldehyde *Cymbopogon citratus* possesses lemony odor. It has two geometric isomers, neral (citral-b) and geranial (citral a)(8) . Generally, without the other one isomer does not arise. Besidescitral, the essential oils of the Cymbopogon spp.(9) Lemon grass contains several bioactive compounds that impart medicinal value to it. Considerable evidence is available for its pharmacological applications. According to the WHO, herbal medicine is considered an important part of the healthcare industry by more than two-thirds of the population in developing countries(10). Lemongrass is an aromatic plant belonging to Graminese family, itis a tall, clumpy perennial plant. The grass grows to a height of 1 m. The leaves

are straight. The ends are taperedand can grow to 50 cm. The 1.5 cm wide leaf sheath is tubular and serves as a pseudostem. This plant blooms in the mature growth stage. Lemongrass is usually cultivated as ratoon crops. It is the first harvest 4 to 6 months after planting, then Harvest every 2 to 3 months Harvesting is done by cutting 20 cm above the ground Level (11).The ideal condition for growing lemongrass is warm and humid climate, fully sunny and 250-330 cm of rainfall yearly.(12)

MATERIALS AND METHODS

Collection of plant material and extraction of essential oil 2KG leaves of *C. citratus* were collected early in the morning from herbal garden of Amritsar pharmacy college .Leaves were dehydrated in shade and cut into small pieces. For the extraction of essential oil dried 500g leaf semi-crushed leaves were macerated with a small amountof distilled water and the slurry was hydrodistilled with hydrodistillation unit (Clevenger's apparatus) for 4 hr. Essential oil collected in tubes was dried with anhydrous sodium sulphate. Moisture free oils were stored in ambercoloured bottles in three different temperature conditions, room temperature, 30°C temperature and refrigerator temperature (2-8°C) for two year for experimental analysis. Experiments were conducted once for each condition.

GAS CHROMATOGRAPHY

GC and GC-MS analysis were carried out as per standard protocol used in previous article. Quantitative estimationof the essential oil was carried out using a Shimadzu GC- 2010. The carrier gas nitrogen was used as at 10 psi inlet pressure with FID and Omega SPTm column (30.0 m × 0.25 mm ID, film thickness 0.25 um). Injector and detector temperatures were 270°C and 280°C respectively. Column temperature programmed from 80°C (2 min hold), 80°C to 180°C at 4°C/min and 180°C to230°C at 6°C/min with hold time of 6 min and 19 min, respectively. The flow rate of carrier gas was 1.21 ml/min and split ratio was 1:80. The information was managed on GC arrangements programming for oil composition.(13)

PHARMACOGNOSTIC EVALUATION

Organoleptic Evaluation

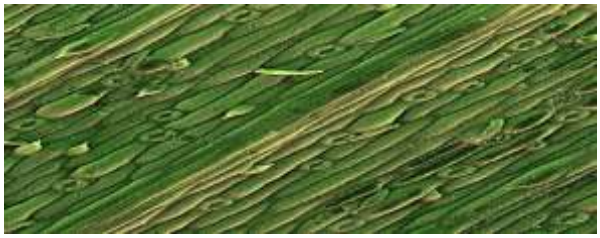
Organoleptic features of the plant were evaluated by observing color, odour, taste, size, shape of morphology andspecial features like texture. A part of quantitative microscopy, stomatal number, stomatal index, was determinedby using fresh leaves of plant.

Organoleptic features of the leaves

Type - Simple leaf Colour - Upper surface: dark green and lower surface: light greenOdour - lemon like smell.
Taste - bitter
Size - 1- 2 meter long and 5- to 10 mm wide.
Shape - leaf blades linear & tapered to both ends, sheath tereteMargin - entire Surface - at, very coarse Venation - parallel

MICROSCOPIC AND HISTOLOGICAL TECHNIQUES:

Study of Transverse Sections



The leaves of *Cymbopogon citratus* were boiled with water until soft. Free hand sections of the leaves were cut transferred on slides cleared by warming with chloral hydrate and mounted in glycerin. The lignied and cellulosictissues were distinguished using differential staining techniques.

Powder microscopy

A few drops of chloral hydrate solution were added to a sample of powered plant material on a slide, was coveredwith a glass slip and heat gently over a microbunsen. Vigorous boiling was avoided. The slide was examined under the microscope. When the clearing process is completed a drop of glycerol solution was added which will prevent crystallization of the mountain on cooling.

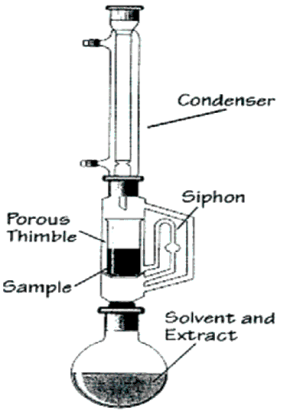
Physicochemical analysis

Physicochemical analysis i.e., alcohol (90% ethanol) and water soluble extractive values, total ash, acid-insolubleash, and loss on drying of the powdered drug were determined

Quantitative Analysis

Calibration curve of citral, limonene, propyl amyl ketone, isogeranial, and caryophyllene oxide were generated using five concentration points. The percentage value of essential oil components was adjudicate using these calibration curves.(14)

EXTRACTION



Essential oils are extracted from flowers, herbs, trees and various other plant materials. These oils contain a mixture of chemical compounds. Terpenes associated with aldehydes, alcohols and ketones form the major chemical component of such essential oils.(15) Apart from being used to manufacture of perfumes, soaps, cosmetics and detergent, citronella oil also finds an application in the pharmaceutical industry. The extraction of this essential oil is classified as clean technology(16,17).Lemon grass contains 1-2% of essential oil on a dry weight basis(18). Lemon grass oil is also known as citronella oil. Steam and hydro distillation are the conventionalmethods of its extraction. These procedures are however time consuming.(19,20) An innovative Microwave-

Assisted Hydrodistillation (MAHD) not only reduces the extraction time but also retains the quality of oil.The benefits of microwave radiation aided oil extraction technique over hydrodistillation have also been reported(21,22). Pressurized liquid extraction using nitrogen gas, is a novel technique and was found to yield better quality of oil in comparison to Soxhlet extraction and hydrodistillation methods(23).Supercritical extraction of citronella oil with CO2 under high pressure has also been investigated.(24)

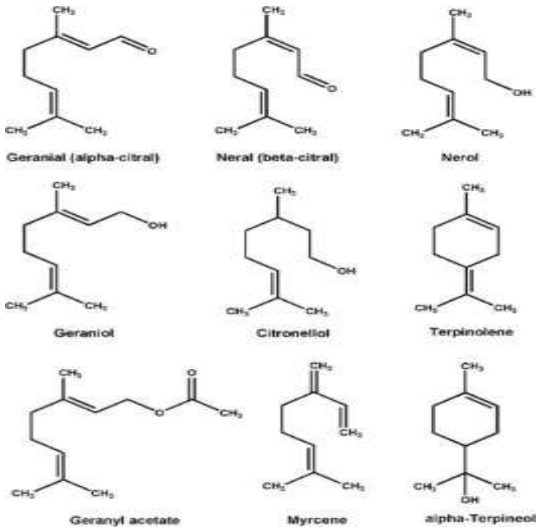
Compounds	Retention Index (RI)[a]	Relative content (%)
Camphene	953	0.29
6-Methyl-5-hepten-2-one	988	0.19
Limonene	1032	0.99
Linalool	1100	0.42
cis-Crisantenol	1164	0.76
n-Decanal	1207	0.19
Neral	1243	36.37
Geraniol	1253	2.66
Geranial	1273	53.20
2-Undecanone	1293	0.22
Geranyl acetate	1379	1.50
trans-Caryophyllene	1423	1.03
γ-Cadinene	1516	0.27
Caryophyllene oxide	1587	0.59
Identified compounds	–	98.39

[a] Retention index (RI) was calculated and compared with the literature (Adams, 2007).

PHYTOCHEMISTRY OF OIL

Citral, geranial and neral form nearly 75 % of the aldehydes present in the oil extracted from lemongrass. These chemicals provide aroma to the plant and helps its usage in aromatherapy. Citral α, citral β, nerol, geraniol, citronellal, terpinolene, geranyl acetate, myrecene and terpinol methylheptenone are some of the chemicals that have been extracted from lemongrass parts by various researchers. Two triterpenoids, cymbopogone and cymbopogonol and flavones identified as luteolin and its 6-C-glucoside have also been isolated from leaves of C.Citratus.(25,26,27). carminative, fungicidal,

analgesic, antiseptic, astringent, bactericidal and antidepressant properties. It can be used for curing of ringworm and athlete's foot disease due to its ability to act as antibiotic aswell as antiseptic properties. Lemongrass possesses good inhibitory activity against methicillin-resistant Staphylococcus aureus (MRSA) infection. It can be used for colitis indigestion and gastro-enteritis ailments. It helps relieves the symptoms of headache, body ache, nervous exhaustion and stress-related condition. Its infusionsare often made useful in infections such as sore-throats, laryngitis, bronchitis etc(28)

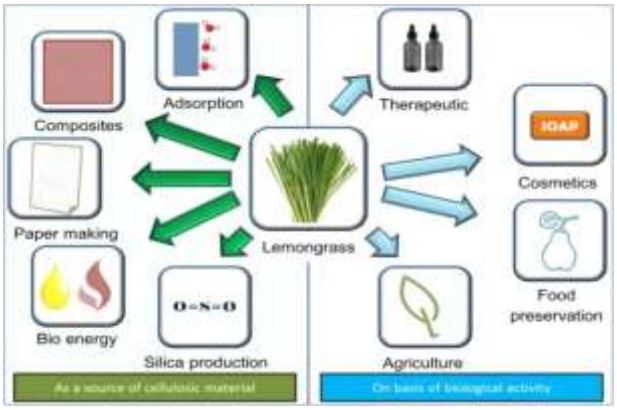


Pharmacological potential of lemon grass Antioxidant activity Latest research investigations have proved that antioxidant potential of plants is attributed to the presence of polyphenols, flavonoids, lignins, alkaloids,terpenoids, carotenoids, vitamins etc. They help in maintaining the nutritional quality and shelf life of foods by inhibiting lipid oxidation, minimizing rancidity, and removing toxic oxidative products [29,30,31,32]. Similarly, phenolic compounds play important role in antioxidant activity and resistance against pests and other species dissemination. Similarly, phenolic compounds play important role in antioxidant activity and resistance against pests and other species dissemination. Phenolic compounds helps in scavenging of reactive oxygen species (ROSs) which include hydrogen peroxide (H2O2), superoxide anion (O2-) and free radicals(33) generated during metabolism in body, hence helps in combating oxidative stress. Due to its reactivity, ROSs damage biochemical components like cell membrane, cellular lipids, proteins and DNA(34). ROSs are main culprit of atherosclerosis, rheumatoid arthritis and muscle destruction, cataracts, certain neurological disorders, cancer and ageing. Antioxidants have to be present in the body to offer protective mechanism against damaging effects of oxidationprocess caused by these radicals. Lawrence et al. determined the antioxidant activity of lemon grass essential oil grown in northern Indian plains by using DPPH assay, Nitrogen Oxide assay, reducing power assay and β-carotenebleaching assay. They observed that IC50 values observed for DPPH and NO scavenging method was 0.5 mg/mland 2 mg/ml respectively. The reducing activity gave positive results of increase in absorbance with increase in the concentration of oil. In β-carotene bleaching method also there is 84.1% bleaching in first one hour and it wentto 46.8% by the completion of second hour. In all the methods BHT and Gallic acid were kept as standard(35)

GENERAL USES

The important aspect of lemon grass is the antimicrobial action of essential oil in the vapour phase . In the previousstudy, LGO anti-fungal activity was assessed through different antimicrobial tests in both stages (i.e. in vapour and liquid phase). This study demonstrates that the antifungal action of LGO and the LGO vapour at ultra structurallevel via TEM and SEM. Plantborne antibodies are very important because their side effects are less pronounced.The increased popularity and unwanted side effects of some antibiotics of multidrug resistance in pathogenic micro-organisms have aroused enormous interest in the search for new herbal antimicrobials drugs. Various species of the lemon grass have been because of its medicinal properties and advantageous impact on the health, for example, digestive stimulus activity, antioxidant activity, antimicrobial action, anti-inflammatory,hypolidemic, anti-carcinogenic activity and antimutagenic effects(36) . Essential oils are very variable in responseto sources. Essential oils are obtained from various varieties of plants, including flowers, trees, grasses, shrubs, fruits and herbs. The oils collected are concentrated in various parts of the plant. Many essential oils are renownedfor their antimicrobial action(37,38)but often the mechanism of action is not fully understandable. This mechanism may involve membrane disruption of lipophilic components. The hydrophobicity that allows them tosplit up in the fluids of bacterial cell membrane and mitochondria thus disrupting and make structures more permeable is a significant feature of the essential oils and their constituents(39).Lemongrass flavonoids– *Cymbopogon citratus* leaves infusions are of medicinal significance, generally consumed beverages for treatmentof the inflammatory conditions. The Luteolin-C, Luteolin-O and C,O-glycosides, which are completely describedin the lemongrass for first moment, are separated and recognized by the nuclear magnetic resonance. Inlipopolysaccharide stimulated macrophages, the anti-inflammatory action of the luteolin and its glycosides was evaluated. The cytotoxicity of luteoline glycosides was lower than that of luteoline itself. Although luteolin's anti-inflammatory properties have been decreased by glycosylation, being

higher than Cglycosylation, the cytotoxic effect of the 7-O-βglucopyranoside luteolin was checked for an inhibitor effect on the production of inflammatory mediators (nitric oxide and IL-1β). There are less toxic effects for current antiinflammatory drugs with use in thefood and pharmaceutical industries on the luteolin glycosides of lemongrass infusion. Additionally, it was found,structure activity relationships, which establishes valued information in the design of the antiinflammatory luteolinglycosides devoid of cytoxicity(40).Number of medicinal significance of lemongrass is known. Lemongrass oil includes a wide range of health characteristics, besides being used as an aromatic flavor. Lemon grass have varietyof significance in different pharmaceutical industries for its anti-depressant, analgesic, antipyretic, bactericidal, anti-septic, carminative and astringent properties. Biologists suggest that oil of lemon grass is used for the treatment of different ailments e.g, toothaches and headaches etc. Lemongrass is also used as an insect repellent and a diuretic agent for fever. Its pepper preparation was used for menstrual and nausea relief. Lemon grass oil goes well with other essential oil like Coriander, Basil, Jasmine, Cedar Wood, Geranium, Lava din, Tea tree andLavender. It is also a good antiseptic and deodorizer. It is used to prepare foot baths and feet talc for sweaty smellfeet. It may be used to treat the ringworm and tinea for any fungal treatments of the feet. It can occasionally triggerinflammation of the skin and also trigger other kinds of inflammation. Therefore, during pregnancy it is better toavoid application(41).



RESULTS

C. citratus essential oil contains varies principal and potential bioactive compounds. The key constituents of *C. citratus* essential oil were found to be citral α (48.26%) and citral β (39.85%) followed by limonene (1.70%), propyl amyl ketone (1.88%), isogeranial (1.43%) and caryophyllene oxide (1.07%).[19] Citral, a major constituent of C. citratus oil is responsible for its antifungal properties .

DISCUSSION

C. citratus an important medicinal plant collected from the Lake city (Udaipur) commonly used by local tribal andsub tribal in several diseases and preparations. C. citratus essential oil have a typical lemon odor. In our previouswork we studied the chemical composition and antifungal potential of lemon grass oil and different fractions. C. citratus leave oil as well as all fractions showed potential antifungal properties against all test dermatophytes.A lot of research regarding chemical composition and antimicrobial activity of C. citratus have been done by variousresearchers. But no data regarding changes in the activity of C. citratus stored in different temperature and time reported till date. Present work dealing with changes in antifungal potential oil *C. citratus* after storage in differenttemperature conditions and of different time interval. Most essential oils have a shelf life, but this shelf life can vary according to the type of oil. Storage conditions can affect the chemical composition of the essential oil. Thissituation can be due to contact and reaction with oxygen, evaporation and other undesirable variations in volatileoil components during storage period.

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