LEMONGRASS -A BOON TO MANKIND

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ABSTRACT

Lemongrass (LG) (*Cymbopogon citrates*) is one of the plants in the genus Cymbopogon that is a rich source of naturally occurring antioxidants, including phenolic acids, flavonoids, tannins, hydroquinone, terpenoids, and fatty alcohols. It has been used in prior research investigations for therapeutic purposes, food preservation, cosmetics, and agriculture. The ability of lemongrass essential oil to defend cowpea grain and seeds against insects and opportunistic phytopathogens is thus confirmed. The acidic polysaccharides also activated a gene that inhibits the growth of tumours in addition to causing damage to the mitochondria. This plant's antiseptic, antibacterial, antifungal, and anti-inflammatory qualities make it widely utilised in pharmaceutical processes. Oral malodor was greatly reduced by the LG mouthwash. Another alternative mouthrinse option for gingivitis, plaque, and bad breath prevention is this mouthwash. the application of essential oils can be a significant strategy worth investigating in the management of insects. Essential oil production of lemongrass are improved by steam-mediated foliar application of catechol and plant growth regulators. the antibacterial properties of lemongrass essential oil and the cytotoxic effects of both test chemicals on human dermal fibroblasts were investigated. the antioxidant activity, total phenolic content, and flavonoid content of several lemongrass extracts. On deep sandy soils in a subtropical environment, lemongrass needed 17 irrigations. Africans frequently drink lemongrass tea for nutrition and as a treatment for diabetic mellitus (DM). various components of lemongrass oil can also cause specific neurotoxic and cytotoxic reactions in insects. antibacterial activity of vacuum distillation fractions of lemongrass essential oil was also investigated significantly. This review focus on the overall effects of lemon grass and its oil in different area of boon for mankind.

Keywords: Lemongrass, Essential Oil, Steam distillation, Lemongrass oil

INTRODUCTION:

Secondary metabolites (SMs) have a variety of proven medicinal benefits. These SMs are the source of numerous medicines. These SMs are recognised to act as powerful sources of antibacterial, antiviral, anti-inflammatory, anticancer, and insecticidal agents because they are naturally occurring substances. The main source of the wide range of readily accessible SMs is aromatic plants. Many of these SMs' classes also function as potent natural antioxidants. Antioxidants are substances that prevent or moderate the oxidation of other molecules and aid in the treatment of oxidative stress. When the amount of free radicals in an organism's body exceeds the homeostatic level of free radicals and native antioxidants, the state is known as oxidative stress. This overabundance of free redials triggers numerous chain reactions that harm cells. In living things, these free radicals are the root of more than a hundred different diseases. About 180 species of monocot grasses belong to the genus Cymbopogon, which is part of the Poaceae (Gramineae) family. Lemongrass (Cymbopogon citrates) is one of the plants in the genus Cymbopogon that is a rich source of naturally occurring antioxidants, including phenolic acids, flavonoids, tannins, hydroquinone, terpenoids, and fatty alcohols. Additionally, the pharmaceutical uses of lemongrass have been thoroughly studied. So, in this chapter, we'll talk about lemongrass's botanical characteristics, historical applications, phytochemistry, antioxidant potential, health advantages, and possible economic significance (Gaba, J.,2020).

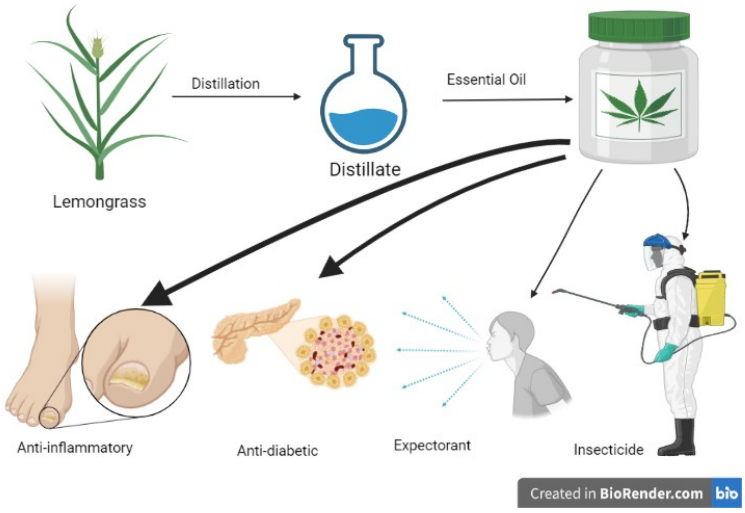

Figure 1: Health benefits of Lemongrass oil

LEMONGRASS (CYMBOPOGON): STRUCTURE, PROPERTIES, APPLICATIONS AND RECENT DEVELOPMENTS

This study focuses on lemongrass, which is a plentiful supply of plant material worldwide, and its structure, qualities, applications, and future potential. It has been effectively employed as a source of cellulose for the production of paper and pulp as well as for the adsorption of metal ions and colours. Recently, it has showed promise in the creation of composites, the generation of bioenergy, and the acquisition of metal oxides like silica. The biological actions of the constituents have, however, primarily been used in prior research investigations for therapeutic purposes, food preservation, cosmetics, and agriculture. As a result, this study examines the literature in all fields of current research on lemongrass and recognises the herb's multifaceted potential. This review also discusses lemongrass' planned use as a source of cellulosic matter, most particularly in the area of materials research. (Haque,2018)

Lemongrass essential oil: Scientific bases for an agroecological approach to seed protection

Particularly in areas with a low technological level, significant losses of grains and seeds stored without any kind of protection against pests and diseases result in economic losses that threaten the ability of small farmers to survive. New technologies are needed to safeguard seeds in agricultural practises free of pesticides and herbicides, and in this context, the usage of essential oils has been extensively researched. As proposed in this article, lemongrass essential oil has a low market value and may be a workable substitute. We examined the biochemical effects of subjecting the target insect (cowpea weevil) to the essential oil in order to test this notion. The findings suggested that the lemongrass essential oil's harmful effects were a result of its impact on the metabolism of the insect. Additionally, the outcomes demonstrated that the application of the essential oil coating guaranteed a level of citral on the seed surface sufficient to offer protection 30 and 90 days after seed treatment while having no effect on the seed's ability to germinate. While there was no toxic action against yeasts, lemongrass essential oil exhibited toxic activity against phytopathogenic fungi. The ability of lemongrass essential oil to defend cowpea grain and seeds against insects and opportunistic phytopathogens is thus confirmed. The article provides more specifics on the findings (Marcela de Souza Alves, 2023).

LEMONGRASS POLYSACCHARIDES KILL CANCER CELLS

Researchers have discovered polysaccharides in lemongrass (Cymbopogoncitratus), a tropical herb extensively used in traditional medicine, that exhibit anticancer effects 1. It was discovered that these polysaccharides killed prostate and cervical cancer cells in vitro. Traditional Chinese

medicine uses aqueous preparations of dried lemongrass leaves to treat cancer, diabetes, cancer, and nervous system diseases. Prior research, however, did not look into their anti-inflammatory and anticancer potential. The scientists separated the polysaccharides from lemongrass leaf extracts into three fractions: one fraction was unbound, while the other two contained acidic polysaccharides. Cultured prostate and cervical cancer cells were subjected to these fractions in order to examine their anticancer potential. In comparison to the unbound fraction, the two fractions containing acidic polysaccharides had stronger anticancer activity against both types of cancer cells. These two fractions caused cancer cells to undergo apoptosis, a process that results in their controlled death. Fluorescence images showed that exposure to the acidic polysaccharides interfered with mitochondrial membrane function, which is a prerequisite for apoptosis. The acidic polysaccharides also activated a gene that inhibits the growth of tumoursin addition to causing damage to the mitochondria. This tumor-suppressor gene's activation increased the activity of enzymes that cause cell death and turned off several genes that stop cell death. RamarThangam, a study co-author, thinks that these polysaccharides "could be useful in developing novel anticancer drugs." (Thangam, R., 2014)

CHARACTERISTICS AND PROPERTIES OF LEMONGRASS (CYMBOPOGANCITRATUS):

The Poaceae family, which is well known for being a source of cellulose, hemicellulose, and lignin, includes lemongrass, also known as Cymbopogancitratus. The composition, uses, and attributes of lemongrass are covered in this review. This plant's antiseptic, antibacterial, antifungal, and anti-inflammatory qualities make it widely utilised in pharmaceutical processes. Prior research had mostly concentrated on exploiting its biological components for food preservation, therapeutic uses, cosmetics, and agriculture. Consequently, lemongrass is covered in-depth in this thorough review as a source of cellulosic matter, including as an adsorbent and a component of biocomposite. A review of recently released research on emerging lemongrass fibre types is also included. (ZatilHafila Kamaruddin,2022).

EFFECT OF LEMONGRASS OIL ON ORAL MALODOR-CAUSING BACTERIA AND A PILOT STUDY ON THE SAFETY AND EFFECTIVENESS OF LEMONGRASS MOUTHWASH

It has been noted that lemongrass oil (LG) is efficient against bacteria embedded in the biofilm. The purpose of this study was to determine the safety and effectiveness of LG mouthrinse on oral malodor in healthy volunteers as well as antibacterial activity against common odourigenic microorganisms. Using the disc diffusion method and the broth microdilution experiment, the antimicrobial activity of LG mouthrinse was evaluated against common odourigenic microorganisms. Twenty healthy volunteers participated in a clinical trial that was randomised and double-blind. Each volunteer's level of volatile sulphur compounds (VSCs) was assessed using a Halimeter on days 0 and 8. According to the findings, LG mouthrinse was more efficient than Streptococcus mutans ATCC 25175 against Aggregatibacteractinomycetemcomitans ATCC43718 and Porphyromonasgingivalis W50. On day 8, the mouthwash also considerably decreased VSCs.Oral malodor may be lessened by LG mouthrinse, and it seemed to be secure. The mouthrinse met expectations in terms of overall pleasure. The mouthrinse'sflavour and spice level, however, require improvement.According to this study, oral malodor was greatly reduced by the LG mouthwash. Another alternative mouthrinse option for gingivitis, plaque, and bad breath prevention is this mouthwash (P. Satthanakul, 2014).

INSECTICIDAL AND REPELLENT ACTIVITY OF NATIVE AND EXOTIC LEMONGRASS ON MAIZE WEEVIL

The maize crop is one of the most significant agricultural crops since it is widely cultivated and easily adapted to the most diverse agroecosystems. Pest insects are notable in this crop because they result in losses both in the field and in storage facilities. Due to its well-known insecticidal activity and low damage to the environment, the application of essential oils can be a significant strategy worth investigating in the management of insects. The study's goal was to evaluate the insecticide and repellent properties of native and exotic lemongrass (Elionurus sp. and Cymbopogoncitratus, respectively) for the control of the maize weevil (Sitophilus zeamais (Mots., 1855, Coleoptera: Curculionidae). According to the CG-MS's chemical analysis of the oils, both native and alien lemongrass have a comparable chemical make-up, but the foreign species has a higher variety of chemicals. It is confirmed that an increase in the applied dose results in a decrease in the insect's exposure period before death occurs. Maize weevil mortality is effectively reduced by the essential oils of native and alien lemon grass. Both species' essential oils consistently shown their ability to repel. As a result, it can be claimed that both species are

capable of being utilised in the management of the maize weevil and can provide a different option for small-scale farmers and organic farming. (Radünz, A., 2024)

THE GROWTH CHARACTERISTICS, PHOTOSYNTHESIS, AND ESSENTIAL OIL PRODUCTION OF LEMONGRASS (CYMBOPOGONFLEXUOSUS (STEUD.) WATS) ARE IMPROVED BY STEAM-MEDIATED FOLIAR APPLICATION OF CATECHOL AND PLANT GROWTH REGULATORS.

Research has been done on the effects of foliar application of PGRs and elicitors on plant growth, yield, and essential oil production. An innovative steam-spray technique was used in place of a sprayer machine to see if we could boost lemongrass growth, yield, and EO production. At 90 days after transplantation (DAT), the leaves of lemongrass were steam-sprayed five times with 5 106 M of catechol and PGRs, namely Indole acetic acid (IAA), kinetin (Kn), 6-benzyl aminopurine (BAP), salicylic acid (SA), triacontanol (TRIA), and ethrel. To prevent the steam jet from harming the plants, the steam spray was conducted with a specified distance between the steam source and plant leaves. After being extracted using Clevenger's technique, lemongrass essential oil was analysed using GC-MS. At 150 DAT, all the parameters were examined. For the majority of the characteristics examined, the steam spray of SA and catechol showed to be the best. The application of SA increased the plant's fresh and dry weights by 26.1% and 43.4%, total chlorophyll and carotenoids content by 52.6% and 62.8%, and chlorophyll fluorescence (Fv/Fm) by 15.2% when compared to the control. Lemongrass essential oil's concentration (350%) and productivity (433.3%) were both greatly increased by catechol, however its proline content (25%) was lowered. The SA therapy increased the amount of neral and geranial, the active components of EO, by 65.7% and 59.6%, respectively. IAA treatment also produced promising values for the majority of metrics after SA and catechol (M. Masroor A. Khan, 2023)

ANTIMICROBIAL ACTIVITY, CYTOTOXICITY AND CHEMICAL ANALYSIS OF LEMONGRASS ESSENTIAL OIL (CYMBOPOGONFLEXUOSUS) AND PURE CITRAL

In this work, the antibacterial properties of lemongrass essential oil (C. flexuosus) and the cytotoxic effects of both test chemicals on human dermal fibroblasts were investigated. Disc diffusion was employed to screen for antimicrobial susceptibility. Four out of the five

Acinetobacterbaumannii strains showed signs of antimicrobial resistance, and two strains were identified as multi-drug resistant (MDR). All of the studied strains were sensitive to citral and lemongrass, with zones of inhibition ranging from 17 to 80 mm. Citral had a lower mean minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) than lemongrass, as assessed by the microtitre plate method (MIC: 0.65% and MBC: 1.0% v/v, respectively). Using human dermal fibroblasts (HDF; 106-05a), cell viability was assessed after exposure to both chemicals and a control (Grapeseed oil), and the IC50 was discovered to be 0.095% (v/v) for citral and 0.126% (v/v) for lemongrass. The viability of cells was unaffected by grapeseed oil. With the use of the LumaScope 500 imaging system, live cell imaging was carried out, and modifications in HDF cell morphology, including necrotic characteristics and shrinkage, were noticed. The potential for usage in the treatment of drug-resistant infections is highlighted by the ability of lemongrass essential oil (EO) and citral to inhibit and kill MDR A. baumannii; nevertheless, in vitro cytotoxicity does indicate that more research is necessary before in vivo or ex vivo exposure to humans (Adukwu, E.C., 2016)

PREVENTIVE EFFECT OF LEMONGRASS (CYMBOPOGONCITRATUS) AGAINST OXIDATION IN SOYBEAN OIL

The purpose of this investigation was to look at the antioxidant activity, total phenolic content, and flavonoid content of several lemongrass extracts (methanolic, ethanolic, and aqueous). The extract with the highest TFC, TPC, and antioxidant activity was used as a natural source of antioxidants to prevent oxidation of soybean oil by storage at 63 °C for 20 days at different concentrations (0.2 and 0.4%). Compared to other lemongrass extracts, the ethanolic extract (ET-lemongrass) demonstrated stronger antioxidant activity. The results showed a considerable rise in the acid value (AV), thiobarbituric acid level (TBA), and peroxide value (PV) for soybean oil's oxidative stability. However, compared to samples treated with antioxidants (both synthetic and natural), the iodine value (IV) in the untreated oil sample was significantly lower. Additionally, ET-lemongrass (0.4%) demonstrated extremely potent antioxidant activity that was somewhat comparable to both artificial (TBHQ) and natural antioxidants (ascorbic acid and quercetin) (Gazwi, H.S.S., 2020)

RESPONSE OF LEMONGRASS (CYMBOPOGONFLEXUOSUS) UNDER DIFFERENT LEVELS OF IRRIGATION ON DEEP SANDY SOILS

On deep sandy soils at the research farm of the Central Institute of Medicinal and Aromatic Plants, Lucknow, from 1991 to 1993, the growth, herbage, and oil production of East Indian lemongrass (Cymbopogonflexuosus) in response to various levels of irrigation water (IW) [0.1, 0.3, 0.5, 0.7, 0.9, 1.1, 1.3, and 1.5 times cumulative pan evaporation (CPE)] were assessed. In general, an increase in irrigation level led to a 0.7 IW:CPE ratio increase in plant height. Depending on the harvest season, irrigation amounts had different effects on lemongrass tiller production. Maximum tillers/clump were produced in response to irrigation levels of 0.9, 0.5, 0.7, and 0.7 IW:CPE ratio, respectively, during the second, third, sixth, and seventh harvests. Oil content had an inverse relationship with the levels of irrigation, specially during the 1st, 2nd, 5th and 6th harvests. Regardless of harvest season, yields of herbs and essential oils were noticeably greater at a ratio of 0.7 IW:CPE. The highest yields of oil (146.2 l/ha in the first year and 205.3 l/ha in the second year) and total herb (22.79 t/ha in the first year and 33.11 t/ha in the second year) were seen at a 0.7 IW:CPE ratio. The main chemical components (geraniol, citral-a, and citral-b) did not alter the oil's quality. At the ideal irrigation rate (0.7 IW:CPE ratio), lemongrass used 118.2 cm of water in the first year and 123.8 cm in the second. The second year's water use efficiency (1.66 l oil/ha-cm) was found to be higher than the first year's (1.23 l oil/ha-cm). On deep sandy soils in a subtropical environment, lemongrass needed 17 irrigations in the first year of harvest and 14 irrigations in the second year to reach its maximum output potential. During the dry winter and summer, irrigations were conducted (Singh, S.,2000).

A COMPREHENSIVE APPROACH TO CHITOSAN-GELATINE EDIBLE COATING WITH B-CYCLODEXTRIN/LEMONGRASS ESSENTIAL OIL INCLUSION COMPLEX — CHARACTERIZATION AND FOOD APPLICATION

A major forward in food packaging technology, biopolymer-based films offer an ideal matrix for the inclusion of active ingredients like antimicrobial agents. This gives active packaging a framework of green chemistry. utilising a different method, the chitosan-gelatine active coating was created utilising lemongrass oil as an antibacterial ingredient. To achieve compound compatibilization, -cyclodextrin was employed to encapsulate lemongrass oil rather than surfactants. On recently harvested cherry tomatoes that had been experimentally contaminated

with Penicilliumaurantiogriseum during 20 days of cold storage, the antimicrobial impact was evaluated using the dip-coating method. The application of the coating formulation was found to be very effective based on the mathematical assessment of the antimicrobial effect of coating formulation on cherry tomato samples using predictive kinetic models and digital imaging, where fungal contamination for active-coated samples was observed for 20 days (Tamara Erceg, 2023).

DIRECT SYNTHESIS OF LEMONGRASS (*CYMBOPOGONCITRATUS* L.) ESSENTIAL OIL-SILVER NANOPARTICLES (EO-AGNPS) AS BIOPESTICIDES AND APPLICATION FOR LICHEN INHIBITION ON STONES

When applied directly to destroy lichens, lemongrass essential oil has a number of drawbacks, including being ineffective, volatile, and inefficient. Because they are very erosive, lichens are a type of microorganism that develops in rocks and causes biodeteriorations of rock material. As a result, the objective of this study is to investigate the direct synthesis of lemongrass essential oil-silver nanoparticles (EO-AgNPs) for use as biopesticides and as a means of lichen lichen suppression on stones. This was done to enhance the efficiency and performance of biopesticides, which are very good at eliminating lichen on stone surfaces. However, it has a number of drawbacks, including poor economy, sluggish performance, and excessive volatility. Lemongrass essential oil was immediately mixed with AgNO3 powder to create the EO-AgNPs nanoparticles. The impact of changes in storage time on material stability and AgNO3 concentration was then observed. Before being put to the test for its efficiency in directly killing lichens on stones and its inhibitory activity, the synthesised substance was characterised by UV-Vis Spectrophotometer, FTIR, particle size analyzer (PSA), and SEM-EDX. The clear dark brown solution's colour in the 430 nm range was an indication from the results that the EO-AgNPs had been successfully synthesised. Additionally, EO-AgNPs had a particle size of 332 nm, were spherical, and contained 27.28, 57.98, and 14.74% of Ag, C, and O, respectively, after being examined by PSA and SEM-EDX. Based on the diameter of the inhibition zone (DIZ) utilising EO and EO-AgNO3, the antifungal activity for eliminating lichens was 14.7 mm and 20.3 mm, respectively. This demonstrates that EO-AgNPs nanoparticles have better inhibitory activity than EO and are capable of destroying lichens on rock surfaces (Riyanto, 2022).

LEMONGRASS - AN ANTICLASTOGENIC AGENT AGAINST ARSENIC

Since ancient times, Cymbopogoncitratus, often known as lemongrass and a common ingredient in Asian cooking, has been used for its medical benefits, including the relief of cough and nasal congestion. Groundwater poisoning from arsenic (As) has wreaked havoc on eastern Indian districts since the early 1980s. The environmental contaminant arsenic is known to induce liver damage, neurotoxicity, and an increased risk of skin, lung, bladder, and liver malignancies in humans. It is also a proven human carcinogen. It is believed that the inorganic arsenicals found in water are necessary for the beginning of carcinogenesis because they cause DNA damage and genetic instability. Many natural herbs that we regularly ingest in our diets have excellent anti-cancer chemopreventive qualities. The goal of the current investigation was to determine whether lemongrass extract may prevent chromosomal abnormalities caused by As. Our findings show that lemongrass extract, in especially Citral (60 mg/kg/b.w.), is efficient in reducing the clastogenicity of sodium arsenite, the most potent form of as in mice. These findings imply that including lemongrass in your diet may offer effective defence against the health catastrophe brought on by As (De, P., 2015).

EFFECT OF LEMONGRASS TEA IN A TYPE 2 DIABETES RAT MODEL

Africans frequently drink lemongrass (CymbopogoncitratusStapf) tea for nutrition and as a treatment for diabetic mellitus (DM). The current study's objective was to examine the anti-diabetic effects of lemongrass tea (LGT) in a rat type 2 diabetes (T2D) model. The LGT was made using the fructose-streptozotocin (STZ) animal model for T2D, boiled for 10 minutes in water, allowed to cool, and then given to the T2D rats at 0.25 or 0.5% (as needed) for 4 weeks. Comparing the LGT to the cold-water extract, the LGT revealed higher phytochemical concentrations. In comparison to the normal mice, the diabetic untreated animals showed significantly lower levels of serum insulin, -cell function (HOMA-), and liver glycogen, as well as significantly higher levels of serum glucose, lipids, and insulin resistance (HOMA-IR) index. These alterations were improved by oral LGT supplementation for 4 weeks equal to the metformin-treated group. According to the research, consumption of LGT provided outstanding anti-diabetic effects in rats using a T2D model, which can be attributable to the components' increased quantity (Garba, 2020)

BIOSYNTHESIS OF LEMONGRASS ESSENTIAL OIL AND THE UNDERLYING MECHANISM FOR ITS INSECTICIDAL ACTIVITY

The aromatic perennial grass known as lemongrass (Cymbopogonflexuosus) is grown extensively for its essential oil. The main component of lemongrass oil is a blend of several cyclic and acyclic bioactive monoterpenes. In this chapter, we studied the biochemistry of lemongrass oil as well as its biosynthesis. The mevalonate and non-mevalonate pathways for essential oil production in lemongrass, as well as how these pathways interacted with one another, were also explored. The pharmaceutical, cosmetic, food, and energy industries all have significant economic possibilities for lemongrass oil. Regarding the pharmacological qualities, lemongrass oil has been found to have a wide range of biological activities, including antibacterial, insecticidal, analgesic, and anticancer effects in addition to its effectiveness as an insect repellent. The analysis of the insecticidal properties of lemongrass oil and the mechanisms underlying this phenomenon was the focus of the later sections. It was found that in addition to having synergistic effects, various components of lemongrass oil can also cause specific neurotoxic and cytotoxic reactions in insects (Mukarram, M., 2021).

DETERMINATION OF ANTIBACTERIAL ACTIVITY OF VACUUM DISTILLATION FRACTIONS OF LEMONGRASS ESSENTIAL OIL

Terpenoids and phenylpropanoid molecules, which make up essential oils, are organic compounds with a variety of biological effects. Essential oils are frequently utilised in foods, cosmetics, and medicinal items because of their activity, but new applications of such combinations still rely on separation methods that can create molecules with certain standardised and reproducible compositions. The purpose of this research is to develop an antibacterial fraction of lemongrass essential oil that is effective against Salmonella choleraesuis, Pseudomonas aeruginosa, and Staphylococcus aureus. The samples were subjected to gas chromatography-mass spectrometry analysis, and the indirect bioautography method and minimum inhibitory concentrations were used to assess the samples' antimicrobial activity. It was discovered that vacuum distillation was a useful technique for getting different fractions with higher antibacterial activity. F3b, F3a1, F2, F3, and F1 were the fractions that responded the best to the three microorganisms studied, with F3a2 being the most successful and having the highest yield (Falcão, M.A., 2012).

CONCLUSION:

Lemongrass is very important medicinal plant.It contains not less than 75% of aldehydes calculated as citral. Lemongrass is indigenous to India and is found in Tin-nevelli, Travancore, and Cochin. It has various important activity such as antidiabetic, antimicrobial, expectorant,anti-inflammatory, preservative, insecticide and cosmetics. Since this plant is being used in India as well as various other countries since ancient time it become very important plants. Further research should be carried out to know about the various other species and phytoconstituents present in it.

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