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An Review On Therapeutic Application Of Eucalyptus Oil

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ABSTRACT:
Eucalyptus globulus a broadly located plant has a superb latent in time period of medicinal uses.Eucalyptus is an evergreen flowering tree and shrub. Eucalyptus globulus a plant from family Myrataceae, usually known as blue gum develops properly in Nilgiries, Annamalai, Palani and Shimala hills. It wealthy resources of phytochemical constituents which include flavonoids, alkaloids, tannins and propanoides. Which might be found in leafs, stems and roots of the plant. Different components of this plant are nutritionally very critical and therapeutically fairly precious due to unique chemical composition as its important oil contain esters, ethers, carboxylic acid, ketones, aldehydes, alcohols and hydrocarbons at the side of monoterpenes and sesquiterpenes. Phytochemical evaluation of this plant has found out that leaf oil include 1,eight-cineole, alpha-pinene, p-cymene, cryptone and and spathulenol. In comparison, vital oil extracted from buds, branches and culmination constituents alpha-thujene, 1,eight-cineole and aromadendrene determined to be potential anti-microbial, anti-fungal, analgesic and anti-oxidant agent of nature.

Keywords: Eucalyptus, phytochemical, therapeutics application

I. INTRODUCTION:

Eucalyptus grows quickly and many species grow quite tall. Eucalyptus is a large evergreen tree or shrub belonging to the Myrtaceae family. Although native to Australia and Tasmania, it has spread widely to other countries [1]. Nature has been a source of medicine for thousands of years. Plants have been used to treat disease for centuries, before the use of newer clinical drugs.

There are approximately 500 species of eucalyptus that produce essential oils. The demand for herbal products for therapeutic use has increased over the past decades. Aromatic herbs are used in primary health care in many countries around the world, especially in rural areas [2], and 80% of the population in developing countries use these traditional resources [3]. It is mainly grown in subtropical and Mediterranean regions [4]. and in Nigeria.

E.globulus has various local names (eucalyptus in Bengali and Hindi; blue gum in English and karpuramaram in Tamil[5]) and is widely used in the pulp industry as well as in the production of eucalyptus oil, eucalyptus oil is extracted on a commercial scale in many countries and used in perfumery, cosmetics, food, beverages, [aromatherapy and phytotherapy [6]. About 100 species of plants have been tested in India at various times and some of them have been cultivated [7]. This plant grows in the pits of the Nilgiris (5,000 to 8,300 feet), Annamalai and Palani hills in Himachal Pradesh, and Indian skinks [8].

Eucalyptus blueus has rich medicinal value and has a long history of popular use. The plant is said to have powerful antiseptic, astringent, deodorant, diaphoretic, expectorant, inhalant, anthelmintic, sedative and supportive effects [9,10]. Traditionally, eucalyptus leaves have been used to treat wounds and fungal infections.

1.1Scientific Classification:[34]

kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Dicotyledons
Subclass	Rosidae
Order	Myrtales

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Family	Myrtaceae
Genus	Eucalyptus
Species	Eucalyptus globulus labill

1.2 Major Species:[11]
There are over 500 species of eucalyptus. The major ones are enlisted below.

Major species of eucalyptus	Major species of eucalyptus
Eucalyptus amygdalina	Eucalyptus nitens
Eucalyptus australiana	Eucalyptus ovate
Eucalyptus botryoides	Eucalyptus pauciflora
Eucalyptus calophylla	Eucalyptus perriniana
Eucalyptus camaldulensis	Eucalyptus pilularis
Eucalyptus citriodara	Eucalyptus polyanthemos
Eucalyptus cladocalyx	Eucalyptus polybractea
Eucalyptus consideniana	Eucalyptus populnea
Eucalyptus cypellocarpa	Eucalyptus radiate
Eucalyptus dives	Eucalyptus regnans
Eucalyptus gigantean	Eucalyptus risdonni
Eucalyptus globulus	Eucalyptus robusta
Eucalyptusgomphocephala	Eucalyptus rossi
Eucalyptus grandis	Eucalyptus rostrata
Eucalyptus gunnii	Eucalyptus sideroxylon
Eucalyptusincrassate	Eucalyptus saligna
Eucalyptus kino	Eucalyptus smithii
Eucalyptus largeflorens	Eucalyptus tereticornis
Eucalyptus lesouefii	Eucalyptus tetrodonta
Eucalyptus macrorhyncha	Eucalyptus sieberiana

1.3 Vernacular Names:

It has many Indian names depending on the geographical region or language such as: EUCALYPTUS GLOBULUS (Latin name), Tail parn, sugandha patra (Sanskrit name), Gum tree, Gum eucalypt (English), Neelgir (Hindi), Nilgiri (Kannad), Haritparn (Gujarati).

1.4 Description:

The leaves are hard, drooping or vertically drooping, and are covered with glands that contain a fragrant volatile oil. The budding flowers are covered with a cup-shaped cover (from which the genus gets its name, derived from the Greek word for blue compound cover), which loses its nerve like cover as the bloom unfolds . The fruit is enclosed in a cup-shaped wooden container and contains a large number of small seeds.

1.5 Part Used Widely:
The oil of the leaves.

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1.6 Habitat:

Australia, North and South Africa, India and Southern Europe. The leaves are leathery, oblique or vertical, covered with glands, and the glands contain aromatic volatile oil. The budding flowers are covered with a cup-shaped mulch (from which the genus gets its name, derived from the Greek blue compound mulch), which is denervated into the mulch as flowering proceeds. The fruit is surrounded by a cup-shaped wooden receptacle and contains a large number of small seeds.

1.7 Morphological Characters:

The budding flower is covered with a cup-shaped limb (from which the genus got its name, from the Greek well-covered eucalyptus), which falls like a lid when the flower unfurls. The fruit is enclosed in a cup-shaped wooden container and contains many tiny seeds. The first leaves are broad, stalkless, shiny white-green, opposite and level, but after four or five years develop other sword-shaped leaves, 6-12 inches long, blue-green in color , they are alternated vertical and vertical, that is to say that the edges are turned towards the sky and the earth, the arrangement is more adapted to the climate and produces a unique light and shade.

Flowers solitary or grouped, almost stemless. A mature eucalyptus can be a low shrub or a very tall tree. These are the three main behaviors that species can be split into.

1.7.1.Woodland trees are single-stemmed even have a crown from a minor amount of the whole tree height.

1.7.2.woodland trees are singled-sremmed even though they may branch at a small space above ground level.

1.7.3.Mallees are multi-stemmed from position level, usually less than 10m (33 ft) in height.

Tree sizes follow the convection of:-

➢1.small-to 10m (33 ft) in height
➢2.Medium-sized -10-30m (33-98ft)
➢3.Tall -30-60m (98-197 ft)
➢4.Very tall –over 60m (200 ft)[35]

II. PHYTOCONSTITUENTS:

Eucalyptus essential oil used in medicine is obtained by hydrodistillation of fresh leaves. When properly prepared, it is a colorless or straw-colored liquid with a characteristic odor and taste, soluble in its own weight of alcohol. An important constituent is eucalyptus oil, present in E. globulus up to 70% of its volume [34]. The medicinal properties of red eucalyptus have been studied extensively.

Some of the reported constituents of tree plants include essential oils, sterols, alkaloids, glycosides, flavonoids, tannins, and phenols.

III. CHEMICAL CONSTITUENTS:

3.1. Chemical constituents of the leaves of eucalyptus globulus.

Essential oils are mainly composed of oxygenated monoterpenes, oxygenated monoterpenes and sesquiterpenes. Of these, 1,8-eucalyptus (72.71%) was alpha-terpene (2.54%), terpine-4-ol (0.34%) and linalool (0.24% are the main oxygenated monoterpenes, while α-eudesmol (0.39%), globulus (2.77%) and epilobulol (0.44%) are the main sesquiterpenes. Several important compounds are alpha-terpineol acetate (3.1%), geranyl acetate (0.71%), l-abethol (0.36%), beta-sabinene (0.25%) and terpinolene (0.19%).A fraction (0.26%) of the total composition remains undetermined [12].

3.2. Chemical constituents of the fruit of eucalyptus globulus.

Obtained and identified as β-sitosterol, betulinic acid, stigmasterol, sinapic acid, 2a-hydrogen betulinic acid, macrocarpine B, macrocarpal A, oleanolic acid 3,4,3-o-trimethyltannin 15 compounds such as 4-O floral acid -(2"-O-acetyl)-α-L-rhamnopyranoside, 3-O-methylmethylene acid, ellagic acid and gallic acid[13].

3.3. Chemical constituents of the wood of eucalyptus globulus.

Obtained and identified as β-sitosterol, betulinic acid, stigmasterol, sinapic acid, 2a-hydrobetulinic acid, macrocarbin B, macrocarbin A, oleanolic acid 3,4,3-o-trimethyltanin 4-O-(2"-O-acetyl)-α-L-rhamnopyranoside, 3-O-

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methylmethylene acid, ellagic acid and gallic acid[13] .

IV. THERAPEUTIC APPLICATION:

4.1. Air Freshners

Most eucalyptus oils are used in aromatherapy lamps, electric diffusers, and nebulizers. To make a simple spray, dilute about 50-100 drops of essential oil in 4 fl oz (120 ml) of purified water. Spray to freshen and purify the air [37].

4.2. Antiseptic

Medicinal eucalyptus oil is probably the strongest antiseptic of its kind, especially after aging, as it forms ozone there when exposed to air. It determines the disinfection effect of killing lower life forms [15].

4.3. Antimalarial

Its antiseptic confer some antimalarial action, though it cannot take place of Cinchona[16].

4.4. Antifungal

Treatment of human facial demodicosis with freshly prepared camphor oil (eucalyptus oil) with or without glycerol dilution resulted in complete cure at 100%, 75%, and 50% concentrations. Eucalyptus eucalyptus leaf extracts and oils showed antifungal properties by progressively inhibiting the growth of Malassezia furfur on Sabouraud agar medium [17].

4.5. Antibacterial

A 50% EtOH extract of eucalyptus eucalyptus leaves yielded eight phloroglucinol-sesquiterpene-related compounds, including three new compounds named macrocarpal, H, I, and J. Some of these compounds had antimicrobial activity against microorganisms oral pathogens with MIC values ranging from 0.20 µg/ml to 6.25 µg/ml. Obtain 50% EtOH soluble material from dried E. coli leaves small ball. Using the broth dilution method, the extract showed significant antibacterial activity against S. Mutans Ingbritt & P. gingivalis ATCC 33277 (MIC 12.5 and 6.25 µg/ml, respectively) [18].

4.6. Cytochrome p450 enzymes inhibitor

Eucalyptus oil (Eucalyptus globulus), is identified as inhibitor of six major cytochrome P450enzyme with IC (50) values between 20 and 1000µg/MI[19].

4.7. Allergy

Eucalyptus is used in many of allergies[36].

4.7.1.Bronchitis: A nagging cough that lingers and causes difficulty in breathing is often jsymptomatic of bronchitis.

4.7.2.Congestion: Congestion in the airways, lungs, sinus and chest makes breathing difficult and being sick even more miserable.

4.7.3.Sinus: The cold that linger may not be just a cold. The congestion and headache may be sings of a sinus infection.

4.7.4.Asthma: Eucalyptus has been shown to help ease breathing in asthma.

4.8. Antitumor

Antitumor-promoting activity of Euglobals Ia1, Ia2, Ib, Ic, IIa, IIb, IIc, III, IVa, IVb, and V andVII was tested in vitro on 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced Epstein-Barrvirus early antigen (EBV-EA) activation test system. Euglobal-III showed strong inhibitoryactivity, followed by euglobals Ib, IIa, Ic, Ia1, Ia2.Eucalyptus globulus oil inhibits the nucleartranslocation of NF-kappa B induced by LPS in THP-1 cells[20].

4.9. Antihistaminic

Hexane extract of leaves, ethanol extract of fruits & leaves of Eucalyptus globulus inhibited IgEdependent histamine release from RBL-2H3 cells[21].

4.10. Anti-inflammatory

1, 8-cineole, major constituents present in violate oil of Eucalyptus airway inflammation inbronchial asthma and other steroid-sensitive disorders[22].

4.11. Hepatoprotective

Ursolic acid isolated from the leaves of Eucalyptus hybrid E.tereticomis showed a dosedependent (5-20 mg/kg) hepatoprotective activity (21-100%) in rats against thioacetamide,galactosamine and carbon tetrachloride induced hepatotoxicity in rats [23].

4.12. Anticancer

Phlorogrucinol-monoterpene derivative, euglobal-G1 (EG-1), was obtained from the leaves ofEucalyptus grandis as an active constituent inhibited the promotion stages on two-stagecarcinogenesis induced by both TPA-type & non TPA-type promoter (fumonisin B 1) andinhibited the pulmonary tumorigenesis induced

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by 4-NQO & glycerol. Therfore, EG-1 might bevaluable as a chemo protective agent in chemical carcinogenesis [24].

4.13. Irritant action and parasitic Infection

In large doses, it acts as an irritant to the kidneys, by which it is largely excreted, and as amarked nervous depressant ultimately respiration by its action on the medullary center. Inveterinary practice. Eucalyptus oil is administered to hores in influenze, to dogs in distemper, toall animals in septicemia. It is also used for parasitic skin affections [25].

4.14. UTI and RTI Infection

An emulsion made by shaking up equal parts of the oil and powdered gum-arabic with water hasbeen used as a urethral injection, and has also been given internally in draxhum doses inpulmonary tuberculosis and other microbic diseases of the lungs and bronchitis [25].

4.15. Spasmodic action

In croup spasmodic throat troubles, the oil may be freely applied externally[25].

V. EXTRACTION PROCESS OF EUCALYPTUS OIL

The extraction method of essential oil can be divided into two categories, conventional andmodern methods. The conventional method includes hydro-distillation, steam distillation, andextraction using solvents. The modern method includes supercritical fluid extraction, microwave-assisted hydro-distillation, and ultrasound-assisted extraction.

5.1. Hydro-distillation

This method is a traditional extraction method used for essential oil. In this method, the essentialoil is evaporated by heating a mixture of water and material or with other solvents, then thevapor is liquefied in the condenser. The result then flows into a separate room in which therewill be separated into essential oil and water. This method is quite simple, it can be used in eithera small or big scale, can avoid chemical content loss due to the long extraction process, andsaves energy used. In eucalyptus essential oil extraction, 15 grams of sample was immersed in300 ml water and distilled for 5 hours. The oil extracted by hydro-distillation contained volatilecompounds while the oil from SFE and soxhlet contained volatile and higher molecular weightcompounds. The Eucalyptus oil yield from 3.1 at 1 h to 3.8% at 5 h of hydro-distillationextraction[26].

5.2. Steam distillation

This method is a standard method used for temperature-sensitive materials (such as oil, resin,hydrocarbon, and many others), insoluble in water, and can decompose at its boiling point. Themechanism of this method is separation compound or a mixture of the compound at the boilingpoint below the boiling point of the compound (close to the boiling point of water, 100oC atatmospheric pressure) so that the volatile components whose boiling point of 150 to 300 ° C canbe evaporated at the water temperature. Water vapor is passed to the material that will bedistilled without immersing the material in water. Furthermore, the compounds included in thewater vapor enter the condenser and then are separated for its water and essential oil compound.
The essential oil that has been cooled and returns to liquid comes down from the condenser andis collected in the container under it, called a separator. In this separator flask, the water andessential oil gather with the position of the essential oil is floating on the water. Eucalyptusglobulus' essential oil extraction, generally, uses this method. The part used in the process is afresh or dry leaf with oil yields 1.0% - 2.4% (fresh weight) using fresh or dry leaf[27].

5.3. Solvent extraction

Solvent extraction, liquid-to-liquid separation, is a separation method based on solubility.Solvent extraction is commonly used in the processing of perfumes, vegetable oils, or biodiesel.Solvent extraction is used for soft texture or fragility plants, sensitive to heat, and large quantitiesof essential oils with low cost. E. Globulus leaves were cleaned, air-dried for 4 days until theaverage humidity is around 9%, then ground, sieved to pass 0.5mm, and packed in sealed plasticbags. Eucalyptus leaves were extracted in an orbital shaker with temperature control usingaqueous ethanol as solvent. Two grams of leaf powder then put in 100ml erlenmeyer using asolid/liquid ratio of 1:20 g/mL then a shaking speed of 120 rpm. The extract was filtered usingfilter paper under vacuum, and the filtrate obtained will be analyzed. The results extractionranged from 24.4 to 33.1% [28].

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5.4. Supercritical fluid extraction

Supercritical Fluid Extraction (SFE) refers to a separation process of a component from thematrix using supercritical fluid as the extraction solvent. The extraction was usually from a solidmatrix or liquid. In general, the supercritical fluid used CO2, but it was modified by the additionof other solvents like ethanol or methanol .E. Globulus leaves were air-driedfor two days and bydrying the samples in the oven set at 103◦C for 5 h. Then, the samples were ground with a knifegrinder and the ground sample was sieved using a sieve shaker. Five g of eucalyptus leaves wereweighed and put in the SC CO2 extraction vessel. Installing glass wool at both ends of theextractor to prevent the entry of the substrate. The flow rate of gas CO2 was set at 2 L/min in allruns. Results extract included in the amber bottle, the bottle was placed in an ice bath fordynamic extraction step, which can also function in minimizing the loss of volatile compoundsdue to the sublimation of CO2. Then put in a rotary evaporator and conducted weighing theextract. The extraction E.globulus with this method at pressure (350 bar), temperature (80 C)and flow rate of CO (12 g min-1) gave the highest percentage yield (3.6%) compare with hydrodistillation, solvent extraction, and ultrasonic-assisted extraction method[29].

5.5. Microwave-assisted hydro-distillation

Microwave-Assisted Hydro-distillation is the hydro-distillation technique through a microwaveoven during the extraction process. This method successfully reduced the required time andsolvent volume of the extraction, minimized the environmental impact by releasing less CO2 inthe atmosphere, and required less energy. Extraction of essential oil from E. globulus leaves withthis method at the ratio of raw materials to water is 1:3 mL/g, with 60 min in extraction time, and450W microwave power can give yield 2.65 mg/L (ground material) with the main ingredients ofessential oils were Eucalyptol (38.771%)[30].

5.6. Ultrasound-assisted extraction

Ultrasound-assisted extraction was defined as the extraction method which producing high-valuecompounds. This method was beneficial for extracting the essential oils, especially from flowers,leaves, or seeds[31].Although requires a high price, this method increases yield in a shorter time.The research was done by revealed that the yield produced by this method on Eucalyptusglobulus leaves was higher than the hydro-distillation and extraction method a (2.2%) withimportant compounds extracted are aliphatic saturated hydrocarbons, organic acids, and esters.

VI. FORMULATION DEVELOPMENT OF EUCALYPTUS OIL

Microemulsion For Intranasal Delivery

Migraine headaches appear to be caused by complex interplay of neurologic and vascularchanges and show waves of neurologic changes in brain. Essential oils like eucalyptus oil andpeppermint oil have been used for aromatherapy for the treatment of migraine. The major activeingredient of eucalyptus oil is cineole that has soothing, stimulant and antidepressant effect.Microemulsions have a much greater solubilizing capacity for non-polar organic compoundsthan aqueous micellar solutions and hence attempts are made to develop microemulsion ofeucalyptus oil for intranasal delivery.

6.1. Materials and method

Eucalyptus oil, Tween 80, Span80 and PEG400, NASAL SPRAY PUMPS

6.2. Formulation development of eucalyptus of eucalyptus oil microemulsions

Eucalyptus oil microemulsions were prepared by combining hydrophilic and lipophilicsurfactants namely Tween80, Span80 and Cosurfactant PEG400. Glycerin was added in theformulations as it acts as humectant for nasal formulations.

6.3. Phase solubility studies and microemulsion formulations

The pseudoternary phase diagrams of oil, surfactant, cosurfactant and water were constructedusing water titration method. For solubilty studies, the ratio of oil to the surfactant/cosurfactantmixture (Smix) was varied from 1:9-9:1 (w/w). water was added drop wise to the oil-Smixmixture under vigorous stirring to form a clear and transparent microemulsion.

6.4. Evalution of optimized microemulsion of eucalyptus oil

The optimized formulation was evaluated for parameter like clarity, viscosity, ph, particle sizeand stability. Eucalyptus oil content was determined by HPTLC method.

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6.5. HPTLC method development for analysis of eucalyptus oil informulationsFormulation equivalent to 25 mg of eucalyptus oil was accurately weighted and dissolved in 2.5ml of methanol. The HPTLC scan of eucalyptus oil was developed on camag linomat IV usingprecoated silica gel G254 plates using benzene:ethylacetate (90:10) as mobile phase. The spotswere developes with vanillin-conc.sulphuric acid as spraying agent and the plates were scannedat 540 nm. The method was validated for linearity, accuracy and reproducibility.[32,33]

VII. ANTIMICROBIAL ACTIVITY:

The essential oil was tested against 11 microorganisms including Aspergillus niger ATCC 16404, Candida albicans ATCC 10231, Pseudomonas aeruginosa ATCC 27853, Bacillus subtilis ATCC 6633, Staphylococcus aureus ATCC 29737, Escherichia coli ATCC 10536, Klebsiella pneumoniae ATCC 10031, Staphylococcus epidermidis ATCC 12228, Shigella dysenteriae PTCC 1188, Proteus vulgaris PTCC 1182 and Salmonella paratyphi-A serotype ATCC 5702. All were provided by Iranian Research Organization for Science and Technology (IROST). Bacterial strains were cultured overnight at 37°C in nutrient agar (NA) and fungi were cultured overnight at 30°C in sabouraud dextrose agar (SDA).

7.1. Disk diffusion assay

The in vitro antimicrobial activity of samples was evaluated by the disk diffusion method (NCCLS).[37] The dried plant extracts were dissolved in DMSO to a final concentration of 30 mg/mL and filtered using 0.45 µm millipore filters for sterilization. Antimicrobial tests were carried out using the disk diffusion method[38] and employing 100 µL of suspension containing 108 CFU/mL of bacteria, 10 6 CFU/mL of yeast and 10 4 spore/mL of fungi spread on the NA, SDA and potato dextrose (PD) agar mediums, respectively. The disks (6 mm in diameter) impregnated with 10 µL of the essential oil, a commercial sample of 1,8-cineole or the extract solutions (300 µg/disk) and DMSO (as negative control) were placed on the inoculated agar. The inoculated plates were incubated for 24 h at 37°C for bacterial strains and for 48 and 72 h at 30°C for yeast and mold isolates, respectively. Gentamicin (10 µg/disk) and rifampin (5 µg/disk) were used as positive controls for bacteria and nystatin (100 IU) for fungi. The diameters of inhibition zones were used as a measure of antimicrobial activity and each assay was repeated two times.

7.2. Microwell dilution assay

MIC values were measured by microwell dilution assay method.[39] The inoculum of the microbial strains were prepared from 12 h broth cultures and suspensions were adjusted to 0.5 McFarland standard turbidity. The samples were dissolved in 10% DMSO and diluted to the highest concentration (500 µg/mL) to be tested, and then serial twofold dilutions were made to a concentration ranging from 7.8 to 500 µg/mL in 10 mL sterile test tubes containing brain heart infusion (BHI) broth for bacterial strains and sabouraud dextrose (SD) broth for yeast. The 96-well plates were prepared by dispensing 95 µL of the culture media and 5 µL of the inoculum into each well. A 100-µL aliquot from the stock solutions of the plant extracts initially prepared at the concentration of 500 µg/mL was added into the first well. Then, 100 µL from their serial dilutions was transferred into six consecutive wells. The last well containing 195 µL of the culture media without the test materials and 5 µL of the inoculum on each strip was used as the negative control. The final volume in each well was 200 µL. Gentamicin and rifampin for bacteria and nystatin for yeast were used as standard drugs for positive control in conditions identical to tests materials. The plates were covered with sterile plate sealers. Contents of each well were mixed on plate shaker at 300 rpm for 20 s and then incubated at appropriate temperatures for 24 h. Microbial growth was determined by the presence of a white pellet on the well bottom and confirmed by plating 5 µL samples from clear wells on NA medium. The MIC value was defined as the lowest concentration of the plant extracts required for inhibiting the growth of microorganisms. All tests were performed in duplicate.

7.3. Minimum inhibitory concentration agar dilution assay

MIC values of 1,8-cineole for the fungus isolate sensitive to it were evaluated based on the agar dilution method.[40] Appropriate amount of this compound was added aseptically to sterile, molted SDA medium containing tween 20 (0.5%, v/v) to produce a concentration range of 7.8-500 µg/ml. The resulting SDA agar solutions were immediately mixed and poured into petri plates. The plates were spot inoculated with 5 µL (104 spore/mL) of fungus isolate. Nystatin was used as reference antifungal drug and the inoculated plates

were incubated at 30°C for 72 h. At the end of the incubation period, the plates were evaluated for the presence or absence of growth. The MIC was defined as the lowest concentration of the compound needed to inhibit the growth of microorganisms. Each test was repeated at least twice.

VIII. CONCLUSION:

Eucalyptus globulus has been known since decades because of its rich ethanomedicinal and therapeutic importance. Various phytochemical isolated from the plant has been well accepted to possess various therapeutics effects. A variety of eucalyptus species have also been widely studied for their various therapeutic activities, like Analgesic, Antiviral, Anti-inflammatory, Antibacterial, Antidiabetic, Antioxidative, Antitumor, Antihistaminic, Anticancer and hepatoprotective properties. In present review, we have made an attempt to congregate the description, phytochemical, therapeutics application and information on Eucalyptus species.

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