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Formulation and Evalution of Polyherbal Emulgel for the Treatment of Antifungal Activity

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ABSTRACT:- Interest in natural and herbal alternatives has increased as a result of the growing incidence of fungal infections and growing worries about the adverse effects of synthetic antifungal medications. In this work, an antifungal herbal emulgel formulation is developed, with the primary active pharma ceuticaling redients (APIs) being Aloevera (renowned for its calming and anti-inflammatory qualities) and Andrographis paniculata (often referred to as the "King of Bitters").The purposeofthis mixture istotreat superficial fungal infections with a natural, safe, and effective alternative.

Formulation Design: A gel matrix and an emulsion-based technology were used to create the emulgel formulation. The formulation's main components were Aloe vera gel and Andrographis paniculata extract, which was standardized to contain a specified amount of andrographolide. Proper emulsifiers, stabilizers, and gelling agents were used to form the emulsion (oil-in-water), which increased the APIs' spreadability and skin penetration. The final formulation was refined to provide the desired release profile, spreadability, and viscosity.

Because of its well-established antifungal properties, especially against dermatophytes and Candida species, Andrographispaniculata was employed. Andrographolide, which has strong antifungal, antibacterial, and anti-inflammatory qualities, is abundant in the extract.

Aloe vera, a versatile herbal ingredient, was chosen for its soothing**,** moisturizing, and anti-inflammatory effects**,** enhancing skin healing and providing relief from symptoms associated with fungal infections like itching, redness, and inflammation.

Keywords: Antifungal emulgel**,** Andrographispaniculata**,** Aloevera**,** Herbal formulation

I. INTRODUCTION:-

People are suffering from many age groups of different types of illnesses occur in health and wells. The route of administration depends on the type and severity of the disease.

Localized pathways are generally preferred for skin diseases. Top based drug delivery systems improve bioavailability, reduce side effects, more uniform plasma levels, longer duration faction, leading to reduced dosage frequency and improved treatment until the end of the dosage of the agent. Topical drug collection systems have fewer side effects than oral drugs and additions. This is a replacement for those who are not. Local drug delivery systems cannot reach high drugs in the blood or in the plasma.

This system cannot be developed if medicines or words tend to cause irritation to the skin Topical drug delivery systems can be defined as the use of drugs containing skin preparations to directly treat skin disorders. Topical drug delivery systems are commonly used in the administration of other routes (oral, sublingual, rectal, parental) medications, or for the administration of local skin infections, such as fungal infections. The main advantage of a local tax system is to avoid initial path metabolism. Distribution of topical drugs is the easiest and easiest way to pay localized drug collection anywhere in the

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body via routes as ophthalmology, rectal, and vaginal skin Skin diagrams and skin layers and other components are shown Aloevera damages the membranes of fungal cells and aids in healing. The compound andrographolide, derived from Andrographis paniculata, attaches to fungal enzymes, which hinders their growth and reproduction. Thanks to the emulgel base, the drug penetrates deeply into the skin and is released gradually, which enhances therapeutic efficacy.

II. METHODOLOGY:-

1. Selection of Drug and Excipients

- **Drug:** Based on solubility, stability, and therapeutic need (commonly anti-inflammatory, antifungal, or analgesic drugs).
- **Excipients:**
  - **Oils (lipidphase):** e.g., is opropylmyristate, liquid paraffin.
  - **Emulsifiers:** e.g., Span20, Tween 80 (for oil-in-water emulsions).
  - **Gelling agents:** e.g.,Carbopol934,HPMC.
  - **Preservatives:** e.g., methylparaben, propylparaben.
  - **Penetration enhancers:** e.g., propyleneglycol, ethanol.
  - **pH adjusters:** e.g., triethanolamine.

2. Preparation of Emulgel

A. Preparation of the Emulsion

1. Oil Phase Preparation:

- Dissolve oil-soluble components and drug in the oil phase.

2. Aqueous Phase Preparation:

- Dissolve water-soluble components in the aqueous phase.

3. Emulsification:

- Mix both phases at 60–70°C with continuous stirring to forman oil-in-water (O/W) emulsion.

B. Preparation of Gel Base

- Disperse gelling agent (e.g.,Carbopol934) indistilled water.
- Allow to swell over night or stirtohydrate completely.
- Adjust pH with triethanolaminet of ormagel.

C. Incorporation of Emulsion into Gel Base

- Mix the emulsion with the gelbase slowly with gentle stirring to form a uniform emulgel.

3. Evaluation of Emulgel

A.Physical Evaluation

- **Appearance:**Color, consistency, homogeneity.
- **pH:** Measured using a digital pH meter (idealrange:5.5–6.5).
- **Viscosity:** Measured using a Brook field viscometer.
- **Spreadability:** Measured by the time taken to spread a known weight between two glass slides.
- **Extrudability:** Ability of the emulgel to be extruded from the tube.

D. Stability Studies

- Conducted asper ICH guidelines(e.g.,40°C/75%RH).
- Observe changes in color, consistency, pH, and drug content overtime.

III. LITRATURE REVIEW :-

1. **M Shilpa et. al. (2020)[1].**The present study aimed to evaluate the in vitro antimicrobial activity of ethanolic extracts of aloe vera leaf and gel against Candida albicans. Materials and methods: Fresh leaves were gathered from aloe vera plants that grow naturally in Coorg. The gel and leaf of the aloe vera plant were separated, then extracted using 95% ethanol in a rotary shaker at a constant temperature for three days. The extract was evaporated using a heating mantle and stored in screw-cap test tubes at 4°C for further analysis. The antifungal efficacy of aloe vera leaf and gel extracts against C.albicans was evaluated using the well diffusion method. Additionally, gel extracts of aloe vera at various dilutions (500, 400, 300, and 200 µL) were created, and the turbidity was assessed.

2. **Kalit, et. al.(2024)[2].** Research has been conducted on Andrographis paniculata, commonlycalled the king of bitters, regarding its potential as a natural fungicide because of its various bioactive compounds, such as andrographolides. This study aimed primarily to show the potential effectiveness of A. paniculata against various fungal diseases, based on the characteristics of A. paniculata extracts that could serve as a bio-fungicide. The presence of alkaloids, flavonoids, phenols, terpene derivatives compounds, and other phytochemical constituents makes the A. paniculata extract more precise in its mode of action against the variety of phytopathogenic

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fungi During storage, various physiological and biochemical changes in crops can lead to unintended physiological issues, degradation, and subsequent financial losses. To manage plant diseases triggered by phytopathogenic fungi, synthetic fungicides have been utilized.

3. **Jeyasakthy Saniasiaya et.al.(2017)[3].**Aloebarbadensis miller, also knownas Aloe vera, has been utilized for therapeutic purposes since ancient times, with antifungal activity recognized as one of its medicinal properties. A pilot study was carried out to assess the antifungal effects of Malaysian Aloe vera leaf extract onotomycosis species such as Asper gillusniger and Candidaal bicans. Methods This prospective study, which was conducted under laboratorycontrol, tookplace at UniversitiSains Malaysia. Using theSoxhlet extraction method, extracts from Malaysian Aloe vera leaves were prepared inethanol and solutions. Using the well-diffusion method, Sabourauddextroseagar that had been cultured with the two fungal isolates was inoculated with five different concentrations of each extract (50 g/mL, 25 g/mL, 12.5 g/mL, 6.25 g/mL, and 3.125 g/mL). The zone of inhibition was measured, and then the minimum inhibitory concentration (MIC) was determined

4. **P Danish et. al.(2020)[4].** Aloe vera is a widely recognized medicinal plant utilized for various therapeutic purposes. It is of course made up of various beneficial compounds that can be employed in treating numerous illnesses. This plant contains several active compounds, including saponins, sugar, enzymes, vitamins (both fat-soluble and water- soluble), aloesin, aloeemodin, aloin, acemannanaloemannan, aloeride, methylchromones, flavonoids, naftoquinones, sterols, minerals (including simple/complex sugars), anthraquinones, amino acids, lignin and salicylic acid. Additionally, it includes various other substances such as organic acids and phenolic compounds. This study examines the antibacterial and antifungal effects of aloevera against various strains of bacteria and pathogenic fungi

5. **Saurabh D.Bahekaret. al. (2020)[5]**.This study aimed to create and assess an antifungal herbal gel for candidiasis treatment, utilizing extracts from aloe vera and betel leaves. Herbal remedies are now commonly utilized for both therapeutic and commercial purposes. The herbal plant-based antibacterial gel is more effective than synthetic medications and causes fewer side effects. Aloevera is part of the Asphodelaceae family, which contains Aloe barbadensis as well. The betel leaf is a species within the Piper betle L. family of Piperaceae. It has also been demonstrated that products made from betel leaf and aloe vera, including plant branches, roots, and leaves, are rich in phytochemicals. Aloe vera and betel leaves are the most popular herbs for treating fungal infections, as they possess strong anti-inflammatory, antibacterial, and antifungal properties.

6. **Tuan Noorkorina et.al(2018)[6]**The herbal plant Andrographis paniculata(AP) is said to have multiple pharmacological properties, including that of antifungal agents. This study aims to develop and assess a gel that includes an ethanol extract from AP regarding its description and topical antifungal efficacy against superficial my coses. The gelling agent utilized was entirely petroleum jelly (100%). In the present study, the different concentration of the AP ethanol extracts were homogenized with petroleum jelly for the formulation of gel.

Advantages of Emulgel:-

1) Avoidance of the systemic adverse effects of drugi.e. first pass metabolism in the body
2) Systemic circulation is minimized or prevented
3) Improve patient compliance and acceptability
4) Ability to easily terminate medication when needed
5) Can easily pass through skin having dual behaviori. e. hydrophobic as well as hydrophilic
6) They are convenient to apply on hairy skin due to absence of greasiness and lack of residues upon application
7) Better stability and release of drug
8) Production possibilityand low preparation cost
9) No intensive sonication needed
10) Emulgel can be used to prolong the effect of drugs having shortert1/2

Aim and Objectives:-

1. Selection and Authentication of Herbs
2. To identify and select medicinal plants with documented traditional use or scientific

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evidence of antifungal properties relevant to common fungal skin infections

3. To procure and authenticate the selected plant materials to ensure correct species and quality.
4. To Prepare efficient Soxhlet extraction method to extract the antifungal constituents from the selected herbs using appropriate solvents.
5. To perform preliminary phytochemical screening of the extracts to identify the presence of relevant classes of compounds.
6. To select suitable ingredients (oils, emulsifying agents, gelling agents, penetration enhancers, preservatives) compatible with the herbal extracts and suitable for topical delivery.
7. To formulate a stable emulgel base by combining the emulsion and gel phases.To incorporate the polyherbal extracts into the emulgel base at various concentrations to create emulgel formulations.

Emulgel Formulation:-

Preparation of emulgel comprises of simple and short steps which increase feasibility of the production. There are no specialized instruments needed for the production of emulgel.

Moreover, materials used are easily available and cheap. All these; decrease the production cost of emulgel. The rheological properties and the breakdown behavior of gels filled with emulsions droplets can be varied by changing the interactions between oil droplets and gel matrix, the oil content and the oil droplet size

Flow Chart Showing Preparation of Emulgel:-

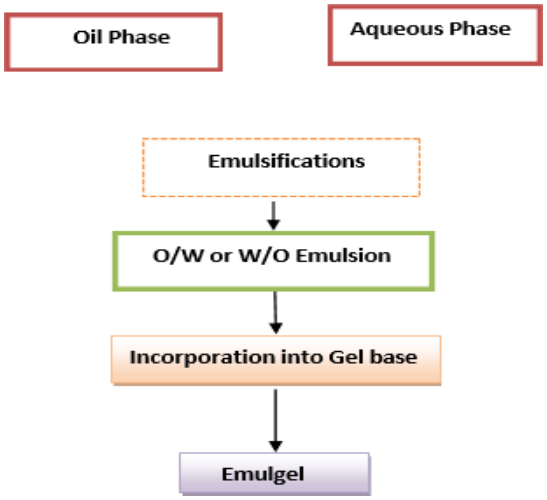

Fig1- FlowChart Showing Preparation of Emulgel

Formulation table :-

Ingredients	**F1**	**F2**	**Role**
Andrographis paniculata	2ml	2ml	API
Aloevera	2ml	2ml	API
Carbopol	3000mg	6000mg	Gellingagent
Propyleneglycol	5ml	5ml	Humectant
Methanol	5ml	5ml	Solvent
Propylparaben	0.01mg	0.01mg	Preservative
Methylparaben	0.03mg	0.03mg	Presentative
Almondoil	7ml	7ml	Oilphase
Triethanolamine	1.2ml	1.2ml	Neutrilizing agent
Tween 80	0.5ml	0.5ml	Emulsifying agent
Water	QS	QS	Solvent

Table1–Formulation Table

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Herbal Ingredients:-

1) Andrographis Paniculata:-

Fig2-Andrographis Paniculata

Andrographis paniculata, a plant commonly used in traditional medicine, has shown promising antifungal properties. Studies have demonstrated its effectiveness against various fungal strains including those responsible for skin infections.[7]

The plant's extracts, particularlythe dichloromethane and methanol extracts, have exhibited significant antifungal activity against pathogenslike Microsporumcanis, Candida albicans, and Aspergillus niger. The isolated compounds, such as 14- deoxy and rographolide, have shown potent antifungal effects, with minimum inhibitory concentrations (MICs) as low as 50 µg/mL. Andrographolide, a natural diterpene lactone found in Andrographis paniculata, has also been shown to inhibit Candida spp. biofilm formation and eradicate mature biofilms.[2] This compound's antifungal properties make it a potential candidate for treating fungal infections, particularly those resistant to conventional antifungals. Overall, Andrographis paniculata and its isolated compounds demonstrate significant antifungalactivity, making them a valuable area of research for the development of new antifungal agents.

Pharmacological Activity:

Demonstrates broad-spectrum antimicrobial properties, which encompass antifungal effects. Andrographolide hindersthe growth of fungi by interfering with the synthesis of their cell walls and triggering apoptosis in fungal cells. Demonstrates robust activity against species of Candida albicans, Aspergillus, and Trichophyton.

2) Aloevera:-

Fig 3-Aloevera

Aloe vera, aplant widelyused intraditional medicine, has been shown to possess antifungal properties. Aloe vera extracts have been shown to inhibit the growth of various fungal strains,

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including dermatophytes and yeasts.[8]

Antifungal Compounds:

1. Aloe-emodin: Aanthraquinone compound with antifungal activity against various fungal strains, including Candida albicans.
2. Aloin: A glycoside compound with antifungal properties, effective against fungi like Aspergillus niger and Penicillium expansum

Pharmacological Activity:
Includes anthraquinones, aloin, saponins, and glucomannans that exhibit antibacterial, antifungal, and antiviral effects.
Improves wound healing through the stimulation of collagen synthesis and fibroblast proliferation.
Hydrates and calms the skin—perfect for dermaluse.

Chemicaltests of extract:-

1) Aloevera

test	**Inference**	**Result**
1)Mayerstest	Brownppt	+
2)ferricchloridetest	Purplecolour ppt	+
3)leadAcetatetest	Yellowppt	+

Table2 –chemical test of Aloevera

2) Andrographis Paniculata

test	Inference	Observation
1)Mayerstest	Yellowish–whiteppt	+
2)ferricchloridetest	Purplecolour complex	+

Table3 -chemicaltest ofAndrographis Paniculata

Fig4-Chemicaltests of Aloevera

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Fig 5-Chemical tests of Andrographis paniculata

EVALUATION OF EMULGEL:-

To make sure the formulation is stable, safe, and effective, a number of factors must be evaluated when evaluating an emulgel that contains Andrographis paniculata and Aloe vera as the active pharmaceutical ingredients (APIs). This is a thorough assessment test that covers a number of parameters that are commonly examined for these formulation. [9]

1. Physical Appearance Evaluation:-

Objective: To assess the color, texture, clarity, and homogeneity of the emulgel

TestParameter	Method	Observations
Color	VisualInspection	greenish
Texture	FeelTest	Smooth,gritty,thick
Homogeneity	Visual and Microscopic	Homogenious
Clarity	VisualInspection	opaque

Table 4-Physical Appearance Evaluation

2. pH Measurement:-

Take a sample of the emulgel(5g) and dilute with 10mL of distilled water. Measure the pH of the solution.

pH Range for Emulgels:

1. Skin pH: The pH of the skin is slightly acidic, ranging from 4.5 to 5.5.
2. Emulgel pH: The pH of anemulgel should be close to the skin's natural pH to avoid irritation and ensure optimal absorption.

pHAdjustment:

pH Adjusters:

1. pH adjusters, such as citric acid or sodium hydroxide, used to adjust the pH of an emulgel to a desired range.
2. Buffering Agents: Buffering agents, such as phosphate buffers, used to maintain the pH of an emulgel within a specific range.

pH stands for "potential of Hydrogen" or "power of Hydrogen." It is a scale used to specify the acidity or basicity (alkalinity) of an aqueous (water-based) solution.[10]

- The pH scale ranges from 0 to14.
  - pH<7:Acidic solution
  - pH = 7:Neutral solution
  - pH>7: Basic(alkaline) solution

The pH value is based on the concentration of hydrogenions(H^+) in a solution Mathematical Formula for pH

The pH is calculated using the negative base-10 logarithm of the molar concentration of hydrogen ions:[11]

$pH=-\log10[H+]$

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Test Parameter	Method	Calculation	Range
pH	pHMeter	Measure using a Calibrated pH meter	4.9

Table5 –pH Measurement

3. Viscosity Evaluation:-

A fluid's resistance to flow is measured by its viscosity. This indicates how"thick" or "sticky" a fluid is.[12]

High viscosity fluids, like honey and syrup, resist motion.

Water and alcohol are examples of fluids with low viscosity that flow readily. Methods of Viscosity Measurement:

1. Viscometer: Aviscometerisa tool for determining a fluid or semi-solid's viscosity.
2. Rheometer: Arheometerisa tool for determining a material's viscosity and other rheological characteristics
3. .Brook field Viscometer:-

The viscosity of liquids and semi-solids is commonly measured with the Brookfield Viscometer[13]. It operates on the principle of rotational viscometry, which involves measuring a fluid's resistance to the rotation of an immersed spindle in order to a scertain viscosity.

Working Principle

1. **Spindle Immersion**: A spindle of known geometry is submerged in the test fluid.
2. **Rotation**: The spindle is rotated at a set speed (or multiple speeds in some models).
3. **Torque Measurement**: The instrument measures the **torque** required to overcome the viscous resistance of the fluid.
4. **Viscosity Calculation**: Torque is converted into viscosity using calibration constants specific to the spindle and rotation speed.

5. **Viscosity Result:-**

Test Parameter	Method	Calculation	viRange
Viscosity	Brookfield Viscometer	Record the viscosity in centipoise(cP)	800cP

Table6 –Viscosity Evaluation

4. Spreadability:-

The term"spreadability" describe show easily a substance (such as a nointment, gel, cream, paste, or lotion) covers a surface with a little push.[14]

It is a crucial rheological characteristic, particularly in:

Formulations for pharmaceuticals (ointments,creams) Cosmetic items (makeup, lotions)

Science of food (butters, spreads)

Coatings and paints to guarantee eanemulgel's effectiveness and user experience, its spreadability must be measured. Techniques to Assess Spreadability:

1. Parallel Plate approach: This approach includes inserting a sample of the emulgel between two parallel plates and measuring the distance it spreads.[15]
2. Slop Test: This technique measures the distance that an emulgel sample flows after being placed on a sloping surface.
3. Spreadability Tester: A specialist tool for assessing topical compositions' spreadability.

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Test Parameter	Method	Calculation	Range
Spreadability	Apparatus or Manual Test	Measure the force required for spreading the emulgel over a fixed area	Minimum spreading diameterof5cmin1 minute

Table 7–Spreadability Evaluation

Summary:-

The present study focused on the formulation and evaluation of an emulgel for the effective topical treatment of fungal infections. Emulgels, being a combination of emulsions and gels, offer advantages like enhanced drug penetration, improved patient compliance, and controlled drug release, making themsuitable for antifungal drug delivery.The formulation was developed using a suitable antifungal agent (e.g.,Andrographis paniculata and Aloevera), an oil-in-water emulsion, and a gel base (such as Carbopol934).The emulgel was prepared by in corporating the emulsion into the gel base under controlled conditions.

Various evaluation parameters were studied, including:

- Physical characteristics (color,consistency,pH),
- Spreadability and extrudability,
- Viscosity, ensuring ease of application,
- Drug content to confirm uniform distribution,
- And stability studies to ensure product integrity overtime.
- The emulgel demonstrated favorable physicochemical properties and effective drug release, indicating its potential as a promising delivery system for antifungal the rap

Overall summery of Formulation:-

Sr.No	**Parameter**	**Method of Evalution**	**Obervation**
1	Colour	Visual Inspection	Greenish
2	Textcure	Feel Test	Smooth,gritty,thick
3	Homogenicity	Visual and Microscopic	Homogenious
4	Clarity	Visual Inspection	Opaque
5	Ph	Ph Meter	4.9
6	Viscosity	Brookfield Viscometer	800cp
7	Spreadibility	Apparatus or Manual Test	Minimum spreading diameter of 5cm in 1 minute

Table8-summary of Formulation

Summary of Chemical Tests Of Aloevera and Andrographis Paniculata

1) Aloevera

test	**Inference**	**Observation**
1)Mayers test	Brownppt	Aloinpresent
2)ferric chloride test	Purplecolour ppt	Aloeemodin
3)lead Acetate test	Yellowppt	Aloinpresent

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2) Andrographis Paniculata

test	Inference	Observation
1)Mayers test	Yellowish–white ppt	Diterpane lactone
2)ferric chloride test	Purple colour complex	Andrograph in present

Table9–Summary Of Chemical Tests

IV. CONCLUSION:

The research consistently suggests that emulgels are a **viable and potentially superior topical drug delivery system for treating fungal infections.** The combination of anemulsion and a gel base offers several benefits:

- **Enhanced Drug Delivery:** The emulsion component can improve the solubility and permeation of hydrophobic antifungal drugs through the skin, while the gel base provides sustained release and prolonged contact time at the site of infection.
- **Improved Patient Compliance:** Emulgels are generally non-greasy, easily spreadable, and washable, leadingtobetterpatientacceptancecomparedtotraditionalointmentsand creams.
- **Reduced Systemic Side Effects:** Topical application minimizes systemic absorption of the drug, reducing the risk of adverse effects.
- **Targeted Drug Delivery:** Emulgels allow for localized treatment, concentrating the drug at the site of infection.
- **Stability:** The gel matrix can enhance the stability of the emulsion.

The findings from various studies indicate that emulgel formulations of different antifungal drugs, including herbal Extracts like Andrographis paniculata and Aloevera and other Excipients, exhibit promising in-vitro drug release profiles and significant antifungal activity. In-vivo studies, where conducted, generally show good skin tolerability.

Therefore, the formulation and evaluation of emulgels represent a significant advancement in topical antifungal therapy, offering a more effective, patient-friendly, and potentially safer treatment option for various fungal skin infections. Further research may focus on optimizing emulgel formulations with different antifungal agents, penetration enhancers, and gelling agents to achieve even better therapeutic outcomes.

REFERENCE:-

[1]. Shilpa M, Bhat V, ShettyAV, et al. Antifungal Activityof Aloe Vera Leaf and Gel Extractsagainst Candidaalbicans:AnInVitroStudy.WorldJ Dent 2020;11(1):36–40.

[2]. Kalit SN, Zain WZ, Ramli NW, Musa SA, Hamid NA, Hamzah F. Phytochemical Screening, Bioactive Compound Quantification by HPLC, and AntifungalPropertiesof Andrographis paniculata Extracts Against Plant Pathogenic Fungi. InIOP Conference Series:EarthandEnvironmentalScience2023Jun1(Vol.1182,No.1,p.012016).IOP Publishing.

[3]. SaniasiayaJ,SalimR,MohamadI,HarunA.Antifungaleffect ofMalaysianaloevera leaf extract on selected fungal species of pathogenic otomycosis species in in vitro culture medium. Oman Medical Journal. 2017 Jan;32(1):41.

[4]. DanishP, AliQ, HafeezMM, MalikA. Antifungalandantibacterialactivityofaloevera plant extract. Biol Clin Sci Res J. 2020 Dec 12;2020(1):1-8.

[5]. DeS,SKAK, ShahSK, KaziS, SarkarN,BanerjeeS,DeyS. Pyridine:thescaffolds with significant clinical diversity. Rsc Advances. 2022;12(24):15385-406.

[6]. NoorkorinaTK,AbAzizFM,AlojidAA,AhmadNN,SalmunaZN,HassanSA,Hashim S, Harun A. Antifungal effects and phytochemical screening ofAndrographis paniculata extracts on dermatomycoses. Malaysian Journal of Microbiology. 2021 Sep 1;17(5).

[7]. Sule A, Ahmed QU, Latip J, Samah OA, Omar MN, Umar A, DogaraiBB. Antifungal activityofAndrographispaniculataextractsandactiveprinciplesagainst skinpathogenic fungal strains in vitro. Pharmaceutical biology. 2012 Jul 1;50(7):850-6.

[8]. DanishP, AliQ,HafeezMM, MalikA. Antifungal andantibacterialactivityofaloevera plant extract. Biol Clin Sci Res J. 2020 Dec 12;2020(1):1-8.

[9]. GuptaS,GuptaJ,AnandA,OjhaS.Reviewon

nanogel/emulgelformulationsof traditional medicines. Biological Sciences. 2022 Jul 29;2(3):269-78.

[10]. PazhoohanM,Hezave AZ.Investigationonthesynergisticeffectofp Handpyridinium- based ionic liquid on the wettability alteration of dolomite rock and IFT of formation brine/alkaline crude oil at the presence and absence of SiO2 nanoparticles. Journal of Petroleum Exploration and Production Technology. 2023 Dec;13(12):2519-37.

[11]. SgambatoF,ProzzoS,SgambatoE,Sgambat o R,Milano L.The100thanniversaryofpH (1909-2009). Negative logarithms for measuring hydrogen ions: are they essential in medicine? Part I. Italian Journal of Medicine. 2011;5(3):147-55.

[12]. BarnesHA. Ahandbookofelementaryrheology. Aberystwyth:UniversityofWales, Institute of Non-Newtonian Fluid Mechanics; 2000.

[13]. ChengDC.Viscosity(Part1).Measurementa ndControl.1981Mar;14(3):73-8.

[14]. NaeH.Rheologicalpropertiesoftopicalform ulations. HandbookofFormulatingDermal Applications: A Definitive Practical Guide. 2016 Dec 12:287-348.

[15]. Khunt DM,MishraAD,ShahDR.Formulationdesig n&developmentofpiroxicam emulgel. Int J PharmTech Res. 2012;4(3):1332-4.