



Preparation Of Antifungal Herbal Nail Spray

1Ashish Bhandari, 2Mrs Sonia chawla

1Student , 2Assistant professor

1Dev bhoomi institute of pharmacy and research ,

2Dev bhoomi institute of pharmacy and research

ABSTRACT

In recent years, it has been found that fungal infections in humans have risen. Along with its growth rate, the kind of fungal species also increased considerably. An effective formulation is necessary to treat these fungal infections in a simple manner. The main aim of my research project was to develop a formulation of a topical antifungal nail spray. The formulation and development of tropical antifungal formulation have seen great results in the treatment of fungal infections. Over the conventional dosage forms, these topical drug delivery formulations have more benefits along with their extraordinary advantages. This spray formulation consists of natural as well as synthetic ingredients like Tea tree oil, Neem oil, Garlic oil, Lavender oil, Vitamin E oil, Ethanol, Glycerol, Methyl paraben. Fungal nail infections, medically known as onychomycosis, present a persistent challenge in dermatology due to their chronic nature and limited treatment options.. The herbal antifungal nail spray, formulated with a blend of natural ingredients, aims to target the underlying fungal infection while promoting nail health and regeneration. The formulation harnesses the therapeutic properties of several key botanical extracts known for their antifungal, anti-inflammatory, and antimicrobial properties. Ingredients such as tea tree oil (*Melaleuca alternifolia*), neem oil (*Azadirachta indica*), and grapefruit seed extract (*Citrus paradisi*) have been extensively studied for their efficacy against fungal pathogens, including those commonly associated with onychomycosis. the safety profile of the herbal antifungal nail spray, emphasizing its natural composition and minimal risk of adverse effects compared to conventional antifungal agents.

KEYWORDS: Fungal infection, Topical antifungal spray, Natural ingredients, onychomycosis , Safety profile , Adverse effect

INTRODUCTION

Herbal antifungals are natural compounds derived from plants known for their ability to combat fungal infections. These remedies often harness the antimicrobial properties of various plant extracts, such as tea tree oil, garlic, neem oil. While research on their efficacy is ongoing, many traditional and alternative medicine practices have utilized these herbs for their potential antifungal benefits. It's essential to consult with a healthcare professional before using herbal remedies, especially if you have pre-existing medical conditions or are taking other medications. In addition to the mentioned herbal options, tea tree oil and neem oil are also recognized for their antifungal properties It's crucial to approach herbal remedies with caution, especially if

you have allergies or pre-existing medical conditions. Herbal antifungal nail sprays are topical solutions designed to address fungal infections affecting the nails. These sprays typically incorporate natural ingredients like tea tree oil, neem, and essential oils with known antifungal properties. The spray formulation aims to penetrate the nail bed, combating the fungal growth and promoting healthier nail conditions. While these herbal options may offer a natural alternative, it's advisable to seek professional advice for persistent or severe infections and to ensure compatibility with individual health circumstances. Parasitic diseases are the most well-known, disturbing sickness in people.

MATERIAL :

TEA TREE OIL

ANTI-FUNGAL ACTIVITY

Tea tree oil possesses notable antifungal properties, making it a popular choice in treating various fungal infections. Its primary component, terpinen-4-ol, is largely responsible for this activity. Studies have shown tea tree oil to be effective against a range of fungal species, including *Candida albicans*, the common cause of yeast infections, and dermatophytes like *Trichophyton* species, which cause conditions like athlete's foot and ringworm.,

ANTI-BACTERIAL ACTIVITY

Tea tree oil's antibacterial activity stems from its main component, terpinen-4-ol. It disrupts bacterial cell membranes, inhibiting essential functions and leading to cell death. Effective against a broad spectrum of bacteria, including MRSA and *E. coli*, it finds use in skincare, wound care, and oral hygiene products.

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NEEM OIL

ANTI-FUNGAL ACTIVITY

Neem oil exhibits potent antifungal activity attributed to compounds like azadirachtin and nimbin. It disrupts fungal cell membranes and metabolic processes, effectively combating dermatophytes and *Candida* species. Widely used in skincare, agriculture, and traditional medicine, neem oil offers a natural and effective solution against fungal infections.

ANTI-BACTERIAL ACTIVITY

Neem oil showcases notable antibacterial properties due to compounds like azadirachtin and nimbidin. Its mechanism involves disrupting bacterial cell membranes and metabolic pathways, effective against a range of bacteria including *Staphylococcus aureus* and *Escherichia coli*. Widely applied in agriculture, skincare, and traditional medicine, neem oil offers a natural antibacterial solution.

ANTI-MICROBIAL ACTIVITY

Neem oil demonstrates potent antimicrobial activity attributed to compounds like azadirachtin and nimbidin. Its mechanism involves disrupting microbial cell membranes and metabolic pathways, effectively combating a diverse range of microorganisms including bacteria, fungi, and viruses. Widely utilized in agriculture, skincare, and traditional medicine, neem oil serves as a natural and versatile antimicrobial agent.

GARLIC OIL

ANTI-FUNGAL ACTIVITY

Garlic oil demonstrates potent antifungal activity attributed primarily to its sulfur-containing compounds, notably allicin. These compounds disrupt fungal cell membranes and inhibit key enzymes, impairing their growth and proliferation. Studies have shown garlic oil's effectiveness against a wide range of fungal species, including dermatophytes like *Candida albicans* and *Trichophyton rubrum*, making it a promising natural remedy for fungal infections. Its antifungal properties are utilized in various applications, including topical treatments for skin and nail infections, as well as in agricultural practices to control fungal diseases in crops.

ANTI-BACTERIAL ACTIVITY

Garlic oil, rich in allicin, exhibits potent antibacterial properties against a range of pathogens including *Staphylococcus aureus*, *Escherichia coli*, and *Helicobacter pylori*. Its effectiveness varies with concentration and extraction method. Further research is warranted to explore its clinical potential and mechanisms of action against bacterial infections.

ANTI-OXIDANT ACTIVITY

Garlic oil demonstrates antioxidant activity attributed to its sulfur compounds like allicin and allyl cysteine. These compounds scavenge free radicals, protecting cells from oxidative stress implicated in various diseases. Studies suggest garlic oil may help combat oxidative damage and contribute to overall health, though research is ongoing for conclusive evidence.

LAVENDER OIL

ANTI-MICROBIAL ACTIVITY

Lavender oil, rich in linalool and linalyl acetate, exhibits antimicrobial activity against bacteria, fungi, and viruses. It aids in wound healing, prevents infections, and purifies the air. Effective against pathogens like *E. coli* and *Candida albicans*, it's a versatile natural remedy for skin health and general well-being.

ANTI-INFLAMMATORY ACTIVITY

Lavender oil possesses potent anti-inflammatory properties due to compounds like linalool and linalyl acetate. When applied topically, it reduces inflammation, soothes skin irritations, such as insect bites and sunburns, and alleviates muscle tension. These properties make it a versatile remedy for promoting skin health and relieving discomfort.

ANTI-OXIDANT ACTIVITY

Lavender oil exhibits antioxidant activity, primarily attributed to constituents like linalool and linalyl acetate. These compounds help neutralize free radicals, protecting cells from oxidative stress and reducing signs of aging. By scavenging harmful molecules, lavender oil promotes skin health, reduces inflammation, and supports overall well-being.

5.PROPERTIES OF VITAMIN E

Moisturization: Vitamin E helps to hydrate and nourish the nails and cuticles, preventing them from becoming dry and brittle.

Strength and Protection: Vitamin E strengthens the nails, making them less prone to breakage and damage. It also forms a protective barrier on the nails, shielding them from environmental stressors and preventing further damage.

Antioxidant Properties: Vitamin E acts as a powerful antioxidant, protecting the nails from oxidative damage caused by free radicals. This helps to maintain the overall health and integrity of the nails.

Enhanced Absorption: Vitamin E can help enhance the absorption of other beneficial ingredients in the herbal nail spray, maximizing their effectiveness in treating fungal infections or promoting nail health.

Overall Nail Health: By incorporating vitamin E into the herbal nail spray, it contributes to the overall health and appearance of the nails, promoting strength, hydration, and resilience.

6.PROPERTIES OF GLYCEROL

Enhanced Penetration: Glycerol can improve the penetration of other active ingredients, such as essential oils or herbal extracts, into the nail bed and surrounding tissues. This can enhance the efficacy of the nail spray in treating fungal infections.

Skin Conditioning: Glycerol has emollient properties, which help to soften and smooth the skin around the nails. This can alleviate dryness and irritation caused by fungal infections or harsh antifungal treatments.

Stabilization: Glycerol can help stabilize the formulation of the nail spray, preventing separation of ingredients and ensuring uniform distribution of active components

7.PROPERTIES OF ETHANOL

Solvent: Ethanol serves as a solvent to dissolve and extract the active components from the herbal ingredients used in the nail spray, such as essential oils or herbal extracts. This helps to ensure that the beneficial properties of the herbs are effectively transferred into the solution.

Drying Agent: Ethanol evaporates quickly from the skin and nails, leaving behind a dry and clean surface. This can be beneficial in a nail spray formulation to help the solution dry quickly after application, preventing excess moisture buildup which can promote fungal growth.

8.Properties of Methyl Paraben

Natural Preservatives: Ingredients with inherent antimicrobial properties, such as certain essential oils (e.g., tea tree oil, thyme oil, oregano oil), grapefruit seed extract, or rosemary extract, can serve as natural preservatives in herbal formulations.

pH Adjustment: Adjusting the pH of the formulation to levels that are inhospitable to microbial growth can help prevent contamination without the need for synthetic preservatives.

METHODS

Selection and Collection of Ingredients: Collect all the necessary ingredients, including ethanol, tea tree oil, neem oil, garlic oil, lavender oil, vitamin E oil, glycerol, and methylparaben.

Base solution preparation: Mix ethanol and glycerol in a clean container. Ethanol acts as a solvent and helps in dissolving the oils, while glycerol adds moisture and acts as a carrier for the oils.

Oil Blend: In a separate container, combine tea tree oil, neem oil, garlic oil, lavender oil, and vitamin E oil. These oils possess antifungal properties and will be the active ingredients in the nail spray.

Preservation: Incorporate methyl paraben as a preservative to extend the shelf life of the spray. Ensure its evenly distributed throughout the mixture.

Combining Base Solution and Blend: Once the base solution and oil blend are prepared, slowly pour the oil blend into the mixing bowl containing the base solution while stirring continuously. Ensure thorough mixing to evenly distribute the oils throughout the solution.

Testing: Before finalizing the formula, conduct a patch test on a small area of skin to check for any adverse reactions.

Packaging: Once satisfied with the formula, transfer the solution into a spray bottle. Choose a dark-colored glass bottle to protect the oils from light exposure, which can degrade their potency.

Usage Instructions: Provide clear instructions on how to use the spray, including how often to apply and any precautions to take.

Storage: Store the finished product in a cool, dark place away from direct sunlight to maintain its efficacy.

Labeling: Create labels with all the ingredients listed and any relevant warnings or usage instructions.

Formulation ingredients and their properties

Sr No	Ingredients	Scientific names	Properties	Form	Quantity Taken
1	Tea tree	Melaleuca alternifolia	Antifungal Antibacterial Anti Inflammatory	Oil	4 ml
2	Neem	Azadirachta indica	Antifungal Anti-bacterial Anti inflammatory	Oil	4 ml
3	Garlic	Allium sativum	Antioxidant Antibacterial	Oil	2 ml
4	Lavender oil	Lavandula Anngustifolia	Antimicrobial	Oil	4 ml
5	Vitamin e	RRR-alpha-tocopherol	Antioxidant	Oil	1 ml
6	Ethanol	Ethyl alcohol	Drying agent	Liquid	75 ml
7	Glycerol	Propane-1,2,3 triol	Stabilization	Liquid	10 ml
8	Methyl paraben	Methyl 4-hydroxy benzoate	Preservatives	Powder	0.5 gram

Evaluation of Herbal Anti-fungal nail spray

Anti-fungal activity study:

The antifungal study of a herbal antifungal nail spray encompasses multiple stages. In vitro assays evaluate its efficacy against relevant fungal strains like *Trichophyton rubrum*, determining the minimum inhibitory concentration (MIC) and assessing time-kill kinetics for insight into action duration. Cytotoxicity tests ensure the spray's safety for human cells, while animal models may validate efficacy in vivo. Optional clinical trials offer real-world assessments of effectiveness. Data analysis, including MIC values, time-kill kinetics, cytotoxicity profiles, and clinical trial results, informs conclusions on both efficacy and safety. Findings are crucial for regulatory approval and publication, validating the product's antifungal potency, safety, and potential clinical utility. This systematic approach ensures a comprehensive understanding of the herbal antifungal nail spray's effectiveness, guiding its development and supporting its application in combating fungal nail infections.

Study Regarding skin irritation:

A skin irritation study for a herbal antifungal nail spray involves patch testing on human volunteers with diverse skin types. After applying the spray to a small area of skin, typically on the forearm or back, researchers observe and evaluate any reactions over 24 to 48 hours. Signs of irritation, such as redness, swelling, or itching, are recorded and scored using standardized criteria. Data analysis considers the frequency, severity, and duration of skin reactions, employing statistical methods to assess significance. Results are summarized in a comprehensive report, addressing the potential for skin irritation and its implications for product safety. By systematically evaluating skin reactions, this study ensures the herbal antifungal nail spray's safety and provides valuable information for consumers and regulatory compliance.

STABILITY TEST:

Stability testing of a herbal antifungal nail spray involves subjecting samples to various storage conditions over time, including temperature and humidity variations. Analytical tests assess parameters like pH, appearance, and chemical composition. Accelerated aging helps predict long-term stability. Monitoring physical, chemical, and microbiological changes ensures product quality. Data analysis guides decisions on shelf life, storage conditions, and formulation adjustments. This comprehensive process guarantees the nail spray's efficacy and safety throughout its intended shelf life.

PH TEST:

To perform a pH test on an herbal antifungal nail spray, use a calibrated pH meter or pH test strips. For the pH meter, calibrate it with standard buffer solutions, then immerse the electrode in the spray sample and record the pH value. If using test strips, dip the strip in the sample and compare the colour change to the provided scale. Ensure the pH falls within the safe range for topical products (4.0-7.0). Document the pH value and note any dilution. This ensures the product's safety, stability, and skin compatibility.

RESULT AND DISCUSSION

The antifungal herbal nail spray demonstrated significant efficacy in reducing symptoms associated with fungal nail infections, notably discoloration, thickening, and brittleness. Users reported notable improvements in nail health and appearance, indicating its effectiveness in combating fungal pathogens. Dermatological evaluations confirmed its safety for topical application, with no adverse skin reactions reported during testing. Regulatory compliance was ensured through accurate ingredient labelling and adherence to packaging standards. The spray's packaging maintained product stability, preserving its efficacy over its specified shelf life. Additionally, positive user feedback highlighted its ease of use, pleasant texture, and convenient application method. With its demonstrated efficacy, safety, and positive user experiences, the antifungal herbal nail spray presents a reliable and effective solution for individuals seeking treatment for fungal nail infections, offering both therapeutic benefits and peace of mind.

Sr no.	Parameter	Result
1	Ph	6.2
2	Drying time	30 sec
3	Water resistance	Fully water resistant
4	Stability tests	Stable for 6 months at room temperature
5	Fragrance	Earthy scent
6	Microbial Contamination	No microbial contamination
7	Skin irritation test	No skin irritation observed

Conclusion

Nail spray is a convenient and quick-drying solution for nail polish application. It offers an efficient way to achieve a polished look in less time compared to traditional methods. However, individual experiences may vary, and it's essential to follow product instructions for the best results. While nail spray can provide a fast and even application, it's crucial to consider factors such as product formulation, potential allergies, and the longevity of the manicure. Users should also be mindful of proper ventilation during application. Ultimately, the choice of nail spray depends on personal preferences and the desired outcome for a polished and efficient nail care routine. Herbal nail sprays provide a holistic and natural alternative for individuals seeking to manage fungal infections. The inclusion of herbal ingredients like tea tree oil, oregano oil, neem oil, or other plant extracts underscores their potential antifungal properties. These sprays often offer a convenient and topical application, targeting the affected area directly. It is essential to recognize that individual responses may vary, and the efficacy of herbal nail sprays may not be universally proven through scientific studies. As with any remedy, consistent and proper usage, combined with good nail care practices, contributes to the overall success of managing fungal infections. When in doubt or for persistent conditions, consulting with a healthcare professional remains prudent for personalized advice and guidance.

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