



## Research Article

# Preparation And Evaluation of a *Moringa Oleifera Lam* Nail Serum for the Treatment of Paronychia

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## ABSTRACT

This study evaluates the efficacy and safety of a nail serum for treating paronychia. Results indicate that the serum's physical parameters—specific gravity, pH, acid value, and saponification value meet standard specifications, and the serum is characterized by a pale green colour and pleasant odor. Biological testing on human skin revealed no adverse reactions, such as inflammation or allergy. The findings suggest that nail serums can effectively contribute to the treatment and prevention of mild paronychia, as they contain nourishing ingredients that strengthen nails and moisturize surrounding skin, reducing infection risk. However, addressing underlying infections with appropriate antiseptic or antibiotic treatments is essential for severe cases. For persistent conditions, consultation with a healthcare professional is advised. Regular nail care, hygiene practices, and appropriate serum use can help maintain healthy nails and prevent recurrence of paronychia.

## INTRODUCTION

Herbal cosmaceuticals are cosmetic products that contain biologically active principles or ingredients of plant origin having an effect on users, or they are combination products of cosmetics and herbal pharmaceuticals intended to enhance the health and beauty of the skin. They differ from cosmetics, since cosmetics are the inert substances that cleanse or enhance the appearance of the skin without any therapeutic benefit.

Whereas pharmaceuticals are used to treat or

prevent the diseases or are intended to affect the physiological structure or function of the body. Cosmaceuticals are scrutinised and also reviewed by the FDA; however, one should note that cosmetics and cosmetic ingredients are tested for safety, but evidence is rarely available for their beneficial claims. Ageing of the skin is a cumulative phenomenon and is influenced by several factors.

### 1.1 Anatomy Of Nail:

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Fingernails and toenails, which are made of a tough protein called keratin and are a form of modified hair, are composed of:

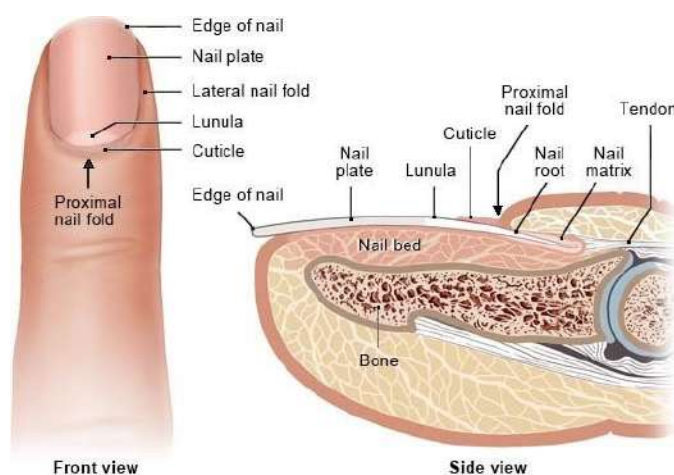
The free edge is the part of the nail extends past the finger, beyond the nail plate. There are no nerve endings within, thus it does not hurt to cut it. The nail matrix or the root of the nail this is the growing part of the nail still under the skin at the nail's proximal end.

- Eponychium or cuticle is the fold of skin at the proximal end of the nail.
- Paronychium is the fold of skin on the sides of the nail.

- Hyponychium is the attachment between the skin of the finger or toe and the distal end of the nail.

Nail plate is what we think of when we say nail, the hard and translucent portion, composed of keratin. Nail bed is the adherent connective tissue that underlies the nail.

- Lunula is the crescent shaped whitish area of the nail bed.
- Nail fold: a fold of hard skin overlapping the base and sides of a fingernail or toenail



**Fig: 1 Anatomy Of Nail**

### 1.2 Bacterial Infections:

Bacterial infections are any disease or condition caused by bacterial growth or poisons (toxins). We can get sick from harmful bacteria in our skin, intestines (gastrointestinal tract), lungs, heart, brain, blood, or anywhere in our body. Harmful bacteria in the environment, an infected person or animal, an insect bite, or something contaminated (such as food, water, or surfaces) can cause infections. Bacteria that are normally harmless but that enter a place in our body where they should not be can also cause infections.

Paronychia is an infection of the proximal and lateral fingernails and toenails the tissue that

borders the root and sides of the nail. This condition can occur spontaneously or following trauma or manipulation. Paronychia is among the most common infections of the hand. Paronychia results from the disruption of the protective barrier between the nail and the nail fold, introducing bacteria and predisposing the area to infection. Acute paronychia is usually limited to one nail; however, if drug-induced, it can involve many nails.



**Fig: 2 Acute & Chronic Paronychia**

### 1.3 Herbal Nail Serum:

Herbal serums are skin care products rich in plant ingredients that aim to nourish, hydrate and treat various skin concerns. They often contain concentrated plant extracts, essential oils and other natural ingredients. These serums are known for their potential to provide benefits such as reducing inflammation, soothing irritation, promoting skin healing and providing antioxidants.

Nail serum is a specialized treatment designed to nourish and strengthen the nails and surrounding skin, particularly the cuticles. It is often formulated with ingredients that promote healthy nail growth, prevent breakage, and hydrate the nail bed and cuticles.

#### Types of nail serums:

- Nail strengthening serums
- Moisturizing nail serums
- Nail serums that stimulate growth
- Cuticle care serum
- Nail Repair Serum

## 2. PLANT PROFILE:

### 2.1 MORINGA OLEIFERA:

**Name:** Moringa oleifera

**Synonyms:** Drumstick tree and Marango tree.

**Biological source:** Moringa alternifolia (Maiden and Betche)

**Family:** Myrtaceae

**Chemical constituents:** terpinen-4-ol,  $\gamma$ -terpinene,  $\alpha$ -terpinene,  $\alpha$ -pinene, 1,8 cineole.

**Uses:**

- Cure fungal toenail infections

- Antiseptic (germ killer) and an herbal medicine enhances blood circulation,
- Promoting hair growth and minimizing the risk of breakage and shedding.
- Promotes Glowing Skin.
- Helps to Get Rid of Acne.
- Prevents Skin Infections.



**Fig: 3 Moringa Oleifera**

## 3. MATERIALS AND METHODS:

### 3.1 Collection Of Seeds:

Collect the mature Moringa oleifera seeds. Dry the seeds through shade dry method to remove seed from the pods. The pods should easily crack and separate the seeds from the pod's material, husk or other debris. Spread the seeds on a clean, dry surface in a well-ventilated area. Allow them to air dry completely, turning them occasionally to ensure even drying. Grind the Moringa seeds into fine powders.

### 3.2 Authentication Certificate:

The plant material collected was identified and authenticated by by Dr. KN Sunil kumar Research officer HOD Department of pharmacognosy, Dr. P.Elankani Research officer ( Siddha ), Sci III-Incharge, SIDDHA CENTRAL RESEARCH INSTITUTE (Central Council for Research in Siddha, Chennai, Ministry of AYUSH, Government of India) Anna Govt. Hospital Campus, Arumbakkam, Chennai – 600106, Certified that the sample submitted by P Gomathi, R Gunasekar, M Hariharasudhan, G Haripriya and D Harishkumar, B Pharm, - Final year, Aadhibhagavan College of Pharmacy, Thiruvannamalai district - 604407 was identified as:

- Form No: PCOG002-ACF
- Code: M06092401O (Moringa oleifera Lam)
- Part: Seed
- Date: 11.09.2024

### 3.3 Extraction Method:

To prepare an alcoholic extract of Moringa oleifera seeds using the maceration method, follow these general steps. Maceration is a simple extraction process that involves soaking the plant material in a solvent to dissolve the desired compounds. Mix plant material with the ethanol.

Use enough ethanol so the material is completely submerged. Leave the mixture in an ultralow temperature for 24 hours. The ethanol will separate the soluble components of the extract during this soaking period. Remove all solid materials with a simple filtration step requiring only a vacuum pump, filter paper. After the material has been filtered, a solution of ethanol and extract remains.

### 3.4 Powder Characteristics:

- Epidermal cells
- Sclereids
- Stomata
- Parenchyma cells
- Oil droplets
- Starch granules
- Xylem and phloem
- Calcium oxalate
- Trichomes
- Endosperm

### 3.5 Phytochemical Evaluation:

- Test For Alkaloids
- Test For Phenol
- Tests For Flavonoids
- Test For Glycosides
- Test for Fats and Oils
- Test For Polyphenols

### 3.6 Preparation Of Nail Serum:

S.NO	INGREDIENTS	QUANTITY %
1	MORINGA SEEDS	20%
2	LAVENDER OIL	13.33%
3	TEA TREE OIL	16.67%
4	CASTOR OIL	6.67%
5	JOJOBA OIL	16.67%
6	ALMOND OIL	10%
7	GARLIC OIL	2%
8	VITAMIN E OIL	3%

**Table: 1 Formulation Table**

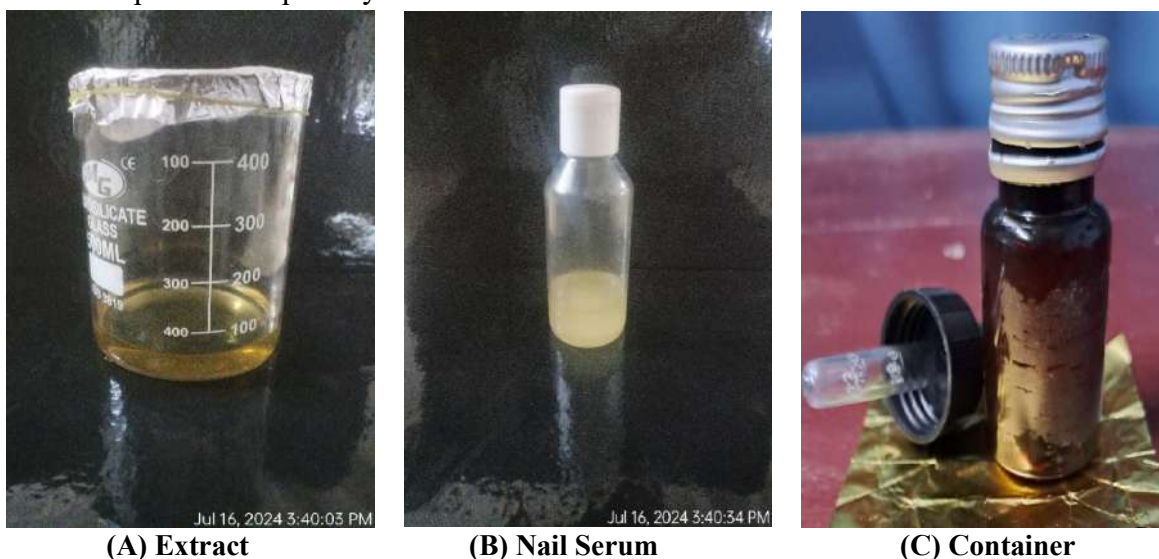
### Procedure:

Collect precisely dried and powdered moringa seeds and mixture of oils such as lavender oil, tea tree oil, castor oil, jojoba oil, almond oil, garlic oil

and vitamin E oil. Then moringa seeds are well grained and powdered, it was macerated in 96% ethanol (1:10 w/v) at room temperature for 48



hours. After maceration the extract was filtered and added to the prescribed quantity of oil mixture.



**Fig: 4 Moringa Seeds Containing Nail Serum**

### 3.7 EVALUATION PARAMETERS:

Prepared serum was estimated for product performance which include physiochemical parameters.

#### 3.7.1 Physical Parameters:

##### Color:

Appearance: Examine the serum's color, which can range from clear to tinted. The color should be uniform and stable over time.

##### pH Level:

Acidity/Alkalinity: Measure the serum's pH to ensure it's within a safe range for skin and nails, typically between 4.5 and 6.5. This helps prevent irritation and ensures compatibility with the natural nail environment.

##### Density:

Weight: Determine the density of the serum, which influences how much product is needed per application and how it feels on the nails.

##### Separation:

Check if the serum separates into different layers over time, which may indicate instability or poor formulation.

##### Odor:

Scent Profile: Evaluate the intensity and quality of the serum's odor. It should be pleasant and not too overpowering.

##### Spreadability:

Measure how easily the serum spreads across the nail surface. Low surface tension usually indicates better spreadability, ensuring even application.

##### Viscosity:

The viscosity of prepared serum was estimated by Ostwald's viscometer at a room temperature. The viscosity of prepared serum was calculated by using the equation.

$$\text{Viscosity of liquid } (\eta_2) = \frac{\eta_1 \times f_2 \times t_2}{f_1 \times t_1}$$

- $\eta_1$  = Viscosity of water
- $f_2$  = Density of sample
- $t_2$  = Mean time of oil from A to B
- $f_1$  = Density of oil
- $t_1$  = Mean time of flow of water from A to B

##### Nonvolatile Content:

8 ml of sample was taken in a glass petri dish of about 8cm in diameter. Samples were spread equally. The dish was placed in the oven at 105°C for 1 hr. The petri dish was removed, cooled, and

weighed. The difference in weight of sample after drying was determined that gives the volatile content present. The difference in weights was recorded.

#### **Drying Time:**

A film of sample was applied on a glass petri dish with the help of brush. The time to form a dry to touch film was noted using a stopwatch.

#### **3.7.2 Chemical Parameters:**

##### **Saponification Value:**

2ml of serum was weighed and transferred into a 25ml of conical flask to this 25ml alcoholic KOH solution was added. It was heated on a water bath for 30 mins by frequently mixing the content of the flask phenolphthalein was added to cooled liquid and titrated against 0.5M HCl. Blank solution was performed and saponification value were calculated.

**SAPONIFICATION VALUE = (b-a) × 28.05 / weight of substance**

**b= blank value**

**a=assay value**

=28.05(21.2-0.7)/2

=28.05(20.5)/2

=287.5

#### **3.7.3 Biological Parameters:**

##### **Primary Skin Irritation Test:**

The prepared formulations were assessed for primary skin irritation test. Healthy human volunteer was selected for the study choose a small area of skin, cleanse the area with mild soap and water, let it dry completely. Apply a small amount of the serum to the test area allow to spread on skin. Leave the serum on your skin for 24 to 48 hours. After 24 to 48 hours observe the area for any sign of irritation, redness, swelling, itching or any other reactions.

##### **Anti-Bacterial Activity:**

The Minimum Inhibitory Concentration (MIC) is a measure used in microbiology to determine the lowest concentration of an antimicrobial agent,

like an antibacterial or antifungal, that will inhibit the visible growth of a microorganism.

For a nail serum, particularly if it is intended to combat bacterial infections (like paronychia), determining the MIC would involve the following steps:

#### **1. Prepare the bacterial strains:**

- Collect the bacterial strain(s) relevant to the nail condition (e.g., staphylococcus aureus).
- Culture the strain in an appropriate growth medium.

#### **2. Prepare Serial Dilutions of the Serum:**

- Prepare serial dilutions of the nail serum in a liquid growth medium. This usually involves making a series of concentrations, such as 1:2, 1:4, 1:8, and so on.

#### **3. Inoculate the Dilutions:**

- Add a standardized amount of the bacterial strain to each dilution.
- Include a positive control (bacteria without serum) and a negative control (serum without bacteria).

#### **4. Incubate:**

- Incubate the cultures at an appropriate temperature, typically 25-30°C, for 48-72 hours or according to the bacterial growth.

#### **5. Determine the MIC:**

- After incubation, observe the cultures for visible growth.
- The MIC is the lowest concentration of the nail serum that shows no visible bacterial growth.

#### **6. Confirm Results:**

- It's often useful to repeat the test to confirm the MIC value.
- Results can also be confirmed by sub-culturing onto a fresh medium without the serum to ensure the bacteria has been effectively inhibited.

**Note:** Performing an MIC test typically requires laboratory equipment and expertise in microbiology. If you're developing or testing a nail serum with antibacterial properties, this

should ideally be done in a professional lab setting to ensure accuracy and reliability.

## RESULTS AND DISCUSSION:

### 4.1 Extraction Appearance and Percentage Yield:

Drug	Moringa Seeds
Solvent	Ethanol 90%v/v
Colour	Light yellowish green
Consistency	Semi Liquid
Percentage yield	19.5 % w/w

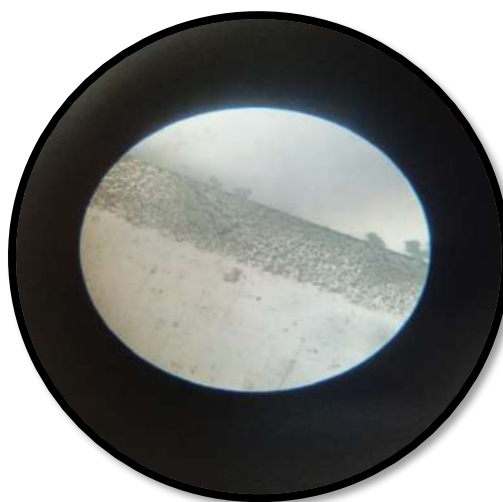
**Table: 2 Appearance and Percentage Yield**

### 4.2 Preliminary Phytochemical Screening:

S.NO	CONSTITUENTS	EXTRACT	NAIL SERUM
1	Alkaloids	Present	Present
2.	Carbohydrates	Absent	Present
3.	Protein	Absent	Present
4.	Terpenoids	Present	Present
5.	Phenol	Present	Present
6.	Tannins	Present	Present
7.	Flavonoids	Present	Present
8.	Glycosides	Present	Absent
9.	Saponins	Absent	Present
10.	Phytosterols	Present	Present

**Table: 3 Preliminary Phytochemical Screening**

### 4.3 Powder Characteristics:



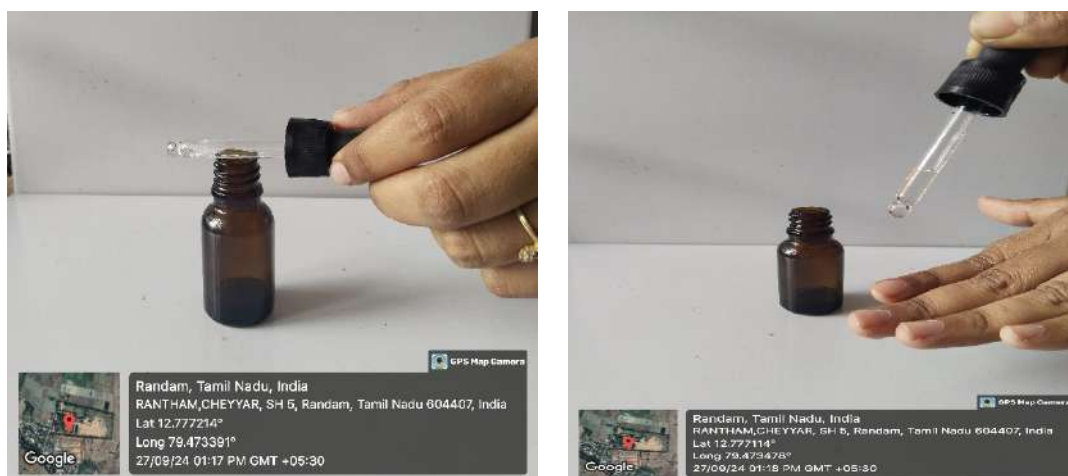
**Fig: 5 Microscopically View of Moringa Seed**

### 4.4 Evaluation of Nail Serum:

S.NO	PARAMETERS	INFERENCE
1.	State	Liquid
2.	Color	Pale green
3.	Odour	Aromatic Odour
4.	PH	7.37

5.	Grittiness	Smooth
6.	Specific gravity	1.015
7.	Viscosity (centipoise)	1.6
8.	Sedimentation	No sedimentation
9.	Sensitivity test	No irritation
10.	Irritation test	No irritation
11.	Saponification value	287.5
12.	Spreadability	8cm
13.	Non volatile content (%)	35 ±0.6
14.	Drying time (sec)	52

**Table: 4 Evaluation Of Nail Serum**



**Fig: 6 Evaluation Of Nail Serum**

#### 4.5 Anti Bacterial Activity:



**Fig: 7 Anti-Bacterial Activity of Nail Serum**

**Table: 5 Zone of Inhibition**

S.NO.	Microorganisms	Control	Sample	Ciprofloxacin
	Zone of inhibition in mm			
1.	<i>Staphylococcus aureus</i>	-	13	23



#### 4.6 Label Preparation:



**Fig: 8 Product Label**

#### DISCUSSION

The result obtained for the evaluation test are under the specified limits. Color is pale green and the serum has pleasant odour. The results obtained for physical parameters like specific gravity, PH, acid value, Saponification value are according to the standard values. In biological evaluation, it is tested on human skin and it did not produce any inflammation, allergy or erythema reactions.

#### CONCLUSION

In conclusion, nail serums can be an effective component in the treatment and prevention of paronychia, particularly in mild cases or as part of a broader care routine. These serums often contain nourishing ingredients that help to strengthen nails and moisturize the surrounding skin, which can reduce the risk of infection and support healing. However, it is essential to address any underlying infection, typically with antiseptic treatments or antibiotics, depending on severity. For persistent or severe cases of paronychia, it is recommended to consult a healthcare professional for appropriate medical treatment. Regular nail care and hygiene practices, combined with the use of a suitable nail serum, can help maintain healthy nails and prevent the recurrence of paronychia.

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