

A Comparative Study of Different Methods of Manufacturing And Evaluations of Nail Paint

Summaiya Nagori^{1*}, Abhishek Nagar², Dr.Maheshkumar Gupta³

¹UG Scholar, Career Point School of Pharmacy, Career Point University, Kota, India

² Associate Professor, Career Point School of Pharmacy, Career Point University, Kota, India

³Dean of career point school of pharmacy, career point university, Kota, India

Corresponding email-id:summaiyanagori786@gmail.com.

Abstract-

Nail lacquer / nail polish is a cosmetic which is used to provide elegant look to the nails and also beautify it. There are many methods of preparation of formulation of herbal and chemical based nail paint. It also a modified pathway for delivery the drug which act as anti-fungal and treat the nail from onychomycosis. In this review formulation from F1 to F5 is consider and the quantity of ethyl cellulose is 8.5gm. , formaldehyde is 2.5 ml, castor oil is 1.5 ml, and curcumin is 2 gm. The antifungal activity of fluconazole against fungal infection was found to be [zone of inhibition of 202 mm at 50 mg/ml and 161mm at 40mg/ml] the non-volatile content was found to be 360.9 to 370.1 and thickness of lacquer film was found to be 0.160.3mm and 0.180.2mm after drying

Keywords: nail lacquer, antifungal activity, non- volatile, onychomycosis.

I. INTRODUCTION

Nails, an essential component of the human body, protect and support the fingertips and the tissue around them. They are composed of a hard, translucent protein called keratin and grow continuously throughout a person's life. The shape, texture, and color of nails can vary depending on factors such as age, health, and genetics. (6,7)

In addition to their protective function, nails also have aesthetic value and are often adorned with nail polish or other decorative elements. However, nails can also be affected by a range of conditions, such as fungal infections, injuries, and certain diseases. Maintaining healthy nails is therefore important for both cosmetic and health reasons. This can be achieved through proper nail care, including regular trimming and cleaning, avoiding harsh chemicals and trauma, and eating a balanced diet rich in nutrients that support nail health. (1,2)

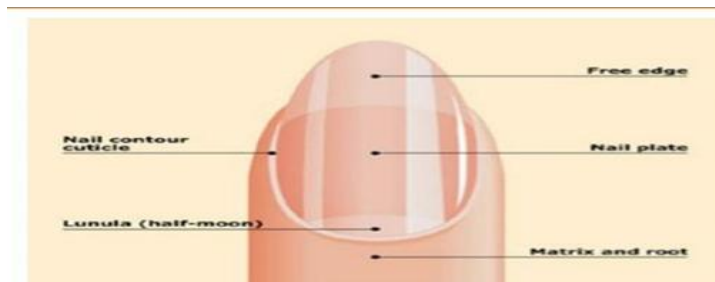


Fig. no. 1 structure of nail

As we know nail polish is a cosmetic which are apply on the nail for the better appearance and also protect the nails. (6)

Structure of the human nail: The human nail consists following part-

The human nail consists of several components, each playing a role in its structure and function. The main parts of a human nail include:

Nail Plate: The nail plate is the visible part of the nail that covers the nail bed. It is composed of dead cells called keratinocytes, which are tightly packed and form a hard, translucent layer. The nail plate protects the underlying nail bed and contributes to the nail's strength and appearance.

Nail Bed: The nail bed is the layer of living tissue underneath the nail plate. It contains blood vessels, nerves, and melanocytes (cells responsible for nail color). The nail bed provides nutrients to the nail matrix, which produces new nail cells, and it plays a role in nail growth.

Nail Matrix: The nail matrix is the area at the base of the nail, hidden beneath the cuticle. It is responsible for producing new nail cells that push forward, adding length to the nail plate. The matrix contains specialized cells that undergo rapid division, contributing to nail growth.

Cuticle: The cuticle is a thin layer of transparent skin that covers the base of the nail. It serves as a protective barrier, sealing the area between the nail plate and the surrounding skin. The cuticle helps prevent bacteria, fungi, and debris from entering the nail bed, reducing the risk of infection.

Lunula: The lunula is a whitish, crescent-shaped area visible at the base of the nail, often on the thumbnail. It represents the visible part of the nail matrix and appears lighter due to the reflection of light off the matrix. The lunula is not a separate structure but a visible portion of the matrix.

Nail Folds: Nail folds are the folds of skin that surround and support the sides of the nail. They help protect the nail bed from injury and provide stability to the nail. Nail folds can be prone to inflammation and infection if not properly cared for.

These parts work together to form the human nail, providing protection, support, and functionality to the fingertips and toes.

1.2 OBJECTIVES:

The objective of using herbal nail lacquer on onychomycosis, which is a fungal infection of the nails, is to provide a natural and alternative treatment option that may help alleviate the symptoms and eradicate the fungal infection. Herbal nail lacquers typically contain a combination of natural ingredients known for their antifungal, antimicrobial, and nourishing properties.

The specific objectives of using herbal nail lacquer for onychomycosis may include:

Antifungal action: Herbal nail lacquers often contain plant extracts or essential oils with proven antifungal properties, such as tea tree oil, oregano oil, or neem oil. The primary objective is to inhibit the growth and activity of the fungal pathogens causing onychomycosis.

Nail penetration and nourishment: Some herbal nail lacquers may contain ingredients that aid in penetrating the nail plate, reaching the fungal infection site more effectively. Additionally, they may include nutrients or botanical extracts that promote nail health and strengthen the nails, which can be beneficial for the recovery process.

Minimal side effects: Herbal nail lacquers are generally considered to have a lower risk of adverse effects compared to synthetic antifungal medications. The objective is to provide a natural and gentle treatment option that is well-tolerated by individuals with onychomycosis, reducing the risk of further complications.

Convenience and ease of use: Nail lacquers are relatively easy to apply and can be used at home without the need for medical supervision. This offers convenience and accessibility for individuals seeking a self-care treatment approach for onychomycosis.

It's important to note that while herbal nail lacquers can be a potential complementary treatment for onychomycosis, severe or persistent cases may require medical intervention and consultation with a healthcare professional. The effectiveness of herbal nail lacquers can vary, and individual responses may differ.

MATERIALS AND METHODOLOGY:

Materials and Methods :-

- According to Mrs. Madhuri Sunil Mohite (2022) :
 - ❖ Method of preparation: In a water bath, melt the beeswax.
 - ❖ Triturate the ethyl cellulose and then add the formaldehyde.

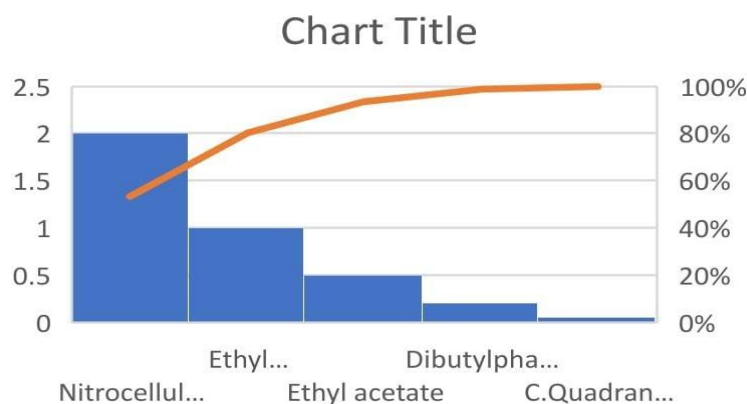
- ❖ With melted beeswax, mix above these two ingredients.
- ❖ Use the olive oil as a moisturizer.
- ❖ At the end, use beetroot powder as a coloring agent
- ❖ Transfer it to a suitable container.

Table no. 1 evaluation table

| Ingredients | F1 | F2 |
|-----------------|--------|--------|
| Ethyl cellulose | 8.5gm | 8.5gm |
| Formaldehyde | 2.5ml | 2.5 ml |
| Castor oil | 1.5 ml | 1.5 gm |
| Bixaorienta | 1.5 gm | - |
| Curcumin | - | 2 gm |

Evaluation parameters:-

- **Appearance:** yellow-colored in appearance.
- **Dryingtime:** nail paint is applied on the nail.
- **Smoothness:** provides essence on the film after drying check the smoothness of the nailpaint.
- **Hardness:** check the hardness by applying the pressure on the nail.
- **Color:** compare with standard color.



According to Dr. Prashant (2020) -

- ❖ **Methodofpreparation:-** In the mixture, mix 75% acetone (solvent) and a whole lot of ethanol (diluent)

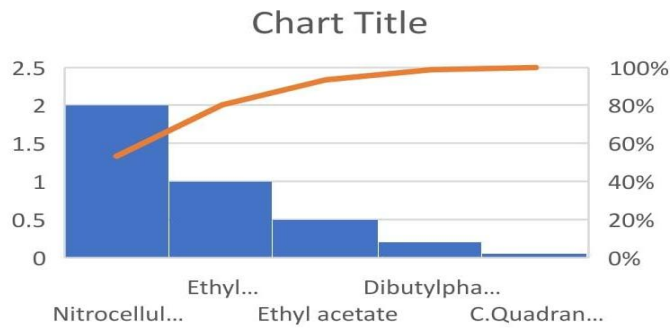
- ❖ Nitrocellulose is dispersed in acetone.
- ❖ Add formaldehyde (resin), camphor (plasticizer), dissolve in a small amount of water, and then mix with nitrocellulose
- ❖ Check viscosity. Add color and place it in a container.

Table no. 2 evaluation table

| Ingredients | Quantity |
|---------------------|----------|
| Nitrocellulose | 15 |
| Dibutylphalate | 4.5 |
| Alcohol and acetone | 10 |
| Ethyl acetate | 30 |
| Butyl acetate | 5 |
| Toluene | 30 |

Evaluation parameters:-

- **Non-volatile content:-** sample 1/0.5 gm in dish place in dish the sample is spread over the dish. Place in oven at 150 degrees. The skin formed by the wire is broken up with the wire. Place in the oven at 150 °C for 1hr., then remove from the oven. When calculating the impurity, the weighed loss value is used.
- **Smoothness of film:-** nail paint is applied to the surface.
- **Drying time:-** applied film of 0.006 on glass or melamine coated. Not the time it takes to dry.
- **Adhesion:-** applied on the surface of the object, attempting to remove the film mechanically and estimating the force required to remove the film.
- **Water resistant:-** measure the film's water resistance by measuring its permeability. Applied to the ground and immersed in deep water. Before and after wt. Taken and calculated
- **Viscosity :-** used Brookfield viscometer



According to WalunjShubhangiBhousaheb (2024):-

- ❖ **Methodofpreparation:-** To obtain a clear solution, nitrocellulose and ethyl cellulose were dispersed in a sufficient amount of ethyl acetate.
- ❖ In the above mixture, salicylic acid was dissolved and dibutyl phthalate was added.
- ❖ On a magnetic stirrer, a mixture of c. quadrangularis and acetone was added with constant stirring at 100 rpm.
- ❖ To achieve the desired consistency of nail lacquer, a sufficient amount of ethyl acetate was added.

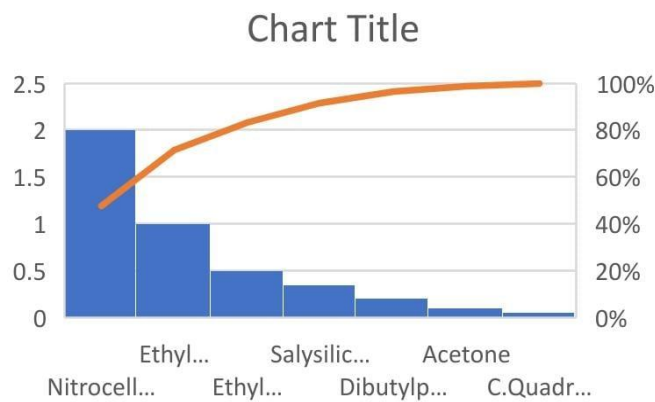
Table no. 3 evaluation table

| Ingredients | F1 | F2 | F3 | F4 | F5 |
|--------------------------|------|------|------|------|------|
| C.Quadrangularis extract | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Nitrocellulose | 2 | 2 | 2 | 2 | 2 |
| Ethyl cellulose | 1 | 1 | 1 | 1 | 1 |
| Ethyl acetate | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Dibutylphthalate | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Acetone | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Salysilic acid | 0.35 | 0.40 | 0.50 | 0.60 | 0.70 |

Evaluation parameters:-

Table no. 4 evaluation table

| Batches | Non volatile content in % | Film thickness In mm | Drying time in sec. |
|---------|---------------------------|----------------------|---------------------|
| F1 | 33+-0.5 | 0.17+-0.2 | 62 |
| F2 | 34+-0.2 | 0.17-0.5 | 64 |
| F3 | 35+-0.4 | 0.18+-0.1 | 62 |
| F4 | 36+-0.3 | 0.19+-0.2 | 65 |
| F5 | 37+-0.2 | 0.19+-0.3 | 65 |



• **According to Srushti M. Bendale:-**

- ❖ **Method of preparation:-** To obtain a clear solution, nitrocellulose and ethyl cellulose were dispersed in a sufficient amount of ethyl acetate.
- ❖ In the above mixture, salicylic acid was dissolved and butyl phthalate was added.

- ❖ Then add calendula officinalis, organumvulgare, allium sativum, and oils of syzygiumaromaticum, melaleucaalternifolia, cymbopogon, ocimumtenuflorum, and menthapiperita with continuous stirring at 100 rpm.

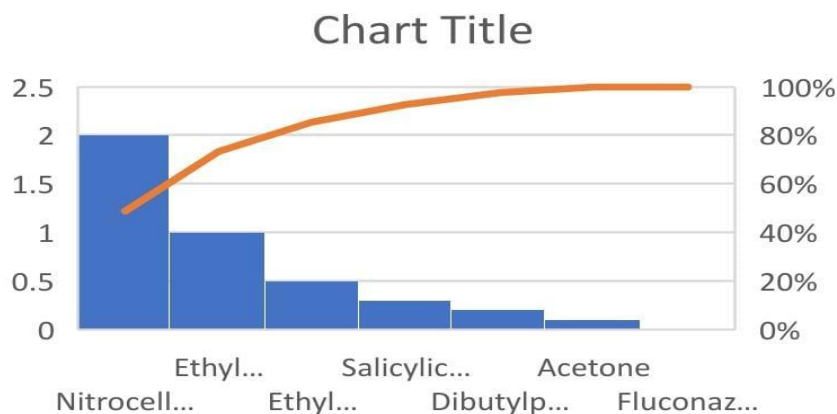
Table no. 5 evaluation table

| Ingredients | F1 | F2 | F3 | F4 | F5 |
|--------------------|-----------|-----------|-----------|-----------|-----------|
| Extract | 0.05 | 0.06 | 0.07 | - | - |
| Fluconazole | - | - | - | 0.04 | 0.04 |
| Nitrocellulose | 2 | 2 | 2 | 2 | 2 |
| Ethyl cellulose | 1 | 1 | 1 | 1 | 1 |
| Salicylic acid | 0.30 | 0.45 | 0.60 | 0.45 | 0.60 |
| Ethyl acetate | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Dibutylphalate | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Acetone | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

Evaluation parameters :-

- **Nonvolatilecontent** :- The non-volatile content of f1-f5 was found to be 340.3 to 370.1. Formulation f3 and f5 contained 360.9 and 370.1% non volatile content, respectively. It also confirmed the consistency of all batches' preparations.
- **The thickness of the lacquer film** was found to be between 0.160.3mm and 0.180.2mm after drying. Uniformity in thickness was there.
- **Drying time and gloss drying time** range of f1 to f5 was found to 582 - 612. In all batches, significance difference was not found. The drying time of f3 and f5 was measured in terms of 583s and 612s respectively. The nail was glossed with nail lacquer, and there was no noticeable difference between the two batches.
- **The glossiness of nail lacquer** was compared by the advertised nail lacquer. The nail was glossed with nail lacquer, and no noticeable difference between the two batches .f3 and f5 was excellent in glossiness (+++) and good (++) .

- **Smoothness of flow** (f1 to f5) was measured against marketed nail lacquer and compared to marketed product.



II. RESULT&IMPLEMENTATION

According to Mrs.MadhuriMohite ,all the ingredients are suitable for the formulation and this research paper also use the herbal ingredients which give colour to the nail paint and all the parameter of evaluation are perfectly done ,drying time also appropriate.

According to Dr.Prashant, adhesion property is appropriate.But the working process of Brookfield Viscometer is not discuss in it.

According to WalnujShubhangiBahusaheb , use the C.Quandragularis which is the main ingredient act as a anti fungal .And also perform the evaluation parameter like drying time ,non volatile content, film thickness and all the parameter are appropriate.

According to SrushtiM.Bendale , use the Fluconazole ,which is anti fungal and use in the disease of Onychomycosis which is a nail fungal infection. The glossiness of batch F3 and F5 is excellent. The result of this review is that the formulation which contain the fluconazole which has anti fungal property and all the evaluation parameter is appropriate and perfect when it is compare with marketed formulation and other research article.

III. CONCLUSION:

According to this review article the several ingredients are use in the formulation of nail paint. Nitrocellulose act as a main ingredient of nail paint formulation .According to c. quadrangularis act a antifungal agent and the robustness of F5 formulation compared with marketed nail paint and it has proper strength when applied on the surface of nil plate. The purpose of this review article is to study on manufacturing of nail paint which provide not only elegant but also perform the anti fungal activity. The c quadrangularis extract has tested for antifungal activity against candida albicans which is also a nail fungal infection.

IV. REFERENCES:

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