

FORMULATION AND EVALUATION OF HERBAL BASED NAIL POLISHES FROM *CLITORIA TERNATEA* AND *BETA VULGARIS* EXTRACTS.

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ABSTRACT

The flora of India is one of the richest in the world, estimated to be over 50,000 species of plants in India. Plants has been an integral part of life in India. as source of food and nutrition, medicine, shelter, wood, oil, paper manufacturing, fuel, adhesive, etc from the earliest times. Beyond physical health, cosmetics can help to improve our mood, enhance our appearance and boost our self-esteem. Nail polishes (also called lacquers or enamels), base coats, top coats, nail hardeners, and nail treatments are coatings applied to the nail plate to provide a pleasing look and to address specific nail plate conditions, such as soft, peeling or brittle nails. The current study was to formulate and evaluate nail polish with herbal ingredient in place of colour pigment to reduce long-time side effect. Two plant parts beetroot and aparajita flowers has intense bright colour. Beet root is a rich source of a group of red pigments known as betalains, Aparajita flowers contain anthocyanins which imparts the blue colour. The colour pigments from the beetroot and aparajita flowers were extracted by suitable method and concentrated. Nail polish were formulated using basic ingredient and natural colour pigments extracted. The formulated nail polishes were evaluated for various parameters such as colour, consistency, grittiness, spreadibility, smoothness of flow, drying time, hardness and water resistance. Formulated nail polishes were looks light blue and red in colour with good texture. Formulated nail polishes have sufficient hardness and excellent spreadibility. Drying time was observed to be 72 seconds for F1 and 74 seconds for F2 formulations. Evaluation tests were found to in normal range according to I.P. Novel formulations can used as alternatives as chemical-based nail polished which is free from harmful chemicals and side effects related to it.

KEYWORDS: Cosmetic, Nail Polish, Herbal color, Aparajita, Beetroot.

INTRODUCTION

Cosmetics are products that are used to enhance or alter the appearance of the face, body, or nails. They can include a wide range of products such as makeup, skincare products, hair care products, nail care products, fragrances, and more. Cosmetics are commonly used for personal grooming, self-expression, and to enhance one's physical appearance. The concept of beauty and cosmetics is as ancient as mankind and civilization.

Herbal cosmetics are the latest, a safe and effective trend in the field of beauty and fashion.

Herbal Cosmetics, referred as Products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide defined cosmetic benefits only, shall be called as "Herbal Cosmetics"^[1,2,9] Herbs do not produce instant cures. They offer a way to put the body in proper tune with nature. A huge number of cosmetic and toiletry

formulations have been designed and developed based u p o n Indian Herbs recently. Other than traditionally documented applications, some modern trials have also been using the utility of Indian herbs in Personal Care products.

These Herbal Cosmetics are gaining popularity as nowadays most people prefer natural products over chemicals for their personal care to enhance their beauty as these products supply the body with nutrients and enhance health and provide satisfaction as these are free from synthetic chemicals. Indian herbs and their significance are popular worldwide. An herbal cosmetic has a growing demand in the world market and is an invaluable gift of nature. Herbal formulations always have attracted considerable attention because of their good activity and having no side effects. Herbs and spices have been used in maintaining and enhancing human beauty.

For multitudinous, well-fixed, glossy nails are a symbol of health and youth and are greatly asked. The significance of nail beautification is deep-seated, constantly made up subconsciously at a youthful age, and while nail cosmetics have been traditionally reserved for women, the request for manly manicures is hastily expanding.

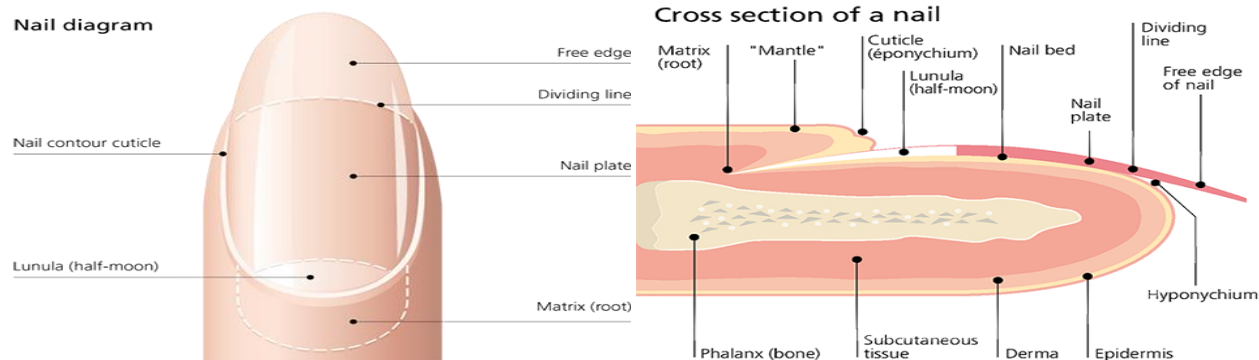


Figure 1: Anatomy of Nail.

The human nails compose of following parts.

1. Nail matrix or the root of the nail
2. Eponychium or cuticle-Living skin covers approximately 20 percent of the nail plate.
3. Paronychium: The perionychium is the skin that overlies the nail plate on its sides.
4. Hyponychium: The farthest or most distal edge of the nail unit
5. Nail plate: The nail plate is mostly made of keratin; it is a special protein that creates the bulk of the nail plate.
6. Nail bed: The nail bed is an area of pinkish tissue that supports the entire nail plate.
7. Lunula: The opaque, bluish white half-moon at the base of the nail plate.

The human nails are not only defensive and ornamental part, but also considered as indispensable pathway for the medicinal delivery, especially in nail conditions like psoriasis or Onychomycosis.^[4,5,6] Onychomycosis is likewise known as tinea unguium which is a chronic fungal infection affecting nail plate and nail bed. Different types of fungus like dermatophytes and *Fusarium* can produce onychomycosis.^[4,5] It's seen largely in Males than ladies and aged people are more affected. The challenges of the medicine delivery to the nail, with the lack of the accord of both the barrier parcels of the nail and formulations to achieve the enhanced ungula delivery confining the effectiveness of topical treatments for nail diseases. And also suffer from low patient compliance due to the lengthy treatment ages up to 4 - 8 months which are needed. still, being oral formulations generally not only contain large dosages of active constituents but also bear long treatment and creating the eventuality for systemic toxicity especially in the liver. therefore, developing further effective styles for nail medicine delivery is an important goal for the pharmaceutical industry.

Anatomy of Nail^[7,8]

The nail is the most prominent skin appendage. It continues to expand throughout one's life. The size and shape of the nails vary from finger to finger and toe to toe. Both epithelium and connective tissue components make up the nail apparatus. The nail unit is composed of the nail matrix, proximal and lateral nail folds, the hyponychium, and the nail bed.

Nail polish^[3,16] (also known as nail varnish or nail enamel) is a lacquer that can be applied to the human fingernail or toenails to decorate and protect the nail plates. The formulation has been revised repeatedly to enhance its decorative effects, and to suppress cracking or flaking. Nail polish consists of a mix of an organic polymer and several other components that give it color and texture. Nail polish has one of the highest demands in the cosmetic market. Nail polish is so common among women and even among men now because it's one of the easiest ways to beautify the hands. It can make you feel beautiful and boost your confidence. It can also help cover up flawed or unattractive fingernails or toenail.

Marketed nail polishes are made up from purely chemical based process and used chemicals are harmful to nails after long time use. Herbal formulations made by using natural herbs and very less side effects, due to these properties their demand is increase continuously. Herbal nail polish is one of the novel options to treat nail diseases and beautify them. So, in recent paper we deal with the formulation and evaluation of herbal nail polish.

The ideal nail polish application technique includes the following steps

1. Base Coat-This is the first layer, meant to build up the nail plate. It is clear (transparent) solution with high resin content and major to stronger attachment of nail polish to the nail. It also helps to restores moisture to the nail and helps in the fill up the ridges and can create a smooth surface.
2. Nail polish: Colouring nail polish applied as 2-3 coats.
3. Top Coat-Again applied a transparent, clear coat that contains additional nitrocellulose than the resin. This prevents the nail polish from chipping and fail. It added to get shine to the polish. This type of nail polish is a clear coloured polish formula that is used specifically

after applying nail polish to the nail. Top coat helps the underlying-colored polish dry quickly as well.

4. Nail polish drier: Liquid that increase drying of the nail polish by the evaporation of the solvent. Generally, it includes the vegetable oils, alcohols, and the silicone derivatives.

Constituent of nail polish

1) Film forming agent-Nail polish is applied the solvent evaporates, leaving the polymer to form a film on the nail. Example- Nitrocellulose, dissolved in a solvent, usually ethyl acetate or butyl acetate.

2) Plasticizers- Nail polish stays flexible, it will be dries, making the nail polish last longer. Example Dibutyl phthalate and camphor, trimethyl pentanyl di isobutyrate, triphenyl phosphate, ethyl tosylamide, glyceryl tribenzoate, castor oil.

3) Adhesive polymer resins- To make sure that the nitrocellulose stick to the nail plate's surface.

Example- 1. Tosylamide -formaldehyde resin. 2. A polyester resin or cellulose acetate butyrate in hypoallergenic nail polishes.

4) Dyes and pigments -The dyes and pigment are imparted in colour. Example-Chromium oxide greens, chromium hydroxide, ferric ferrocyanide, stannic oxide, titanium dioxide, iron oxide, carmine, ultramarine and manganese violet.

5) Opalescent Pigments-Opalescent pigment add glittery or shimmer look. Example – Mica bismuth ox chloride, natural pearls, and aluminium powder.

6) Thickening agents-The thickening agent used to maintain the sparkling particles in suspension while in the bottle. Example- Stearalkoniumhectorite.

7) Ultraviolet Stabilizers-Ultraviolet stabilizer is used to resist colour changes when the dry film is exposed to sunlight. Example- Benzophenone.

Plant profiles

Clitoria ternatea (Aparajita Flower)^[10,11]



Figure 2: Aparajita Flowers.

Synonym: Visnukranta, Asian pigeonwings, bluebell vine, blue pea, butterfly pea, cordofan pea or Darwin pea

Biological source: It consists dried flowers of plant *Clitoria ternatea*.

Family: Fabaceae.

Geographical source: This plant is native to equatorial Asia, including locations in South Asia and Southeast

Asia but has also been introduced to Africa, Australia and the Americas, India.

Chemical constituents: The flowers are mainly composed of flavanols (quercetin, myricetin, and kaempferol derivatives), anthocyanins. Triterpenoids, steroids, taraxerol, taraxerone, aparajitin, beta sitosterol, and kaempferol.

Uses: The flower can be used to dye natural fibers. As food colourant. In traditional ayurvedic medicine, it is ascribed with various qualities including memory enhancing, nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing, and sedative properties. Its extracts possess a wide range of pharmacological activities including antimicrobial, antipyretic, anti-inflammatory, analgesic, diuretic, local anesthetic, antidiabetic, insecticidal, blood platelet aggregation-inhibiting and for use as a vascular smooth muscle relaxing property.

Beet Root^[12,13,14,15]



Figure 3: Beetroot.

Synonym: beet, chard, spinach beet, sea beet, garden beet, white beet and Chukander

Biological source: It is one of several cultivated varieties of *Beta vulgaris* grown for their edible taproots and leaves (called beet greens); they have been classified as *B. vulgaris* subsp. *vulgaris*.

Family: subfamily Betoideae of the family Amaranthaceae

Geographical source: The wild forms of *Beta vulgaris* are distributed in southwestern, northern and Southeast Europe along the Atlantic coasts and the Mediterranean Sea, in North Africa, Macaronesia, to Western Asia. Naturalized they occur in other continents. The plants grow at coastal cliffs, on stony and sandy beaches, in salt marshes or coastal grasslands, and in ruderal or disturbed places.

Chemical constituents: The color of red/purple beetroot is due to a variety of betalain pigments. Some of the betalains in beets are betanin, isobetanin, probetanin, and neobetanin (the red to violet ones are known collectively as *betacyanin*). Other pigments contained in beet are indicaxanthin and vulgaxanthins (yellow to orange pigments known as *betaxanthins*). other valuable compound such as glycine, betaine, Saponins,

betacyanin, carotenoids, folates, betanins, polyphenols, minerals and flavonoids.

Uses: Pigment have been widely used in food products as a natural colorant. It has antioxidant, antidepressant, antimicrobial, antifungal, anti-inflammatory, diuretic and carminative properties. Also used as anticancer, antihypertensive, antisterility, anti-stress, anti-Anxiety and anti-Depressive.

MATERIALS AND METHODS

Procurement of raw materials

The plants were selected on the basis of their phytoconstituents (color pigments) and their uses reported in the literatures. The herbs [*Clitoria ternatea* (Aparajita Flower) and Beet Root (*Beta vulgaris*)] procured from local source. All chemicals are purchased from S. D. Fine Chemicals and used without purification.

Monographic evaluation of Herbs

The individual herbs were evaluated for microscopy, Loss on drying, extractive values, ash values as per the Herbal Pharmacopoeia of India.

Extraction of herbal color from selected plant parts.

Extraction of *Clitoria ternatea* flower (Aparajita Flower) color^[17]

10 gm freshly plucked flowers were washed with cold water to remove dust particles. 200 ml 50% hydroalcoholic solvent was added to flask containing 10 gm flowers. This mixture was reflux at 70° c for 60 minutes. Mixture was allowed to cool at room temperature. It was filtered and concentrated.

Extraction of Beet Root (*Beta vulgaris*) color^[15]

Peeled and chopped beet roots into uniform size using knife, these uniform slices were dried in laboratory hot air oven at 60°-70° c for 8 -10 hrs. The dried beet roots were grinded in mixer grinder. Then passed through mesh sieve. Finest powdered of beet root and water in 1:5 gm/ml proportion were taken in flask, boiled at 60° c for 20 minutes. It was filtered and concentrated.

Formulation of nail polish^[3,18,19]

Film forming material (nitrocellulose) was triturated into mortar pastel and made free flowing powder. Nitro cellulose and formaldehyde (resinous material) were dissolved into ethyl acetate (solvent) and stirred for 20 min (solution A). color extracted from plant was suspended into plasticizer (castor oil) and mixed both well in separate beaker (solution B). solution A and solution B were mixed with continuous stirring. Transferred all content in to suitable container, labeled it and evaluated for different parameter.

Table 1: Composition of Nail Polishes.

Sr. No.	Ingredients	Quantity F1	Quantity F2
1	Nitrocellulose	3 gm	3 gm
2	Formaldehyde	1 ml	1 ml
3	Ethyl acetate	5 ml	5ml
4	Castor oil	1 ml	1 ml
5	<i>Clitoria ternatea</i> flower color	0.6 ml	-
6	Beetroot color	-	0.6 ml

Evaluation parameters of nail polish formulation^[18,19]

The prepared formulations were evaluated for different parameter using following tests.

Colour: The colour of the formulation was checked out against white background. Colour comparing with master color standard by applying on thumbnails, holding them side by side moving the thumb with the standard first on the right and then left. Artificial acrylic nails have been utilized as well for matching comparative shades.

Odour: The odour of the nail polish was checked by manually.

Consistency: The consistency was checked by applying on nail.

Grittiness: The product was checked for the presence of any gritty particles by applying it on the nail.

Drying time: The application and performance properties of a nail coating depend greatly on the volatility characteristics of its solvent system and therefore on its drying time. A thin layer of lacquer is spread or flowed out on a clean and clear glass plate and observed. The time taken to dry is measured with a stop watch. The total time should be less than 10min. Film is applied under the controlled temperature and humidity condition at 25° C and 50% relative humidity.

Smoothness of the flow: Smoothness of flow is determined the smoothness of film. This can be done by sample was poured to approximately 1.5inches and spread on the glass plate and made rise vertically.

Hardness: This is the measure of the hardness of the film. Hardness was evaluated after apply nail polish on nail and apply external pressure by hand on it.

Spreadibility: Spreadability is the ability of a film to spread on nail. Spreadability of nail polish is determined by applying the formulated nail polish on glass slide and then another glass slide was placed over the glass slide. Then load the weight on upper glass slide.

Water resistance: It was carried out to evaluate the water-permeability resistance. On the plate, a continuous film was applied, allowed to dry, and then the film was submerged in water. Before and after immersion, the weight of the plate was measured, and the weight gain was determined. It was calculated by using formula.

Water resistance = $\frac{\text{Loss of the weight of lacquer}}{\text{Actual weight}} \times 100$

RESULTS AND DISCUSSION

Monographic Analysis of Herbs

Table 2 shows the results of monographic analysis of the herbs, performed according to the Indian Herbal Pharmacopoeia and WHO guideline for quality control of herbal raw materials. The extractive values, loss on drying and ash values of all the extracts were within the pharmacopoeias limit. It indicates the good quality of raw materials.

Table 2: Monographic Analysis of Herbs.

Parameters	<i>Beta vulgaris</i> (%w/w)	<i>Clitoria ternatea</i> %w/w
Loss on drying	11.52 %	12.87 %
Alcohol Soluble Extractive	11.68%	7.25%
Water Soluble Extractive	20.95%	10.72%
Total Ash	10.48%	6.19%
Acid Insoluble Ash	0.19 %	1.14%
Water soluble Ash	1.35%	3.64%

Extraction of herbal color from selected plant parts.

The herbal color prepared had different color and odor according to raw materials from which they are extracted as shown in Figure 4.



Beetroot **Aparajita Flower**
Figure 4 Herbal color extracted from plants.

Formulation of nail polish

Formulated nail polishes were looks blue and red in color with good texture as shown in Figure 5.



Figure 5: Final Appearance of Nail Polishes.

Evaluation of formulated nail polishes

Colour: Colour of nail polish is determined by using the standard colour strip. As per the standard colour strip colour of first nail polish (F1) is light blue and colour of second nail polish(F2) is red.

Odour: Both nail polishes F1 and F2 had distinct odour.

Consistency: The consistency of formulated nail polishes was good.

Grittiness: Both nail polishes were found to be free from gritty particles.

Drying time: Drying time was found to be 70-75 seconds. Optimum drying time is less than 10min.

Smoothness of the flow: It was revealed that both nail polishes spread and developed a smooth, uniform film on the glass plate. Both nail polishes were found to be smooth.

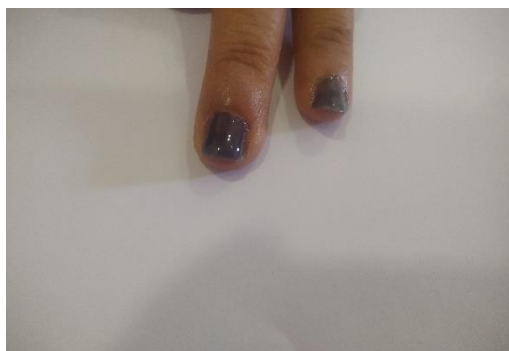
Hardness: Nail polish F1 was sufficient hard whereas nail polish F2 was less hard when apply external pressure by hand on it.

Spreadibility: Both nail polishes were found to be easily spreadable.

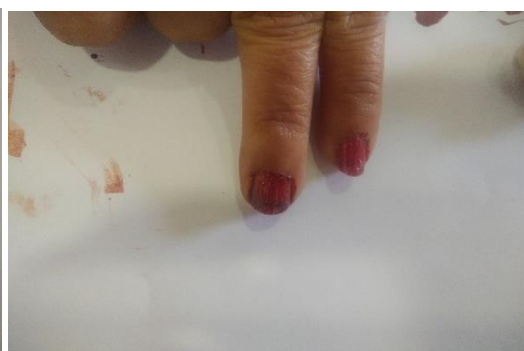
Water resistance: Water resistance of F1 was 0.94 and water resistance of F2 was 0.85.

Table 3: Results of Evaluation of Nail Polishes.

Sr. no.	Test parameter	F1	F2
1	Colour	Light Blue	Red
2	Odour	Distinct	Distinct
3	Consistency	Good	Good
4	Grittiness	Free from gritty particles	Free from gritty particles
5	Drying time	72 seconds	74 seconds
6	Smoothness of flow	Smooth	Smooth
7	Hardness	Sufficient hard	Less hard
8	Spreadibility	Easily spreadable	Easily spreadable
9	Water resistance	0.94	0.85

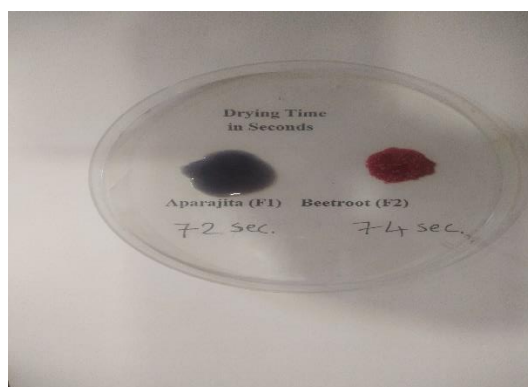


F1



F2

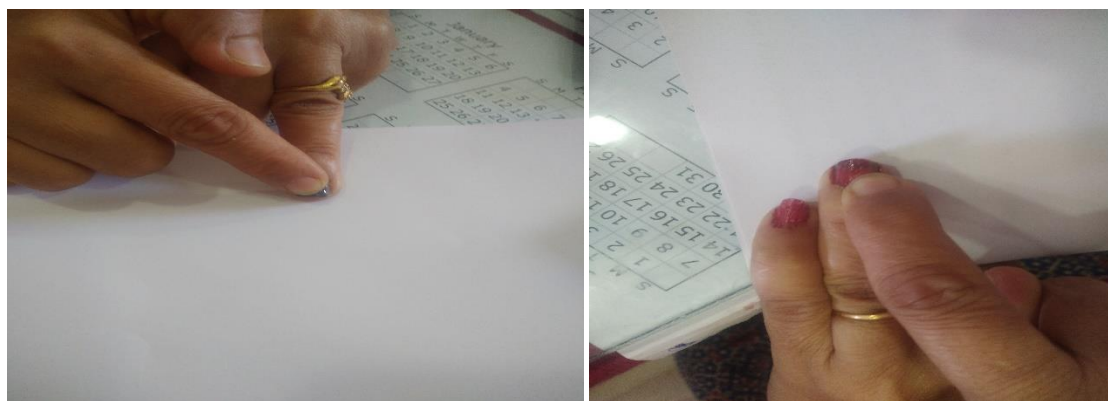
Appearance of nail polish after applying on nails



Drying time of nail polishes



Smoothness of flow



F1

F2

Hardness of nail polishes



Water resistance of nail polishes

Figure 6: Evaluation Test Result of Nail Polishes.

CONCLUSION

The use of natural extracts as active ingredients has improved the use of cosmetics. Usefulness of herbs in the cosmeceuticals production has been extensively increased in personnel care system and there is a great demand for the herbal cosmetics. The study reveals that the developed nail polish with herbal active ingredient was comparatively better than other formulations because of its antimicrobial, antiviral, anesthetic, analgesic and antioxidant activity when applied on skin.

In present study, two different nail polish formulations F1 and F2 were formulated by incorporating *Clitoria ternatea* and *Beta vulgaris* extracts and evaluated. Formulation process was very easy and free from toxic chemicals. Formulated nail polishes were looks blue and red in colour with good texture. Formulated nail polishes have sufficient hardness and excellent spreadibility. Drying time was observed to be 72 seconds for F1 and 74 seconds for F2 formulations. On the basis of result data, it was concluded that *Clitoria ternatea* and *Beta vulgaris* based herbal nail polishes were successfully formulated and evaluated and ready to use as alternative of marketed chemical-based nail polishes.

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