INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Formulation and Assessment of Herbal Liquid Sindoor with Bixa Orellana

Anushka Pradhan, Anwesh Pandey, Ashik Subba, Anushree Paul, Jyochhana Priya Mohanty, Rajat Das*

Department of Pharmacognosy, Himalayan Pharmacy Institution, Majhitar, 737136, Sikkim, India

ARTICLE INFO

Published: 17 Jun. 2026
Keywords:
Herbal Sindoor, Bixa orellana, Annatto, Herbal Cosmetics, Organoleptic Evaluation, Natural Colorant, Herbal Formulation
DOI:
10.5281/zenodo.20736979

ABSTRACT

The use of synthetic cosmetic products containing harmful chemical constituents has raised concerns regarding their safety and potential adverse effects on human health. The present study was undertaken to formulate and evaluate a herbal sindoor using Bixa orellana (Annatto) as a natural coloring agent. The formulation was prepared using selected herbal ingredients possessing colouring, aromatic, and skin-compatible properties in order to develop a safe and effective cosmetic preparation. The prepared herbal sindoor was evaluated for various physicochemical and organoleptic parameters including colour, odour, appearance, pH, spreadability, washability, irritancy, and stability. The evaluation results indicated that the formulation exhibited satisfactory organoleptic characteristics, acceptable pH suitable for topical application, good spreadability, and ease of washability. Irritancy studies showed the absence of any skin irritation, confirming the safety of the formulation for external use. Stability studies demonstrated that the formulation remained stable under different storage conditions without significant changes in its physical properties. The findings of the study suggest that Bixa orellana-based herbal sindoor can be considered a promising natural alternative to conventional synthetic sindoor formulations. The developed formulation offers improved safety, better skin compatibility, and eco-friendly characteristics, thereby supporting the growing demand for herbal cosmetic products in the pharmaceutical and cosmetic industries

INTRODUCTION

The *Bixa orellana* is a tiny perennial tree or shrub that is native to tropical America and is a member of the genus Bixa and family Bixaceae. The greatest amounts of annatto are found in Mexico, Ecuador, Brazil, Paraguay, Colombia, the Dominican Republic, Haiti, Trinidad, Mexico, Panama, and Bolivia. Primarily, B. orellana is significant for the reddish-orange pigment derived

***Corresponding Author:** Rajat Das
Address: *Department of Pharmacognosy, Himalayan Pharmacy Institution, Majhitar, 737136, Sikkim, India*
Email ✉: rajatdas1992@yahoo.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

from the seeds, which are commercially known as annatto and have a fleshy test. Bixin, a carotenoid pigment found in annatto seeds, is used to color food, particularly dairy goods, butter, cheese, rice, margarine, soups, etc., as well as cosmetics, varnishes, and oils. It is also utilized in the paint and textile industries. A further intriguing fact is that annatto is the source of 70% of all natural coloring compounds used globally (1).

Fig.1: Annatto fruit (Source: India Flora Online)

The beneficial plant *Bixa orellana*, commonly known as "lipstick tree," is primarily found in South America, Central America, Caribbean islands, and some regions of Asia. The plant is utilized in traditional medicine, dyes, cosmetics, and food industries in India. It is commonly referred to as "Sinduri" or "latkan." The plant is either farmed or found in the wild, and it exhibits considerable genetic variety. The plant seeds are valuable commercially because they produce a natural colorant called bixin, a carotenoid that is used to color dairy products, make "sindur," and make "lipstick." They also have a high calorie content (2).

Liver diseases are treated using *Bixa orellana*, which is a member of the Bixaceae family. It is a small, attractive evergreen tree with cordate, acuminate leaves, white or pink flowers in terminal panicles, reddish-brown fruits, and trigonous seeds with crimson flesh. B. orellana's roots, bark, and seeds have astringent, antiperiodic, and antipyretic properties. They help with gonorrhea and sporadic fevers. The pulp that surrounds the seed can be used to cure dysentery and repel mosquitoes. Liver disorders are treated using the root's decoction. The entire plant is bitter, purgative, and treats vomiting, kidney problems, leprosy, and biliousness (3). Sindoor is a significant cosmetic item used by Hindus during prayer and other events. Married ladies traditionally use it as an auspicious symbol when parting their hair. Synthetic dyes, filler materials, lime, and lead and mercury salts are used to create the quick and vivid red hues found in the majority of indoor decor. Long-term usage of the sindoor can result in lead poisoning and other health risks (4). All of this occurred as a result of the excessive usage of synthetic products, synthetic chemicals, chemical dyes, and items produced from them during the past 150 years. These products' manufacture and use offer a risk to human health and have a number of adverse effects that can result in various diseases. So, a sudden shift occurs in the cosmetic industry from synthetic colour to naturally occurring pigment found in plants and trees. Among the various plants and trees, Annatto, also known as lipstick tree, employed for the red-pigment in herbal sindoor (5). The pigment in the annatto seed's outer coat, which varies in color from yellow to red, is influenced by the concentration of color compounds. The main color pigments of annatto seeds are nor-bixin (water soluble) and bixin (oil soluble), which come from

the seed's outer layer. The commercial value of annatto seed dye is substantial, and its use as an extract in medicine would be justified by a number of bioactive and advantageous compounds derived from the plant's constituents. Bixin and norbixin are two pigments with several industrial uses as natural colorants in food and cosmetics. Bixin, Norbixin, and other carotenoids—collectively known to as annatto—are included in the basic extract. Anatto is widely used as a natural colorant due to its non-toxic qualities and plant-based origin (6).

This plant's seeds yield one of the most widely used colors in the world, utilized not just in food goods but also in the textile, paint, and cosmetic sectors. Its use has been encouraged by the World Health Organization's (WHO) ban on the use of synthetic dyes in food and cosmetics, where it is one of the few approved because it is nontoxic and does not appear to alter the food's value. A further intriguing fact is that annatto is the source of 70% of all natural coloring compounds used globally.

Annatto initially became popular as food coloring, sometimes referred to as paprika, a condiment that is frequently used in cooking to intensify the color of food. However, it is now used in many different areas of industrial production. As a result, it is now applied to the skin in the form of sunscreen and makeup, and research indicates that using it has health benefits, which makes producers grateful for growing it (7).

In Hinduism, the sindoor is a symbol of a married woman, either as a dot on the forehead or at a woman's hair parting line (also known as simandarekha in Sanskrit or mang in Hindi). In contrast, married women are represented by sindoor in Hinduism. For important occasions, single ladies wear bindis in a range of colors, but they don't wear sindoor for their hairline separating. In Hindu tradition, sindoor is a sign of married ladies. The Asian subcontinent has a high incidence of socioreligious behaviors, which can lead to a variety of skin conditions that dermatologists may overlook due to ignorance. Developing natural products is therefore necessary (8).

The main focus of our research was to formulate herbal liquid sindoor using *Bixa orellana* as the main constituent and other pigment containing plant like B*eta vulgaris* was used.

Herbal sindoor has active natural pigments that provide rich color that doesn't fade as the day goes on, unlike synthetically prepared sindoor that has dangerous levels of lead that could irritate skin. There is no irritation and the color lasts for a long time. The chic sindoor is packed and has a dark texture. It is made completely of natural materials that won't harm the skin or hair even if it is use all day or every day. It has no toxins at all. Herbal sindoor is made with natural herbal ingredients and is simple to apply and remove (9). The aim of the research was to formulate and evaluate herbal liquid sindoor and the objectives were to formulate herbal liquid sindoor by using poly herbal plant extract and evaluation of the formulated herbal liquid sindoor with the help of different organoleptic and physico-chemical parameters.

2. MATERIALS AND METHODS

2.1. Plant Materials

Collection of Annatto:

The fruits of *Bixa orellana* were collected from Majhitar, East Sikkim, India after that the fruit seeds. were shade dried and coarsely powdered using mortar and pestle.

Fig.2: Fruits of Bixa Orellana

Fig.3: Seeds of Bixa orellana

Collection of Beetroot:

The taproots of *Beta vulgari*s were collected from Majhitar, East Sikkim, India after that the roots were sliced into pieces, then ground in a grinder and by using a muslin cloth, the juice was extracted.

Fig.4: Sliced form of *Beta vulgaris*

Collection of sandalwood powder:

The sandalwood powder was collected from the local market of Majhitar, East-Sikkim, India.

Fig.5: Sandalwood powder

Collection of lavender oil and glycerin: The lavender oil and glycerin were purchased from the local market of Majhitar, Sikkim, India.

Fig.6: Lavender oil

2.2. Chemicals and reagent

These includes glycerin, sandalwood powder and lavender oil (Table No. 1).

Table No. 1: Ingredients used in herbal liquid sindoor

Sl. No.	Ingredients	Parts	Scientific Name	Use
1	Annatto	Fruit seeds	*Bixa orellana*	Natural Dye
2	Beetroot	Taproot	*Beta vulgaris*	Natural Dye
3	Sandalwood powder	Wood	*Santalum album*	Flavouring Agent
4	Lavender oil	Petals	*Lavandula angustifolia*	Flavouring Agent
5	Glycerin	Plant based oil	-	Retain moisture

Table No. 2: Formulation table of herbal liquid sindoor

Sl. No.	Ingredients	Quantity
1	Annatto	2.2 gm
2	Beetroot	5.6 ml
3	Sandalwood powder	2 gm
4	Lavender oil	0.5 ml
5	Glycerin	1 ml

2.3. Methods of herbal liquid sindoor formulation:

The Annatto seeds were dried and crushed into fine powder using mortar and pestle then passes them by fine mesh sieve. The beetroot was sliced and make it into fine paste in a grinder, which was then filtered using muslin cloth and the juice was extracted. The fine powdered form of annatto was then mixed with the beetroot juice and a thick slurry like consistency was made. Then added the glycerin which acts as a binder and for fragrances, sandalwood powder and lavender oil were added. The final product i.e, the herbal liquid sindoor was stored in container (Table No. 2).

Fig.7: Annatto seeds powder

Fig.8: Beetroot juice

Fig.9: Formulated herbal liquid sindoor

2.4. Evaluation of herbal liquid Sindoor

2.4.1. Organoleptic Evaluation

The organoleptic properties of the formulated herbal liquid sindoor containing *Bixa orellana* extract were evaluated by visual and sensory examination for colour, odour, appearance, texture, and consistency (10).

2.4.2. Physico-chemical Evaluation

2.4.2.1. pH paper test:

A small quantity of the formulated herbal liquid sindoor was diluted with distilled water , and a strip of universal pH paper was immersed in the sample for a few seconds. The colour change was compared with the standard pH colour chart, and the pH value was recorded (11).

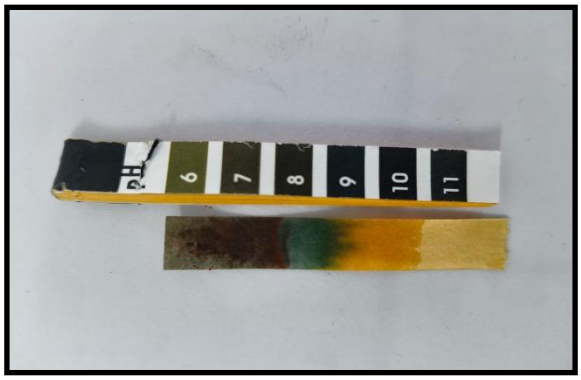

Fig.10: pH paper test

2.4.2.2. Irritancy test:

The human patch test method was used to determine whether the herbal liquid sindoor containing *Bixa orellana* extract caused skin irritation. Healthy participants had a little amount of the mixture applied to a 1 cm² area on their inner forearms, and they were watched for a few hours for any indications of burning, itching, or allergic reaction (12,13). The subject underwent testing upon providing informed consent.

.**Fig.11: Irritancy test**

2.4.2.3. Spreadability test:

The spreadability of the formulated herbal liquid sindoor containing *Bixa orellana* extract was determined by placing a small quantity of the formulation between two glass slides and applying light pressure for uniform spreading. The formulation was then observed for ease of spreading and uniform application (14).

Spreadability is expressed as:

$$S = (M \times L) \div T$$

Where,

S = Spreadability

M = Weight tied to upper slide

L = Length moved by glass slide

T = Time taken

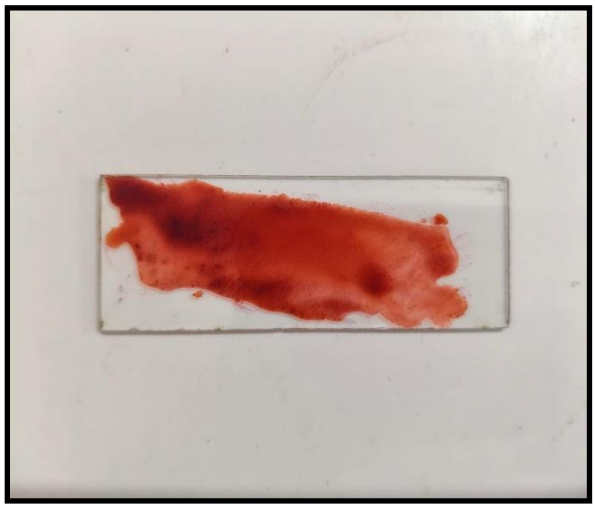

Fig.12: Spreadability test

2.4.2.4. Washability test:

The washability of the formulated herbal liquid sindoor containing *Bixa orellana* extract was evaluated by applying a small amount of the formulation on the skin and allowing it to dry. The applied area was then washed with normal water, and the ease of removal was observed (15). The subject underwent testing upon providing informed consent.

Fig.13: Washability test

2.4.2.5. Stability test:

The stability of the formulated herbal liquid sindoor containing *Bixa orellana* extract was evaluated by storing the formulation at room temperature for a specified period and observing any changes in colour, odour, consistency, or phase separation (16).

3. RESULTS AND DISCUSSION:

The formulated herbal liquid sindoor prepared using natural colourant from *Bixa orellana* showed satisfactory physicochemical and organoleptic properties (Table No. 3). The formulation exhibited a uniform reddish-orange colour, pleasant herbal odour, and smooth homogeneous appearance, indicating good aesthetic appeal and

acceptability for cosmetic application. The pH of the formulation was found to be within the acceptable skin-friendly range (5.5–7.0), suggesting suitability for topical use without causing skin irritation.

The irritancy test showed no signs of redness, itching, burning sensation, or allergic reaction, confirming that the formulation was non-irritant and dermatologically safe. The spreadability of the liquid sindoor was observed to be good, allowing smooth and uniform application on the skin surface. The formulation also demonstrated easy washability, as it could be removed easily with water without leaving significant residue. During the stability study, no noticeable changes in colour, odour, consistency, or phase separation were observed, indicating good physical stability of the formulation.

Overall, the prepared herbal liquid sindoor showed promising results in terms of safety, stability, ease of application, and cosmetic acceptability, suggesting that *Bixa orellana* can be effectively used as a natural colourant in herbal cosmetic formulations.

Table No. 3: Observation Table on evaluation parameters

Sl. No.	Parameters	Observed value	Standard value
1	Colour, odour, and appearance	Reddish-orange, pleasant odour and smooth, glossy liquid appearance	Uniform red to reddish-orange, pleasant and smooth, homogenous liquid
2	pH	6	5.5-7.0
3	Irritancy	No irritancy	No irritation
4	Spreadability	Good	Good
5	Washability	Washable	Easily washable
6	Stability	Stable	Stable

4. CONCLUSION:

The present study successfully formulated a herbal liquid sindoor using natural colourant obtained from *Bixa orellana* and evaluated its physicochemical and cosmetic properties. The formulation exhibited desirable characteristics such as uniform colour, pleasant odour, smooth appearance, skin-friendly pH, good spreadability, easy washability, non-irritant nature, and satisfactory stability. These findings indicate that herbal liquid sindoor prepared with natural ingredients can serve as a safe, effective, and eco-friendly alternative to synthetic sindoor, reducing the risk of harmful chemical exposure while maintaining cosmetic acceptability. Thus, *Bixa orellana* shows promising potential as a natural colouring agent in herbal cosmetic formulations.

5. ACKNOWLEDGEMENT:

The authors would like to thank Department of Pharmacognosy, Himalayan Pharmacy Institute, Sikkim, India for the technical support to carry out the work.

REFERENCES

1. Patel J. Studies on extraction of sindoor from annatto seeds (Bixa orellana).
2. Pandey S, Sharma A, Panika G, Kumar M. Morphological studies, traditional and industrial uses of Bixa Orellana. A review. Current Science International. 2019;8(1):70-4.

3. Aher AA, Bairagi SM, Kadaskar PT, Desai SS, Nimase PK. Formulation and evaluation of herbal lipstick from colour pigments of Bixa orellana (Bixaceae) seeds. International Journal of Pharmacy and Pharmaceutical Sciences. 2012;4(5):357-9.
4. Kapoor VP, Katiyar K, Pushpangadan P, Singh N. Development of natural dye based sindoor. Natural Product Radiance. 2008 May 28;7(1):22-9.
5. Samariya S, Dwivedi S, Panigrahi D, Joshi H. Formulation and evaluation of herbal sindoor using different natural/herbal ingredients. International J Pharm Teach Pract. 2013 Sep 1;4:752-4.
6. Raju SK, Chandrasekar S, Vengadhajalapathy P, Sundaram R, Periyasamy S, Chinnaraj T, Sekar P, Kumar S. Review on phytochemical composition and pharmacological activities of Bixa orellana L. Journal of Pharmaceutical and Biological Sciences. 2023;10(2):57-67.
7. Vilar DD, Vilar MS, Moura TF, Raffin FN, Oliveira MR, Franco CF, de Athayde-Filho PF, Diniz MD, Barbosa-Filho JM. Traditional uses, chemical constituents, and biological activities of Bixa orellana L.: a review. The Scientific World Journal. 2014;2014(1):857292.
8. Wagh JG, Veerkar PV, Mittal A, Kumari R, Sharma S, Sharma S. Preparation and evaluation of modified herbal "Kumkum Powder" to reduce allergic reactions. International Journal of Health Sciences.;6(S5):11274-83.
9. Shid SJ, Pawar AR, Pawar AH, Salunkhe PR, Salunkhe VJ, Nanavare ND. Formulation and evaluation of herbal sindoor using different natural ingredients. Int J Creat Res Thoughts. 2021 Dec;9(12):d679-d683.
10. Wilkinson JB, Moore RJ. Harry's Cosmeticology. 8th ed. London: Longman Scientific & Technical; 1982.
11. Rahul B, Vigneshwar B, Manogna B, Deepika B, Sriram C, Manga K. Formulation and evaluation of lipstick made by natural colourant Bixa orellana. Int J Pharm Res Appl. 2025 May-Jun;10(3):2159-2170. doi:10.35629/4494-100321592170.
12. Ardhany SD, Novaryatiin S, Pratama MRF, Utar Z. Irritation test of Eleutherine bulbosa extract cream with human patch test method. J Farm Sains Praktis. 2021;7(1).
13. Sohail T, Yasmeen S, Imran H, Ferheen S, Rehman AU, Khan RA. Standardization and skin irritation potential of herbal analgesic cream containing Nigella sativa seed oil. Bangladesh J Med Sci. 2020;19(1):163-168.
14. Garg A, Aggarwal D, Garg S, Singla AK. Spreading of semisolid formulations: an update. Pharm Technol. 2002;26(9):84-105.
15. Sharmila D. Formulation and evaluation of aloevera and Daucus carota herbal cream. Int J Pharm Res Technol. 2023;10(1):31-36.
16. Rahul B, Vigneshwar B, Manogna B, Deepika B, Sriram C, Manga K. Formulation and evaluation of lipstick made by natural colourant Bixa orellana. Int J Pharm Res Appl. 2025 May-Jun;10(3):2159-2170

HOW TO CITE: Anushka Pradhan, Anwesh Pandey, Ashik Subba, Anushree Paul, Jyochhana Priya Mohanty, Rajat Das*, Formulation and Assessment of Herbal Liquid Sindoor with Bixa Orellana, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 6, 4394-4403. https://doi.org/10.5281/zenodo.20736979