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ANNATTO (BIXA ORELLANA) AS A NATURAL COLORANT

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ABSTRACT

Bixa orellana L. (annatto), a member of the Bixaceae family, is a natural source of carotenoids, particularly bixin, with promising medicinal properties. This study evaluated the morphology, total phenolic content, antioxidant activity, and antimicrobial potential of seeds from three annatto phenotypes (red, yellow, and green). Seed extracts were prepared using hexane, ethyl acetate, methanol, and hydroethanolic solvents. The methanolic extract of the green phenotype exhibited the highest total phenolic content and the strongest free radical scavenging activity. The highest total antioxidant activity was observed in the hexane extract of the green phenotype and the methanolic extract of the red phenotype. Hydroethanolic extracts from all three phenotypes showed potent antibacterial activity against Staphylococcus aureus. These findings indicate that Bixa orellana seeds are a valuable natural source of antioxidant and antimicrobial compounds, highlighting their potential use in pharmaceutical, cosmetic, and food applications.

INTRODUCTION

In recent years, there has been a significant increase in consumer preference for herbal and natural cosmetic products due to growing awareness of the potential health risks associated with synthetic ingredients. Synthetic colorants used in cosmetic formulations may cause skin irritation, allergic reactions, and environmental pollution during their manufacture and disposal. As a result, researchers and cosmetic manufacturers are focusing on the development of safer, biodegradable, and eco-friendly alternatives derived from natural sources. Natural pigments obtained from plants are considered promising substitutes because they are renewable, biocompatible, and generally exhibit fewer adverse effects.

Among the various natural colorants, Annatto (Bixa orellana L.) has gained considerable attention because of its excellent coloring properties and safety profile. Bixa orellana, commonly known as the lipstick tree, is a tropical shrub native to Central and South America and is now widely cultivated in countries such as India, Brazil, Peru, Mexico, Indonesia, and Kenya. The seeds of this plant contain valuable carotenoid pigments, mainly bixin and norbixin, which impart a bright yellow to orange-red color. Bixin is the major pigment present in the seed coat and is responsible for the characteristic color of Annatto. Due to its natural origin and low toxicity, Annatto has been extensively used as a coloring agent in foods, pharmaceuticals, textiles, and cosmetic products.

Apart from its coloring ability, Annatto possesses several beneficial biological properties. It exhibits antioxidant activity because of its carotenoid content, which helps protect cells from oxidative stress caused by free radicals. Studies have also reported antimicrobial and anti-inflammatory properties, making Annatto a valuable ingredient for topical cosmetic formulations. These additional therapeutic benefits make it more attractive than synthetic colorants, which generally provide color without offering any protective or functional effects.

Lip tint is a cosmetic product designed to impart long-lasting color while maintaining the natural appearance of the lips. Unlike conventional lipsticks, lip tints provide a lightweight finish with better adherence and a more natural look. Modern consumers increasingly prefer lip products formulated with natural ingredients that are free from synthetic dyes, parabens, and other potentially harmful chemicals. Therefore, incorporating Annatto as a natural coloring agent in lip tint formulations aligns with the growing demand for clean-label, herbal cosmetic products.

The present study focuses on the formulation and evaluation of a herbal lip tint using Annatto powder as the natural coloring agent. The formulation contains natural ingredients such as beeswax, castor oil, coconut oil, vitamin E, and vanilla flavour to provide desirable consistency, moisturization, protection, and consumer acceptability. The prepared lip tint will be evaluated for its physicochemical characteristics, stability, spreadability, pH, color uniformity, and overall performance. The development of this formulation aims to provide a safe, effective, aesthetically appealing, and environmentally friendly cosmetic product while promoting the use of plant-based ingredients in modern cosmetic science.

Botanical Description of Bixa orellana

Bixa orellana , commonly known as Annatto or the Lipstick Tree, is a tropical flowering plant belonging to the family Bixaceae and the genus Bixa. It is the most widely cultivated species

of the genus and is grown extensively in tropical and subtropical regions, including India, Brazil, Peru, Mexico, Indonesia, and several African countries. The plant is primarily cultivated for its seeds, which are a rich source of natural carotenoid pigments used in various industries.

The annatto plant is a small evergreen shrub or tree that grows to a height of approximately 3–10 m. It has broad, heart-shaped green leaves with long petioles and bears attractive pink or white flowers arranged in clusters. The fruits are oval or heart-shaped capsules covered with soft, reddish-brown spines. When mature, the capsules split open to expose numerous triangular seeds coated with a bright orange-red aril.

The seed coat is the most valuable part of the plant because it contains the natural pigments bixin and norbixin, which are responsible for the characteristic yellow to orange-red colour. Bixin is an oil-soluble carotenoid, whereas norbixin is its water-soluble derivative. Apart from pigments, the seeds also contain small amounts of fixed oils, proteins, carbohydrates, tannins, cellulose, minerals, and waxes. These constituents contribute to the plant's nutritional, medicinal, and industrial significance.

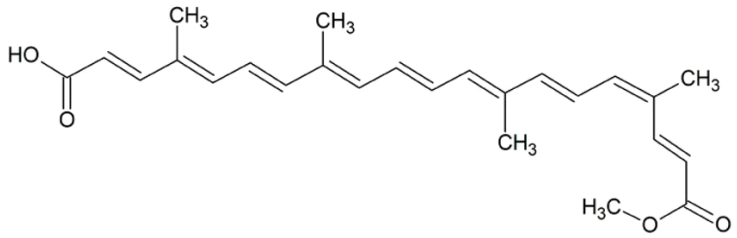
Botanical Classification

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Malvales
- **Family:** Bixaceae
- **Genus:** Bixa
- **Species:** Bixa orellana



Chemical Constituents

It is commonly known as annatto, contains a variety of chemical constituents, primarily carotenoids and apocarotenoids , including bixin and norbixin, which are responsible for its vibrant yellow-orange colour. Other constituents include 2-butanamine, acetic acid, pentanoic acid, phenol, pantolactone, and benzoic acid. Main constituent of pigment is bixin-70%. It is used as colouring agents for foods, cosmetic, alcoholic beverages.



- Synonyms: Annatto, Achiote, Bixa seed powder, Natural Orange Colour.
- Molecular Formula: $C_{25}H_{30}O_4$ (Bixin)
- Molecular Weight: 394.51 g/mol
- Density: Not applicable (Annatto powder is a natural plant powder; density varies depending on processing.)
- Melting Point: 198–200°C (Bixin, with decomposition)
- Storage Conditions: Store in a cool, dry place in an airtight container. Protect from moisture, excessive heat, and direct sunlight to preserve its colouring and antioxidant properties.

Uses of Annatto

Annatto is one of the most widely used natural colouring agents because of its excellent safety profile, biodegradability, and versatility. The pigments extracted from its seeds are extensively used in the food, pharmaceutical, cosmetic, and textile industries.

In the **food industry**, annatto is used to impart an attractive yellow to orange-red colour to products such as cheese, butter, margarine, yogurt, ice cream, bakery products, confectionery, sauces, snacks, processed meat products, and beverages. It is preferred because it provides colour without significantly altering the flavour or aroma of food.

In the **cosmetic industry**, annatto serves as a natural colouring agent in products such as lipsticks, lip tints, lip balms, blushes, soaps, creams, and hair-care products. The increasing demand for herbal cosmetics has further enhanced the importance of annatto as a safe

alternative to synthetic dyes. Its antioxidant properties also help protect the skin and lips against oxidative damage, making it suitable for topical formulations.

In the **pharmaceutical industry**, annatto is used as a natural colouring agent in tablets, capsules, syrups, and topical preparations. Besides its colouring property, studies have reported that annatto possesses antioxidant, antimicrobial, anti-inflammatory, and hypoglycaemic activities, which contribute to its therapeutic potential.

Traditionally, different parts of Bixa orellana have been used in folk medicine for the treatment of fever, skin disorders, digestive problems, infections, and inflammatory conditions. The seeds, leaves, and roots have been utilized in various indigenous systems of medicine for their medicinal properties.

Because of its natural origin, non-toxic nature, and wide range of applications, annatto has become an important raw material in modern industries. Its ability to provide vibrant colour along with potential health benefits makes it an ideal ingredient for the development of herbal cosmetic products such as natural lip tints.

CONCLUSIONS

Bixin and norbixin are the key active components in annatto, responsible for providing the red-to-yellow pigmentation essential to the cosmetic, food, and pharmaceutical industries. To ensure sustainability and effectively replace synthetic dyes, the industry must adopt optimized extraction techniques and

rigorous analytical methods. The literature confirms that annatto offers a safe, environmentally friendly alternative with established methods for rapid analysis and extraction, positioning it as a viable substitute for artificial colorants in the global market.

REFERENCES

1. 1.Mohan K, Verma KD, Kaushal S, Kumar A, Kumar Shukla A. A Review Annatto (Bixa orellana l.) as a Natural Colorant and Bioactive Plant. International Journal of Pharmaceutical and Healthcare Innovation [Internet]. 2025 Dec 31 [cited 2026 July 27];3(I):788–96.
2. 2.Vilar D de A, Vilar MS de A, Moura TFA de L, Raffin FN, Olivei.ra MR de, Franco CF de O, et al. Traditional Uses, Chemical Constituents, and Biological Activities of Bixa Orellana L.: A Review. The Scientific World Journal

3. Shajeeda BV, Awadhesh KP, Rajesh K, Mamta K, Amita S, Anil KS, et al. Growth performance and yield of Bixa orellana L. (annatto) under organic management. Plant Science Today [Internet]. 2026 Jan 14
4. 4.Garg S. Annatto [Internet]. Free UPSC IAS Preparation Syllabus and Materials For Aspirants. 2025 [cited 2026 July 27]
5. 5.Rowe RC, Sheskey PJ, Quinn ME. *Handbook of Pharmaceutical Excipients*. 8th ed. Pharmaceutical Press; 2017.
6. 6.Mercadante AZ, Pfander H. Carotenoids from *Bixa orellana*: Bixin and Norbixin. *Natural Product Reports*. 2001;18(3):310–322
7. Annatto - an overview | ScienceDirect Topics [Internet].www.sciencedirect.com. [cited 2026 July 29]. Available from: https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/annatto
8. Francisco H. News-Medical [Internet]. News-Medical. 2026 Feb [cited 2026 July 29]. Available from: https://www.news-medical.net/health/What-Are-Annatto-Seeds-Uses-Health-Effects-and-Scientific-Evidence.aspx
9. Pooja Ikhar, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 5, 5034-5048 | Research