WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Historical and Formulative Analysis of Lipstick: From Natural Pigments to Modern Chemistries

[1*]Ms. Ankita Ingale, [2]Dr. Reshma Mirajkar, [3]Sharvari Molkar, [4]Smriti Jain, [5]Saleha Shaikh, [6]Ketaki Deshpande, [7]Khushi Muttha, [8]Pranay Darak

[1]Assistant Professor, [2]Assistant Professor, [3]Student, Student, [4]Student, [5]Student, [6]Student, [7]Student, [8]Student

AISSMS College of Pharmacy, RB Motilal Kennedy Rd, Near RTO, Pune, Maharashtra, India-411001

DOI : https://doi.org/10.55248/gengpi.6.0425.1637

A B S T R A C T

Cosmetic products like lipsticks and skincare products boost self-esteem and confidence. Modern lipsticks include moisturising and transfer-resistant options to meet diverse needs. Regulations like the Indian Drugs and Cosmetics Act of 1940 ensure the avoidance of harmful ingredients in response to the growing demand for safe and sustainable products. Innovations such as nanotechnology, biomimetic materials, and even health-monitoring features are transforming these products. The shift toward vegan, cruelty-free, eco-friendly, and personalised options reflects changing consumer preferences, positioning lipsticks to meet health-conscious needs and shape the future of the cosmetics industry.

Keywords: Cosmetics, Lipsticks, Drug and Cosmetics Act 1940, Transfer Resistant, Nanotechnology, Personalised

1. Introduction

Cosmetic means any article intended to be sprayed, poured, rubbed, or sprinkled on, or introduced into any parts for cleansing, beautifying, promoting attractiveness, or altering the appearance. Colour cosmetics are a category of health and beauty products that are routinely applied directly on skin, hair, and nails to enhance or change appearance.

1.1 Colour cosmetics include

Lip cosmetics: lip stain, lipstick, lip oil, lip gloss, lip liner, and lip balm.

Facial makeup: liquid foundation, creamy foundation, concealer, and blush.

Nail cosmetics: nail polish or nail lacquers.

Eye makeup: mascara, eyelash dye and tint, kohl, eyeliner, and eyeshadow.

Hair cosmetics: hair colours and dye. (Uzma S, Shayesta K, Abdul Sameeh, Juveriya M, Shahidulla SM, 2022)

1.2 Impact of colour cosmetics on psychology

Cosmetics nowadays are very popular and used intensively by a large number of people. Cosmetics may function as a self-esteem booster. Cosmetics are especially very popular among women. Cosmetics may be undeniably and implicitly used in a way that affects a woman's daily life. Cosmetics can manipulate facial appearance and enhance or highlight beauty. Thus, use of cosmetics in day-to-day life increases levels of self-esteem by boosting attractiveness. A complementary hypothesis suggests that cosmetics also help to boost cognitive performance via positive emotions, which leads to better performance. (Palumbo R, Fairfield B, Mammarella N, Di Domenico A., 2017)

1.3 Lipsticks

Lips are an essential part of the face; lips serve as an organ of prehension, suction, and speech. Lips are the only part of our body with pores, due to which they require proper nourishment and hydration. Lip care products like lip balm, lip serum, lip rouge, lip oils, lip masks, lip scrubs, lipsticks, and lip exfoliators provide nourishment and help to protect lips from environmental damage. Lipsticks are one of the most popular and widely used colour cosmetic products. Lipstick is a cosmetic product containing pigments, oils, waxes, and emollients that applies colour, texture, and protection to the lips.

Social, psychological, and therapeutic benefits are achieved by using lipstick. They are used to modify or highlight lip colour and are prepared by mixing waxes and colour and moulding them in the form of a stick or a crayon. Lipsticks have been used by humans for over 500 years. Colouring lips is an ancient tradition that dates back to the prehistoric period. It was first introduced in France in 1869 as a cosmetic product that was made from animal fat and beeswax; later it was introduced in cylindrical metal tubes in 1915. Current lip care products not only focus on adding colour and texture to lips but also have added medicinal value for the consumers.

A good lipstick should have persuasive characteristics and should be consumer-friendly, such as having a suitable texture and antioxidant properties.

1.4 Ideal properties

It should be safe and non-toxic, both dermatologically and if unknowingly ingested.

It should be non-irritating to the skin of the lips.

It should be easy to apply.

It should impart uniform colour to the area of application.

It should have stability towards environmental conditions. (Mawazi SM, AzreenRedzal NAB, Othman N, Alolayan SO., 2022) (Chaurasiya IC, Yadav P, Maurya S, Maurya MK, Singh M., 2021)

2. Regulation

Strict regulations are essential for the rapidly expanding Indian cosmetics industry. In India, the Drugs and Cosmetics Act of 1940 and the Rules of 1945 govern cosmetic products. Established under the BIS Act of 2016, the Bureau of Indian Standards (BIS) serves as India's National Standard Body. Its purpose is to facilitate the effective operation of standardisation, marking, and quality certification of goods, as well as to address issues related to or incidental to these activities. Products encompassed by Schedule "S" of the Drugs and Cosmetics Rules 1945 are governed by cosmetics standards established by BIS. Schedule M-II pertains to cosmetics such as lipsticks and lip gloss. It specifies the necessary equipment, plants, and facilities required for the production of these cosmetics. Parts XIII (cosmetic import and registration), XIV (cosmetic manufacturing for sale or distribution), and XV (cosmetic manufacturing for sale or distribution) (regulate labelling, packing, and standards of cosmetics).

If any of the act's provisions are not followed:

On first conviction, a fine of up to Rs 1000 or imprisonment of up to one year, or both, can be imposed.

On subsequent convictions, a fine of up to Rs 2000, or imprisonment of up to two years, or both, can be imposed.

The Bureau of Indian Standards (BIS) has provided the specifications for skin creams and lipstick in Indian Standards (IS) 6608:2004 and 9875:1990.

2.1 Standards for heavy metals in cosmetics:

According to 6608:2004, if all the raw materials that require heavy metals have been tested and comply with the standards, then the manufacturer is not required to test the finished cosmetics for heavy metals and arsenic.

2.2 Standards of colouring agents in cosmetics:

While manufacturing skin creams and lipsticks, dye colours (pigments) are used, and then they should meet the standards of IS 4707 (part I). It should be according to Schedule Q of the Drug and Cosmetic Act and rules specified by CDSCO. Other materials must meet the standards with the provision of IS 4707 (part 2).

Rule 134 of The Drug and Cosmetic Act prohibits the use of cosmetics containing dyes, colours and pigments other than those specified in Schedule Q and in the Bureau of Indian Standard (IS 4707 Part I). Use of lead and arsenic compounds in cosmetics is prohibited under Rule 145 of the Drug and Cosmetics Rules. The imports of cosmetics in which lead and arsenic compounds are used for the purpose of colouring are prohibited under Rule 135. Manufacturing and importing colour cosmetic products containing mercury compounds are prohibited under Rule 145 D and 135 A, respectively. (Dahiya S, Rokshi R, Goyal Y, Sharma C.,2024)

3. History of lipstick

Around 3000 BC, men began using colour to decorate themselves in order to attract the animals they wished to hunt (Sondkar VS, Shinde J, Walave P, Shinde R, Shirole S, Borade D. 2023) (Pakhare RA, Salve M, Deokar RM, 2023). Generally speaking, the term "cosmeceuticals" was first defined in 1961 by Raymond Reed, the founder of the American Society of Cosmetic Chemists. This term derives from the Greek word "kosmtikos", which translates to "decorating talent". Later, in 1984, Albert Kligman coined the term "cosmeceuticals" to describe products that possess both medicinal and aesthetic properties.

Many types of plants and herbs have been used to create cosmetics that are both aesthetically pleasing and environmentally friendly. The natural ingredients in cosmetics provide the body with vitamins and minerals rather than damaging it.

Particularly, lipsticks have been used by humans for around 500 years. Lipstick was first discovered as a rough brick in ancient Mesopotamia. Since the prehistoric age, lip colouring has been a common habit. Coloured cosmetics were first used 5000 years ago in Mesopotamia, when crushed rare and semi-precious jewels were put to the lips and eyelids. A large section of ancient Egypt's civilisation employed makeup to improve looks and provide protection from the heat and hot desert winds, with the exception of the poor, who could not afford the cost of cosmetics. For these people, however, lipstick became an everyday necessity.

Iodine, bromine, mannite, and seaweed extract were used to make the first lipsticks, which were extremely harmful. Eventually, they figured out how to get the carmine colour out of ants and beetles (Rathod MP, Jadhav VA, 2022). Red lips were frequently used to depict Cleopatra (51-30 BC). Cosmetics were virtually nonexistent in Europe for the first 1500 years after Cleopatra's reign, at least until the Renaissance. The word "lipstick" wasn't coined until 1880, and it wasn't until the late 19th and early 20th centuries that it became widely utilised. Lipstick and other cosmetics gained popularity in the 1920s, and this tendency has persisted to this day. Many clients now consider lipstick to be essential. You can choose from a wide variety of colours and textures. To meet the increasing demand, lipstick is being marketed in hundreds of different hue tones, as is visible everywhere. (Kaushik I, Sharma H, Nirwal A, Fatima T, 2024).

Modern Lipstick By 1884, Parisian perfumeries were selling the first modern cosmetic lipstick, which had been launched at the 1883 World's Fair in Amsterdam. Lip and cheek rouge was initially advertised and sold in the Sears Roebuck catalogue in the late 1890s. Silk sheets, paper tubes, and tiny pots were common packaging materials for early lip cosmetics. The tube lipstick, which made it possible for ladies to carry lipstick around, is credited to two pioneers. The metal lipstick tube container was created in 1915 by Maurice Levy. A tiny lever on the side allows you to raise and lower the lipstick. "Levy Tube" is the name Levy gave his device.

Lipstick was first offered for sale in France in 1869 as a cosmetic made from animal fat and beeswax. Lipstick did not start to be sold in metal tubes that were cylindrical until 1915. Many consumers now consider lipsticks to be essential. There are many different colours and textures to choose from. In order to satisfy the increasing demand, lipstick is marketed in hundreds of hue variations. (C. Richard, 2024)

Name	Conventional	Without Transfer	Thin Film	Wet-Look	Fusion	Transfer-Resistant
Year	1990	1995	1998	2000	2004	2007 -2019
Effect	Satin and Opaque	Matte and Opaque	Satin and Bright	Shiny and Bright	Shiny and Bright	Shiny, luster, dewy, glossy and Matte/Nude
Lasting	Medium-hold	Long Time	Medium-hold	Poor hold	Long Time	Long Time
Comfort	Good	Poor	Good	Good	Good	Good

Fig. 1 Evolution of lipstick formulations and features from 1990

4. Current formulations in lipsticks

Fig. 2 Lipstick

Lipstick formulations today come in a wide variety of forms and cutting-edge chemicals, especially with an increasing focus on natural and herbal compounds. Customers' need for safer, environmentally friendly items that are both aesthetically pleasing and healthful is what is causing this change. The lipstick market of today offers a wide variety of products with a wide range of effects and features. Here are a few lipstick varieties with fundamental traits.

4.1 Moisturising Lipsticks:

As they maintain lips smooth and supple, moisturising lipsticks are recommended for people with dry lips. These lipsticks' aloe, glycerin, and vitamin E help to moisturise lips. Wet and glossy lips are two more wonderful benefits of moisturising lipsticks.

4.2 Satin and Sheer Lipsticks:

These lipsticks ensure that lips are hydrated, nourished, and glossy. Because sheer and satin lipsticks contain a lot of oil, they may look darker in the packaging than they do on the lips. Lipsticks that include oil also have the drawback of requiring frequent reapplication.

4.3 Matte Lipstick:

For ladies looking for a lovely and vibrant tint, matte lipsticks are the ideal choice. These lipsticks provide the appearance of flat, unlustrous lips. Matte lipstick will make your lips appear younger and smoother. Additionally, combining aloe vera and vitamin E products with matte lipsticks is recommended.

4.4 Cream Lipstick:

Cream lipsticks are ideal for women with thin lips. Cream-based lipstick gives a smoothing effect on the lips but is not glossy. For the desired effect, you must apply lip gloss afterwards. In order to protect lips, cream lipsticks require more wax, which can result in dry lips.

4.5 Long-Wearing and Transfer-Resistant Lipsticks:

Long-wearing lipstick may be used by women who lack the time to apply lipstick often. The composition of these lipsticks keeps lips looking flawless for four to eight hours. They're tough, and you'll soon be eating something fatty or greasy. To counteract the dryness of the lips, several of them include moisturiser.

4.6 Medicated lipstick:

Lipsticks are made by moulding a colour dispersion in a waxy base into the shape of a stick. They are a cosmetic composition used to alter or highlight the colour of lips. Lipstick is the name of any preparation used in cosmetic procedures. This preparation, which may contain synthetic or herbal medications, is also referred to as a medicated lipstick when it contains active substances. Allantoin, benzoyl peroxide, terbinafine hydrochloride, flurbiprofen, and natural antifungal substances like curcumin, and acyclovir were used in the formulation of numerous medicinal lipsticks, lip balms, and microsponge products. (Hambir UG, Khade PH, Holkar NR, Holle SM, Bhosale A, 2024)

4.7 Waterproof lipstick:

They are composed of a substance that keeps it in contact with water and stops it from evaporating. The degree of colouring will depend on the lipsticks.

4.8 Herbal lipstick

Herbal lipstick is a cosmetic product designed to draw attention to women's beauty. These lipstick compositions have no adverse effects and don't damage our lips. It is essential that health inspectors look closely at the ingredients in lipsticks because users often chew away the product. The lipstick's colouring pigments are harmful to human health when ingested. (Dhadwal A, Thakur C, Aniket, Shikha, Kumari P, 2024)

Benefits of using herbal lipstick:

- The natural lipstick is made entirely of safe natural materials.
- They also include organic elements that keep lips healthy

The drawbacks of using herbal lipstick:

- Their taste and odour are hard to conceal.
- The manufacturing process is difficult and time-consuming.

4.9 Colour-changing lipstick

These lipsticks are guaranteed to be the ideal hue for you once applied, despite the fact that they may come in colourful packaging. However, what is their true mechanism? Why do these lipsticks change colour? It's similar to the mood rings of the 1990s, which change colour based on your skin's temperature rather than your mood. In general, the colour of your lipstick can be affected by three factors: water, the pH of your skin, and your skin tone.

When combined with oil or wax, the lipstick dye Red 27 stays colourless. But it turns a vivid pink when it comes into touch with water, like the moisture from your lips. Even adding water to a swatch on paper can cause this effect. Red 27 can only produce different colours of pink, even though this property produces a fun look.

Human lips have a slightly acidic skin pH of 5 to 5.5, which is closer to neutral. A chemical reaction takes place when Red 27 comes into contact with the lips' higher pH, turning them a vibrant pink.

According to experiments, the lipstick's behaviour varies according to the pH of the surface it is applied to. For example, it becomes hot pink on basic surfaces like soap and water, turns normal pink on naked skin, and stays nearly clear on acidic surfaces like lemon juice. Skin pH can also be changed by hormonal fluctuations and physical exercise, which can result in minor colour changes. The overall impact on lipstick colour is largely constant across users, despite the fact that individual pH levels vary.(Schwartz L,2024)

5. Common ingredients used in lipsticks

(Mawazi SM, Redzal NA, Othman N, Alolayan SO, 2022

1. Waxes

2. Oils

3. Pigments and dyes

4. Alcohol

5. Fragrance

6. Preservation

7. Antioxidant

8. Surfactant

9.Colouring-agents

Table 1: Common ingredients used in lipsticks

INGREDIENTS	CATEGORY
1. Paraffin wax	Stiffening agent,hardening agent
2. Butyl stearate	Lipstick base and solvent for dyes,dispersant
3. Microcrystalline wax	Lipstick base
4. Ozokerite wax	Lipstick base
5. Oleyl alcohol	Emollient, organic base, blending agent
6. Castor oil	Oily base, emollient
7. Coconut oil	Emollientbase
8. Lanolin	Emollient,occlusive moisturizers
9. Vitamin E	Antioxidant
10. Aluminium lakes	Colouring agents
11. Beeswax	Emollients, hardening agents
12. Denatured ethanol	Fragrance
13. Lemon oil	Antioxidant, flavouring agent
14. Petrolatum	Moisturizer

15.	Methyl paraben	Preservative
16.	Propyl paraben	Preservative
17.	Titanium dioxide	Opacifier
18.	Zinc oxide	Colour
19.	isopropyl palmitate	Emollient, gloss
20.	Potassium alcohol sulphate	Surfactant

6. Evaluation Tests for Lipstick Formulation

6.1 Melting Point Determination

Objective:
To determine the melting point (MP) of the lipstick, a critical parameter for assessing its thermal stability during storage and transportation.

Methodology:

- Accurately weigh 50 mg of the lipstick sample.
- Load the sample into a clean glass capillary tube open at both ends.
- Chill the loaded capillary tube in an ice bath for several hours.
- Submerge the tube in a beaker containing water with continuous magnetic stirring.
- Gradually increase the water temperature and observe the sample.
- Record the temperature at which the lipstick begins to melt and flow within the tube—this is considered the melting point.
- Repeat the process three times for each formulation and calculate the mean value.

Acceptance Criteria:

An ideal MP range is 60°C to 65°C. Values below this range may result in poor product stability and soft texture during application.

6.2 Droop Point Determination

Objective:
To assess the structural integrity of the lipstick under high-temperature conditions.

Methodology:
After determining the MP, continue heating the sample and record the temperature at which:

- Phase separation (oil leakage) is observed.
- The lipstick loses its original cylindrical shape and flattens.

Significance:
Indicates the temperature at which the lipstick becomes unstable and undergoes shape deformation.

6.3 Breakpoint Test

Objective:
To measure the mechanical strength and rigidity of the lipstick under applied stress.

Methodology:

- Position the lipstick horizontally, maintaining a 1-inch distance from its base.
- Gradually attach weights, increasing by 10 grams every 30 seconds.
- Conduct the test at 25 ± 1°C.
- Record the weight at which the lipstick fractures—referred to as the Breaking Load Point (BLP).

Acceptance Range:

30–32 grams.

Significance:
Determines the lipstick's resistance to breaking and deformation during consumer use or transportation.

6.4 Force of Application

Objective:
To evaluate the force required to apply the lipstick to a surface.

Methodology:

- Secure a sheet of coarse brown paper on a shadowgraph balance.
- Hold the lipstick at a 45° angle.
- Apply the lipstick uniformly over an area of 1 square inch.
- Record the pressure indicated on the balance.

Significance:
Helps assess ease of application and consumer comfort during usage.

6.5 Thixotropic Behaviour

Objective:
To determine the thixotropic properties of the lipstick base, which influence its texture and spreadability.

Methodology:

- Use a penetrometer fitted with a 50 g needle.
- Allow the needle to penetrate the lipstick sample for 5 seconds at 25°C.
- Measure the depth of penetration.

Interpretation:

- Acceptable range: 9–10.5 mm.
- Higher values indicate better flow properties and smoother application.

6.6 Microbial Load Analysis

Objective:
To evaluate the microbiological safety of the lipstick formulation.

Methodology:

- Accurately weigh a known quantity of the lipstick.
- Inoculate onto:
    - **Nutrient Agar** for bacterial growth.
    - **Sabouraud Dextrose Agar** for fungal growth.
- Incubate the plates for 24–48 hours under suitable conditions.
- Count the number of colonies and report colony-forming units (CFU).

Significance:
Ensures safety by detecting microbial contamination due to raw materials, packaging, or storage.

6.7 Rancidity Test (Peroxide Value Determination)

Objective:
To assess the extent of lipid oxidation in the lipstick formulation.

Methodology:

- Take a known quantity of the lipstick sample and let it react with hydrogen peroxide.
- Calculate the **Peroxide Value (PV)** using standard titration methods.

Interpretation:
Low PV values indicate minimal rancidity and better product freshness.

6.8 Surface Anomalies

Objective:
To visually inspect the lipstick for physical imperfections.

Observation Criteria:

- Crystal formation.
- Mould growth.
- Surface irregularities.

Significance:
Indicates formulation instability or microbial/fungal contamination.

6.9 Ageing Stability (Accelerated Stability Test)

Objective:
To assess the stability of the formulation under elevated temperature conditions.

Methodology:

- Place the lipstick at 40°C for 1 hour.
- Evaluate for:
    - **Bleeding** (oil separation).
    - **Crystallisation** on the surface.
    - **Application ease**, such as glide and smoothness.

6.10 Solubility Profile

Objective:
To determine the solubility of the lipstick in various solvents.

Solvents Used:

Ethanol, ether, hexane, chloroform, and water.

Methodology:
Dissolve a fixed quantity of the sample in each solvent and observe for clarity, residue, or miscibility.

6.11 pH Determination

Objective:
To assess the pH for skin compatibility.

Methodology:

- Disperse a known amount of lipstick in distilled water.
- Measure pH using a calibrated digital pH meter.

6.12 Dermal Irritation Test

Objective:
To evaluate potential irritant reactions on the skin.

Methodology:

- Apply a small amount of lipstick to the skin (e.g., inner forearm).
- Leave undisturbed for 10 minutes.
- Observe for redness, swelling, or irritation.

6.13 Perfume Stability Test

Objective:
To determine the fragrance retention over time under accelerated ageing conditions.

Methodology:

- Store lipstick samples in an oven at 40°C.
- Periodically assess the fragrance for:
    - Intensity.
    - Character.

Significance:

Ensures long-term consumer acceptability of the product's olfactory attributes. (ZKPawane AP, Khan, 2023), (Sondkar VS, Shinde J, Walave P, Shinde R, Shirole S, Borade D, 2023),(Yadav ABP, Vani NS, Bharathi J, Babu MK)(Shaikh PC, Mulla AH, Madankar VS, 2023)

7. Emerging trends in lipsticks

The lipstick industry is rapidly evolving due to advancements in science, changing consumer preferences, and an increased focus on sustainability and safety. The future holds great promise for innovative products and a more personalised approach to lip care. According to a report by Credence Research, the lipstick market is projected to grow from USD 11,655 million in 2023 to USD 18,224.33 million by 2032, expanding at a Compound Annual Growth Rate (CAGR) of 5.00%. The next generation of lipsticks incorporates nanotechnology, biomimetic materials, sunscreen lipsticks, herbal lipsticks (nutricosmetics), biosensing devices, and personalised formulations. (Veludurthi, P.A. and Vadaga, A.K., 2024)

7.1 Herbal Lipsticks (Nutricosmetics)

Lipsticks, popular cosmetic products, often contain harmful chemicals and animal-derived ingredients. These substances can be absorbed through the lips, potentially causing skin issues and other health concerns. To mitigate these risks, many consumers are shifting toward vegan and natural lipsticks. These formulations are cruelty-free, plant-based, and offer additional nutritional benefits for the lips. As the demand for ethical and sustainable beauty grows, the vegan cosmetics market is booming, with projections suggesting it will surpass $20 billion by 2025. In response, many established cosmetic companies are adopting vegan and natural formulations to meet this rising demand. (Balaguru, R., Bhowmick, S. and Iyer, P., 2023)

7.2 Biomimetic Materials

Biomimetic materials are transforming lip care products by mimicking the natural structure and function of lip tissues. These materials help address issues such as lip pigmentation and uneven colouration, leading to enhanced cosmetic and therapeutic outcomes. (Goyal, N. and Jerold, F., 2023)(Veludurthi, P.A. and Vadaga, A.K., 2024)

7.3 Personalised Formulations

Fig. 3 AI in cosmetics

Personalised lip care is gaining traction, driven by innovations like 3D printing and AI-based customisation. For instance, the "Mink" 3D printer enables users to select specific shades and print them directly onto lipsticks, offering a truly bespoke experience. Furthermore, AI and machine learning (ML) models can analyse interactions between lip care ingredients and an individual's unique skin microbiome, leading to the development of highly customised products (Goyal, N. and Jerold, F., 2023); (Veludurthi, P.A. and Vadaga, A.K., 2024).

7.4 Biosensing Devices

Lipsticks, commonly used beauty products, are now being explored as platforms for biosensing due to their direct contact with saliva and frequent application. A notable innovation is ChromaLipSense, a lipstick-embedded colourimetric biosensor that offers non-invasive, continuous monitoring of various health parameters. By changing colour in response to pH levels, it provides visual cues of metabolic changes. This approach addresses limitations of traditional biosensors—like patches and tattoos—which often require frequent calibration and can be uncomfortable. Moreover, integrating machine learning with lipstick-based biosensors opens new avenues in health monitoring through everyday cosmetic use. (Sun, S., Ku, Y.-H., Suk, J.Y., Yetisen, A.K. and Vega, K., 2024)

7.5 Sunscreen Lipsticks

Sunscreen lipsticks containing inorganic UV filters such as zinc oxide and titanium dioxide are becoming increasingly popular for protecting lips from harmful UV radiation. These filters reflect and scatter UV rays, safeguarding the delicate lip tissue. Titanium dioxide, in particular, provides broad-spectrum protection but poses formulation challenges due to its clumping tendency. Researchers are exploring mesoporous silica to help disperse these particles evenly, thereby improving product effectiveness. Overall, such lipsticks offer a convenient and protective lip care solution (Marcelino, P.d.S., Martinez, R.M., Daneluti, Á.L.M., Morocho-Jácome, A.L., Pessoa, F.V.L., Rijo, P., Rosado, C., Robles Velasco, M.V. and Baby, A.R., 2023).

7.6 Nanotechnology

Fig. 4 Nanotechnology in cosmetics

Nanotechnology involves reducing ingredient particle sizes to the nanoscale (5–100 nm), offering substantial benefits in lip care. Nanoparticles, including liposomes and nanoemulsions, enhance the delivery of active ingredients, boosting hydration, protection, and overall lip health. They also improve absorption, colour payoff, and product shelf life. However, concerns remain regarding potential toxicity, as nanoparticles can penetrate the skin and may reach internal organs. Their long-term health effects are still under investigation. Moreover, environmental risks associated with nanoparticle release warrant thorough safety assessments and adherence to strict regulations. (Azam, U., 2024)

7.7 Microbiomic Research

The skin of the lips hosts a diverse microbiome composed of bacteria, yeasts, fungi, and viruses that are essential for maintaining healthy skin. Disruptions in this balance can lead to lip issues. Lipsticks formulated with probiotics and prebiotics can help preserve this balance, protecting against harmful effects and contributing to healthier, more beautiful lips. (Goyal, N. and Jerold, F., 2023)(Azam, U., 2024)

8. Conclusion

Lipstick, a historically and culturally significant cosmetic, has undergone substantial evolution from rudimentary mineral- and animal-derived tints to complex formulations incorporating advanced technologies. The advent of nanotechnology, biomimetic systems, and biosensors has paved the way for multifunctional lip products that offer enhanced aesthetic appeal, targeted lip care, and personalised consumer experiences. Concurrently, the global

cosmetic market is witnessing a paradigm shift towards sustainable, vegan, and environmentally conscious formulations in response to increasing consumer awareness and regulatory pressures.

The future of lipstick formulation necessitates a harmonious integration of innovation, consumer safety, and ecological responsibility. This includes the development of biodegradable packaging, non-toxic pigments, and bioactive ingredients sourced from renewable resources. By aligning scientific advancement with ethical and environmental considerations, the cosmetics industry can ensure that lipstick continues to serve not only as a symbol of beauty but also as a reflection of contemporary values such as sustainability, customisation, and health-centric design.

REFERENCES

1. Uzma, S., Shayesta, K., Sameeh, A., Juveriya, M. and Shahidulla, S.M., (2022). Herbal lipstick – an updated overview. *International Journal of Creative Research Thoughts*, 10(5), pp.208–216. Available at: http://www.ijcrt.org [Accessed 2024 Nov].
2. Palumbo, R., Fairfield, B., Mammarella, N. and Di Domenico, A., (2017). Does make-up make you feel smarter? The "lipstick effect" extended to academic achievement. *Cogent Psychology*, 4(1), p.1327635. https://doi.org/10.1080/23311908.2017.1327635
3. Mawazi, S.M., AzreenRedzal, N.A.B., Othman, N. and Alolayan, S.O., (2022). Lipsticks history, formulations, and production: A narrative review. *Cosmetics*, 9(1), p.25. https://doi.org/10.3390/cosmetics9010025
4. Chaurasiya, I.C., Yadav, P., Maurya, S., Maurya, M.K. and Singh, M., (2021). A review on cosmetic product "lipstick". *International Journal of Creative Research Thoughts*, 9(1), pp.521–525. Available at: http://www.ijcrt.org
5. Dahiya, S., Rokshi, R., Goyal, Y. and Sharma, C., (2024). Quality concerns of lip care cosmetics and applicable regulatory framework: Need for a harmonized cosmetovigilanceprogramme. *Indian Journal of Pharmaceutical Education and Research*, 58(1s). https://doi.org/10.5530/ijpe.58.1s.s1
6. Sondkar, V.S., Shinde, J., Walave, P., Shinde, R., Shirole, S. and Borade, D., (2023). Lipsticks history, formulations, and production: A narrative review. *International Journal of Advanced Research in Science, Communication and Technology*, Dec. Available at: https://www.ijarsct.co.in [Accessed 2024 Oct 30].
7. Rathod, M.P. and Jadhav, V.A., (2022). A review on cosmetic product lipstick. *International Journal of Research Publication and Reviews*, 3(7), pp.1138–1141. Available at: www.ijrpr.com
8. Kaushik, I., Sharma, H., Nirwal, A. and Fatima, T., (2024). Modern herbal lipstick quality assessment and standard: A review. *International Journal of Research Publication and Reviews*. Available at: www.ijrpr.com [Accessed 2024 Oct 31].
9. Pakhare, R.A., Salve, M. and Deokar, R.M., (2023). An overview on: Lipstick history, formulation and production. *International Journal of Pharmaceutical Research and Applications*, 8(6), pp.514–522. Available at: www.ijprajournal.com
10. Richard, C., (2024). Lipstick adhesion measurement. In: *Surface Science and Adhesion in Cosmetics*. 1st ed. Hoboken: Wiley, pp.634–662. Available at: https://www.researchgate.net
11. Hole, S.M., Holkar, N.R., Hambir, U.G., Khade, P.H. and Bhosale, A., (2024). A review on herbal medicated lipstick. *International Journal of Novel Research and Development*, 9(1), pp.163–179. Available at: http://www.ijnrd.org [Accessed 2024 Oct 26].
12. Dhadwal, A., Thakur, C., Aniket, Shikha and Kumari, P., (2024). Formulation and evaluation of herbal lipstick using natural ingredients. *YMER*, 23(6), pp.501–516. Available at: http://www.ymerdigital.com
13. Schwartz, L., (2024). The science behind colour changing lipstick. *Elixuer Magazine*. Available at: https://www.elixuer.com/beauty/the-science-behind-colour-changing-lipstick/ [Accessed 2024 Oct 26].
14. Roxie Cosmetics, (2024). Types of lipstick: Which is best for you? *Roxie Cosmetics*. Available at: https://roxiecosmetics.co.uk/blogs/beauty/types-of-lipstick [Accessed 2024 Oct 26].
15. Lee, C., (2022). Different types of lipsticks: A guide to make the perfect pick. *De'lanci*. Available at: https://www.de-lanci.com/blogs/makeup-blog/different-types-of-lipsticks [Accessed 2024 Oct 27].
16. Pawane, A.P. and Khan, Z.K., (2023). Review on formulation and evaluation of herbal lipstick using red spinach. *International Journal of Research Publications and Reviews*, 4(4), pp.312–321. Available at: https://www.ijrpr.com
17. Sondkar, V.S., Shinde, J., Walave, P., Shinde, R., Shirole, S. and Borade, D., (2023). Lipsticks history, formulations, and production: A narrative review. *International Journal of Advanced Research in Science, Communication and Technology*, 3(1). Available at: https://www.ijarsct.co.in [Accessed 2024 Oct 30].
18. Mawazi, S.M., Redzal, N.A., Othman, N. and Alolayan, S.O., (2022). Lipsticks history, formulations, and production: A narrative review. *Cosmetics*, 9(1), p.25. https://doi.org/10.3390/cosmetics9010025 [Accessed 2024 Oct 30].

19. Yadav, A.B.P., Vani, N.S., Bharathi, J. and Babu, M.K., (2024). A review article on herbal lipstick formulation: Evaluation of herbal lipstick from the extraction of papaya. *YMER*. Available at: https://ymerdigital.com/uploads/YMER2112CU.pdf [Accessed 2024 Oct 30].

20. Shaikh, P.C., Mulla, A.H. and Madankar, V.S., (2023). A review: Formulation and evaluation of herbal lipstick. *International Research Journal of Modern Engineering and Technology Science*, 5(5). Available at: https://www.irjmets.com

21. Veludurthi, P.A. and Vadaga, A.K., (2024). A comprehensive review of formulations, ingredients, advances, and future perspectives in lipcare cosmetics. *Zenodo*. https://doi.org/10.5281/zenodo.11527489 [Accessed 2024 Oct 31].

22. Balaguru, R., Bhowmick, S. and Iyer, P., (2023). Formulation of chemical and cruelty-free vegan lipstick and analyzing its components. *International Journal of Engineering Science and Technologies*, 7(5), pp.37–53. https://doi.org/10.29121/IJOEST.v7.i5.2023.507

23. Goyal, N. and Jerold, F., (2023). Biocosmetics: Technological advances and future outlook. *Environmental Science and Pollution Research*, 30, pp.25148–25169. https://link.springer.com/article/10.1007/s11356-021-17567-3

24. Sun, S., Ku, Y.-H., Suk, J.Y., Yetisen, A.K. and Vega, K., (2024). ChromaLipSense: Lipstick-based biosensors for metabolic monitoring. *University of California, Davis*. Available at: https://iolab.ucdavis.edu [Accessed 2024 Oct 31].

25. Marcelino, P.d.S., Martinez, R.M., Daneluti, Á.L.M., Morocho-Jácome, A.L., Pessoa, F.V.L., Rijo, P., Rosado, C., Robles Velasco, M.V. and Baby, A.R., (2023). In vitro photoprotection and functional photostability of sunscreen lipsticks containing inorganic active compounds. *Cosmetics*, 10(2), p.46. https://doi.org/10.3390/cosmetics10020046 [Accessed 2024 Oct 31].

26. Azam, U., (2024). A new era in cosmetology. *European Journal of Biomedical and Pharmaceutical Sciences. Available* at: https://www.ejbps.com/ejbps/abstract_id/10419 [Accessed 2024 Oct 31].