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A NEW ERA IN COSMETOLOGY

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ABSTRACT
A subset of health and beauty goods known as cosmetics is employed to alter or enhance a person's look in addition to caring for the face and body. Cosmetics have been around for a minimum of 7,000 years, and they are used in nearly every civilization on the planet. It's evident that the industry for beauty has done a phenomenal job of brainwashing our thoughts. With every year that goes by, the cosmetic industry in India grows significantly, making it one of the developing nations. Despite the worldwide economic downturn, the Indian cosmetics industry recorded sales of over 350 billion rupees in 2009. Among the often used cosmetics are soaps, creams, and sunscreens. Despite the fact that a large portion of the world's population views cosmetics as beneficial, it is important to evaluate the risks and toxicity of cosmetical products. Some of the newest developments in cosmetics include release based on biological stimuli, circular economy, and in silico modelling for cosmeceuticals. When compared to other cosmetic formulations, the class of cosmetics known as hypoallergenic products is known for its tendency to cause less allergic responses. The FDA was affirmed by the court despite the two companies' claims that it lacked the jurisdiction to impose the regulation. Eventually, the US Court of Appeals ruled that cosmetic manufacturers could keep using the phrase "hypoallergenic" on their labels. Labelling procedures might lessen the likelihood of a severe allergic reaction in those with extremely sensitive skin and hair. We may infer that cosmetics are essential to daily life and are used by people of both genders, which contribute to a growth in their use and significance.

KEYWORDS: Cosmetics, Cosmetology, Beauty, AI in cosmetics, Nano-cosmetics.

INTRODUCTION

A subset of medical and cosmetic goods called cosmetics is employed to either enhance or alter a person's look or provide maintenance for the face and body. In addition to being used to enhance a person's look, cosmetics are also used to take care of the skin and body and add scent. Even while makeup is typically used for skin and body treatment, important and distinct uses. A wide range of different racial and cultural groups use makeup on a daily basis. The renown of cosmetics in the contemporary scenario is said to be mostly due to the creative self-expression and self-identity feature. The primary purpose of makeup is to give the wearer a fresh, presentable appearance.[1]

Despite the cosmetic industry's phenomenal growth, many Western countries mistakenly view cosmetics as little more than makeup items. However, the US FDA made it very clear that cosmetics are goods that are often applied to the human body to change appearance while enhancing beauty, cleaning, or beautifying without changing the structure or functions of the body. By this definition, a product is considered cosmetic if it satisfies the aforementioned criteria; nevertheless, the US FDA categorically rejects pure soap as something that's cosmetic.[2,3]

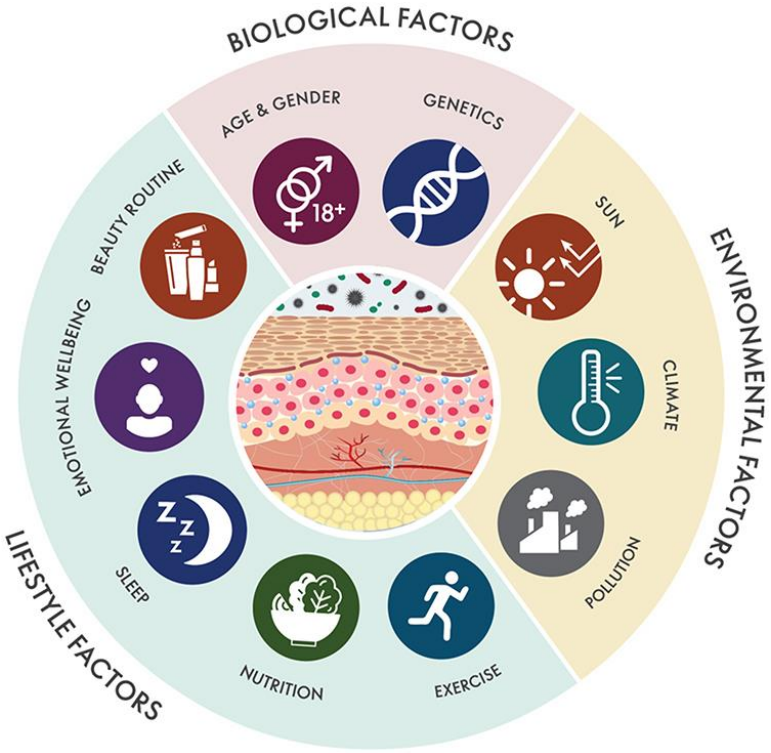

Fig. 1: Factors influencing Dermatology.

History

Cosmetics have been around for at least 7,000 years, and they are used in nearly every civilization on the planet. Body art including makeup is said to be the first instance of human ritual utilising cosmetics. In addition to crayons, red mineral pigments (red ochre) used in conjunction with the appearance of Homo sapiens in Africa are said to be the conclusive evidence supporting the aforementioned claim. The Old Testament story of 2 Kings 9:30 mentions cosmetics. Jezebel painted her eyelids in 840 BC, while the book of Esther lists several procedures meant to enhance one's appearance. The Old Testament book of 2 Kings contains these historical accounts.[4]

Although the cosmetics were not accepted in Rome at the time, some of the nobility there did use them. It has been discovered that certain Romans created cosmetics in earlier eras. When deodorant for cosmetic use was developed in 1888, it was sold under the brand name "Mum" by an unidentified American. People refused to embrace cosmetics regardless of 1900 AD. 1952 saw the introduction of roll-on deodorant, while 1965 saw the introduction of aerosol deodorant. In 1910, Russian ballet and coloured cosmetics were launched simultaneously. It should be mentioned that Japan, the second-biggest cosmetic market, is where the majority of today's cosmetic businesses began their manufacturing in the first decade of the 1900s.Japanese cosmetics have generally entered a stable phase. Conversely, a swift shift in the market conditions is seen. In the present day, a person may quickly and readily obtain knowledge on a wide range of cosmetics intended for distinct objectives. This shapes new employment opportunities in the cosmetics business. Nonetheless, the cosmetic industry's annual growth might be unpredictable at times.[5]

The commercialization of Beauty Philosophy

Greed has no limits. Because someone with a certain type of complexion and hair wants to resemble someone else and hold them up as an example. However, there is a humorous moment when the "role model" continues to strive for perfection. The primary cause of this discontent with US consumerism. Commercialization is carried out in a way that lessens our discontent with our physical attributes. Therefore, it is evident that the beauty industry has done a phenomenal job of brainwashing our thoughts.[6]

India's Production of Cosmetics

The Indian cosmetic industry grew by 7.48% between 2006 and 2008. Although the industry's notable rise is attributed to consumers' increased purchasing power and fashion consciousness, this momentum was anticipated to continue from 2009 to 2012. It is important to acknowledge that the media significantly contributes to Indian consumers' acquaintance with fashion. The majority of Indian cosmetics manufacturers currently serve the local market, although they are progressively expanding into international markets. Indian manufacturers of cosmetics have seen an increase in orders from international markets over the past few years.[7]

The Indian cosmetics business, which has historically been dominated by a small number of significant Indian companies like Lakme and Ponds, has experienced a significant influx of global competitors inside the past

ten years. The skincare, hair care, colour cosmetics, fragrances, and oral care categories comprise the Indian cosmetics business, which was valued at around 2.5 billion in 2008 and is projected to expand at a rate of 7%, as per a sector study. Numerous herbal cosmetics companies, including Forest Essential, Biotique, Himalaya, Blossom Kochhar, Dabur, Louts, and many more, are part of the Indian cosmetics business. India is one of the developing nations that have one of the fastest-growing cosmetic industries with every year that goes by. Despite the worldwide economic downturn, the Indian cosmetics industry saw sales exceeding 350 billion rupees in 2009.The cosmetics industry lavishly invests in advertising and other forms of marketing, particularly in India.[8]

Concerns about Cosmetic Safety

While many people across the world view cosmetics as a blessing, it is important to acknowledge the risks and toxicity associated with cosmetics. Given that a vast number of people use cosmetics, safety needs to be ensured and included into the design of the goods at the manufacturing stage. Overuse of cosmetics can also result in toxicity and long-term negative effects, some of which may be permanent.[9]

Safety issues

Among the potential safety issues with cosmetics and personal hygiene products are the following:

- Scratches and irritation of the ocular area
- Severe eye infections
- Contaminants in goods made outside of the United States of America
- Allergic responses or sensitivity to ingredients specified in the product
- Bacterial dispersion on the skin's surface
- Fire risks associated with aerosol items

The procedures listed below are able to be used to ensure the safety of the cosmetics

Evaluating the safety of cosmetics starts with knowing what components are in them. This may be accomplished by looking through databases such as Skin Deep Cosmetics by EWG, which has information on the ingredient lists for more than 69000 distinct cosmetic goods. These databases allow searches to be done by manufacturer, ingredient, name of product, as well as brand name. The risk key score, which ranges from 1 to 10, can be used to display the hazardous nature of the components in a particular cosmetic product. The relationship between the product's safety and the danger key score is inverse. Certain database programmes, such as the California Safe Cosmetics Programme Product Database (CSCP), offer information on the correlation between a certain chemical and a particular disease or problem. It also offers details on the components included in deodorants and fragrances.[10]

Testing for safety

When manufacturing cosmetic items, the cosmetic industries are required to adhere to US FDA regulations. The United States Food and Drug Administration (US FDA) advises the cosmetics industry to use assessment tests. However, this is not absolutely necessary. It should be mentioned that a cosmetic product ought to be identified with a caution indicating that no evaluation of the product's safety has been done by the industry. A good or service must indicate on its label if safety testing hasn't been done. Additionally, D&C, FD&C, or external D&C may be seen after the name of a colour, such as D&C Red No. 36. These substances are commonly referred to as colour additives. Only medications and cosmetics applied to the skin are permitted to include external D&C.[11]

While FD&C colour is permitted for application in foods, medications, and cosmetics, D&C colour is only permitted for use in pharmaceuticals and cosmetics. FD&C is used to a wide range of items, such as meals, medications, and cosmetics. The use of medication and cosmetic formulations is where D&C and external D&C diverge. The word "external" in External D&C's colour additive makes it very evident that it should only be utilised in the formulation of external treatments. Parabens and phthalates are the two widely utilised chemical compounds for increasing safety off cosmetic items. Parabens are also regularly used for safety.[12]

Phthalates are used in a wide variety of cosmetics' production formulas. Phthalates are acceptable when utilised in cosmetic preparations, according to the findings of several reviews and research investigations. Because of its fixating properties, this molecule is employed in fragrances in addition to being a solvent. Phthalate is also used in nail polish to stop it from breaking right after application. Phthalates are used in hair spray formulations to avoid stiffness. It is not believed that parabens are as safe as phthalates. Due to the fact that several studies have linked parabens to breast cancer. The primary application of parabens is as antimicrobials. This chemical is employed by reducing the product's potential toxicity within the given limit.[13]

CURRENT COSMETICS TRENDS

The advancement of science is happening every hour. In a similar vein, advances in dermatology, trichology, and other fields of research are now being used to cosmetic technologies. The latest advancements in cosmetic technology are listed here.

1. Nano-Cosmetics

Sunscreens are a helpful tool for protecting skin from UVB, UVA-2, and UVA-1 rays of solar radiation. Inorganic UV radiation filters, such as zinc oxide (ZnO) and titanium dioxide (TiO2), are typically used in them to shield the skin from the sun's damaging rays. ZnO has been shown to be more successful at blocking UVA rays, whereas TiO2 is better at blocking UVB rays.[14]

Therefore, wide-ranging UV protection is guaranteed when these particles are mixed in the proper amount. With a greater sun protection factor (SPF) at the nanoscale, TiO2 is arguably the most widely used and effective inorganic nanoparticle for sunscreens. Its openness, as opposed to its original colour, renders it more efficient and has a greater restorative impact.[15]

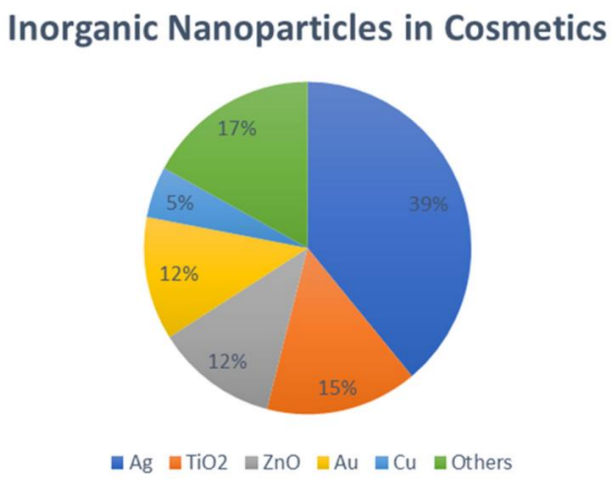

Fig. 2: Proportions of various inorganic nanoparticles in the composition of cosmetics.

TiO2's significant surface-area-to-volume ratio in the nano range, which increases its molecular carrying capacity when molecules get smaller to 10–20 nm in size, is responsible for these features. Additionally, it has been documented that ZnO and TiO2 at the nanoscale exhibit remarkable advantages over a wide variety of materials that are bigger than the nano range. The size of the TiO2 and ZnO nanoparticles utilised in sunscreens as UV filters starts at 20 nm.[16] They have superior protecting or restorative effects and exhibit better dispersion. However, it has been demonstrated that breathing in a significant quantity of these nanoparticles can be hazardous. Nonetheless, the USFDA views ZnO as safe to use as a UV filter in cosmeceuticals or cosmetics. Alternatively, organically produced nanoparticles are used for their UV-protective properties; one example of this is ivy nanoparticles, which are released from the roots of English ivy (Hedera helix). These nanoparticles are typically safer.[17] Ivy nanoparticles reduce the influence on the environment and human health as compared to other harmful nanoparticles because of their improved visual transparency and safety.

The antibacterial and antifungal qualities of gold and silver nanoparticles make them popular in cosmetic formulations including face masks, anti-aging lotions, and antiperspirants. Egypt has an extensive record of using gold in cosmetics and skin health products. Gold was used there to keep skin tone. The Egyptians thought that gold enhanced the elasticity and composition of their skin. Gold is now used in a variety of skincare products, including lotions, salves, and treatments. Generally speaking, gold used in beauty products is referred to as colloidal gold or, more accurately, nanogold if its size falls between 5 and 400 nm. Red to purple are its colour ranges, based on the size and total surface area.[18,19]

Moreover, their widely recognised antifungal, antibacterial, and anti-aging properties are extremely relevant in the cosmeceutical and wound healing sectors. When it comes to repairing skin damage and enhancing the flexibility, elegance, and surface of the skin, gold nanoparticles are quite important. Gold has calming qualities that make it a great treatment for sunburn, rashes, and hypersensitivity. As such, it works well in facial masks as well as additional makeup applications.[20]

A variety of bacteria can be effectively inhibited by silver nanoparticles. In various formulations, the use of silver and mixes containing silver can be employed to regulate the growth of bacteria. Silver precipitates easily in combinations containing silver, which makes its use in cosmetics troublesome.[21] However, this may be avoided by using silver nanoparticles. Awareness in silica nanoparticles has grown, especially in the cosmetics industry, because to their hydrophilic surfaces, which promote broad dispersion and inexpensive manufacturing expenses. Cosmetic products are made more adequate, have a longer shelf life, and have a smoother surface thanks to the use of nanosilica. It has been demonstrated that silica nanoparticles may aid in enhancing lipstick look, appropriation of tints, and colour retention. By encapsulating hydrophilic and lipophilic substances, silica nanoparticles, which range in size from 5 to 100 nm, may be delivered to their intended destinations. Typically, leave-on and wash-off cosmetic products for the hair, skin, lips, face, and nails contain these nanoparticles. It is anticipated that the presence of silica nanoparticles in cosmetic products will continue to grow.[22]

Carbon black, or CI 77266, is widely used as a colourant in cosmetic treatments for the eyes and skin and is recognised as an important component in cosmetic formulas. Its usage as a colourant at a maximum proportion of 10% and in its nanostructure form has been permitted by the EU. When compared to micron-sized nanoparticles, carbon black nanoparticles showed a greater inclination to cause cytotoxicity, aggravation, and alterations in phagocytosis in human monocytes. According to the EU, it is permitted to be used in cosmetic products where inhalation is not a risk.[23,24]

A unique, potent, and photostable filter utilised especially in sunscreen compositions is called tris-biphenyl triazine. Because of its broad-spectrum UV protection properties in nano form, it is often employed in sunscreen formulations. It is an authorised UV protectant in Europe and provides notable photostability. BASF SE uses it under the trade name TINOSORB®A2B.[25] Another UV protectant that is

permitted for use in the EU market is methylene bis-benzo triazolyl tetramethyl butylphenol (nano), or MBBT. It can be used in cosmetic preparations applied topically at levels of up to 10% w/w. The Scientific Committee on Consumer Safety's (SCCS) evaluation states that when MBB is applied to intact, solid skin, it poses no risk to human health. However, it has sparked worries about potential negative effects and has the ability to bioaccumulate in certain organs.

2. AI in Dermatology

Emulation of human intellect in robots that are built to mimic human cognitive processes and behaviours is known as artificial intelligence (AI). Artificial intelligence (AI) technology is being used in medicine to help with repetitive procedures that need human expertise, such epidemiological analysis, diagnosis, therapy, and screening. The study of algorithms and statistical models that allow computers to learn from data without explicitly programming them is known as machine learning (ML), and it is a branch of artificial intelligence.[26] Essentially, it mimics the mental processes involved in human education by using experience information to guide judgements. The work may be carried out in a semi-supervised fashion, without any kind of oversight at all, or under the guidance of an expert (i.e., unsupervised learning).

Deep learning (DL) has been a prominent area of study within machine learning (ML) in recent times, mostly because to advancements in computer hardware technologies. By using deep neural network designs, DL avoids the conventional domain-expert-dependent feature engineering techniques and automatically extracts features from input data.Several studies have shown that when DL is used instead of typical ML approaches, it performs better in the discipline of medicine, particularly in dermatology. Nevertheless, deep learning's higher accuracy relies on the size of its underlying training datasets, making up for the lack of directed feature engineering methods. Thus, it is imperative that deep learning algorithms be able to recognise patterns in heterogeneous data that comes from many forms and sources.[27,28]

Borade and Kalbande state that a sizable portion of dermatologists have historically depended on time-consuming and tedious traditional diagnostic procedures. Furthermore, numerous occupations in the skincare industry must possess a high degree of accuracy and competence, which calls for specific knowledge and skills. For example, several dermatological disorders might seem similarly, making it difficult for even specialists to classify them. Because of the above described problems, automated methods must be used in order to provide dermatologists and other relevant healthcare professionals with the information they need to make decisions.[29] Due to the large amount of medical data that has been accumulated, the trend currently shows a notable increase in the application of AI and ML approaches within the dermatological area.

Processes for making decisions involving skin or hair photos are common hurdles in the area of dermatology. These tasks are commonly presented as computer vision problems that may be solved by machine learning approaches. The machine learning techniques used in dermatology are capable of learning from several kinds of image data, such as self-captured, dermoscopic, clinical, and histological pictures. The capacity to astutely assess and derive valuable information from photographs of patients or specimens has proven advantageous not just in clinical dermatological however in teledermatology, where consultations are conducted remotely.[30] The spread of teledermatology and smartphone applications for self-evaluation can be ascribed to the limited availability of sophisticated healthcare services and dermatologists. In addition, the COVID-19 pandemic's demands acted as a spur for the rapid adoption of teledermatology, wherein the use of internet-based dermatological consultations was seen to become a workable remedy during the socially estranged phase.[31]

Fig. 3: AI in Dermatology.

The use of AI in the field of dermatological problems has been the subject of much investigation. The bulk of earlier research has used AI in medical dermatology, particularly when it comes to the diagnosis and treatment of dermatological conditions that, if ignored, may have a negative impact on patients' quality of life or even result in death. As a result, a number of review papers have concentrated on using AI and ML techniques to address issues in medical dermatology. Wells et al., for example, looked at the application of AI in dermatology. Additionally, Zhang et al. and Mosquera-Zamudio et al. carried out a thorough analysis of academic publications that investigate the use of DL to the analysis of melanoma pictures.[32] Jeong et al. recently examined the patterns, conclusions, and challenges in the field of applied DL in medical dermatology.

Cosmetic dermatology is different from medical dermatology in that it treats skin disorders such as freckles, melasma, age spots, wrinkles, and acne that are not caused by sickness. Despite being non-fatal and not directly endangering a patient's physical health, certain dermatological disorders associated to beauty can have psychological repercussions on people, such as lowered confidence and self-esteem, as well as persistently negative long-term mental impacts. In order to help dermatologists diagnose patients and provide treatments, as well as to improve the production of cosmetic products and reach new audiences, studies on cosmetic dermatology has recently used AI and ML approaches. Nevertheless, to the best of our knowledge, no comprehensive analysis, synthesis, or compilation of studies has been conducted on the uses of AI and ML in cosmetic dermatology.[33]

The present systematic review makes a contribution by examining the application of artificial intelligence (AI) and machine learning (ML) techniques in cosmetic dermatology research. This covers the full range of dermatological processes, which includes the upstream development of cosmetic products, the middle-stream evaluation and therapy activities performed by dermatologists, and the downstream expectations centred on guaranteeing customer satisfaction. This review paper's subsequent sections are organised as follows.[34] Research topics, inclusion and exclusion criteria, and the search phrases used to query academic documents are all explained in Section II along with the review technique. A thorough representation of the selected publications from a variety of demographic perspectives is given in Section III. Section IV presents a comparative analysis of the selected publications, which are categorised according to the various stages of cosmetic dermatological treatments. Section V provides information on pertinent research subjects and potential obstacles.[35]

3. Hypoallergenic Devices

When compared to other cosmetic formulations, hypoallergenic cosmetics are the class of cosmetics that often cause less allergic responses. This does not imply that certain cosmetic formulas should only be used to skin types that are more sensitive than others. The phrase "hypoallergenic" is not properly defined under federal regulations. As a result, a cosmetic manufacturer can describe their product as hypoallergenic formulation without having to file any paperwork or follow any regulatory requirements. Most people view this as a calculated tactic to draw in a larger audience by making the claim that their product is less allergenic than that of other cosmetic manufacturers.[36]

Considering this word doesn't immediately correspond to any brand or composition, it lacks a precise connotation. Additionally, this category of cosmetics has little commercial value. Products with labels such as "hypoallergenic," "tested for allergy," and so on do not guarantee that consumers won't experience an allergic reaction. A number of regulatory agencies are releasing new standards for the cosmetics industry to meet in order to be designated as a hypoallergenic product. The US Court of Appeals made it abundantly evident in the twenty-first century that the USFDA's "hypoallergenic" requirement is impractical. Furthermore, only the cosmetic industries will be able to use this unique set of rules, which must be branded accordingly. As a result, this situation is nearly delusional since no cosmetic firm will go to the trouble of putting a phrase on the label. The use of this word in cosmetic product labels faced strong criticism. Because there is a significant danger for people who are extremely sensitive to allergies if there is no guarantee that hypoallergenic cosmetics are not allergenic.[37] Racial differences in these patients raised the risk of an allergic response. Appropriate validation testing for bioequivalence and demonstrating the lack of allergenicity in cosmetic product formulations were required by some sectors of the cosmetic industry. However, if such labelling is required, more money may need to be spent on the high-quality testing.

Even if the regulatory authorities' guidelines are followed and the cosmetic composition is branded as hypoallergenic, there is still a chance that an adverse medication response might occur. Every regulatory agency made a concerted effort to define the phrase "hypoallergenic." The Food and Drug Administration eventually published the full regulation rules for hypoallergenic cosmetics in 1975. Comparative tests were part of the most recent set of regulatory processes, which were less expensive to conduct than the prior set. Even when some cosmetic corporations filed lawsuits against the USFDA, the regulatory agencies were backed by lower court judges. However, the regulatory processes outlined by the USFDA were rejected by the higher courts. The manufacturers of "hypoallergenic" cosmetics, Clinique and Almay, swiftly challenged the new rule in the U.S. District Court for the District of Columbia.[38] The FDA was upheld by the court despite the two corporations' claims that it lacked power to issue the regulation. Subsequently, the US Court of Appeals ruled that cosmetic firms may keep using the phrase "hypoallergenic" on their labels.

4. Systems for Delivering Nanomedicines in Cosmetics

Nanotechnology has been offering cutting-edge solutions to a number of issues in the pharmaceutical and medical fields for the last several decades. The same idea has been used in cosmetics, leading to the development of innovative formulations known as nanocosmeceuticals, which offer specialised solutions for cosmeceutical issues. A smaller size that aids in acquiring new qualities including improved solubility, transparency, chemical reactivity, and stability may be responsible for the fresh advantages. The cosmetics business uses a variety of nanomaterials, including liposomes, ethosomes, solid

lipid nanoparticles, nanocapsules, dendrimers, nanocrystals, cubosomes, and nanoemulsions.[39]

Liposome-based cosmetic formulations are more stable on the skin since they are difficult to remove. Because they mimic the biological makeup of the skin, they are effective transporters of cells and biomembranes that may be applied to the skin. They may also be used to fix and transfer nutrients and provide pleasant smells to antiperspirants, lipsticks, and body wash.[40-47] Because the particles in nanoliposomes are smaller than those in other cosmetics, they improve skin hydration and leave the skin feeling smooth and elastic. These have the capacity to carry active ingredients to the skin's deeper layers and even the bloodstream, and in cosmeceutical applications, they can function as a transdermal drug delivery system (TDDS).

In recent years, Han et al. showed how to use elastic nanoliposomes in a unique way to enhance the absorption profile of collagen peptides extracted from *Asterias pectinifera*. This combination created a potentially useful formulation that might be employed as an environmentally acceptable resource of ingredients for anti-aging cosmetics in addition to reducing the expression of MMP-1, which is formed during exposure to UV radiation and prevents light-induced ageing. Additionally, a study by Kocic et al. examined the moisturising properties of commercially available creams and creams with nanoliposomes that included skimmed donkey milk. They came to the conclusion that the cream with nanoliposome encapsulation could reach deeper layers and had a respectable moisturising capacity with a quick rate of hydration; as a result, it could have some anti-aging effects.

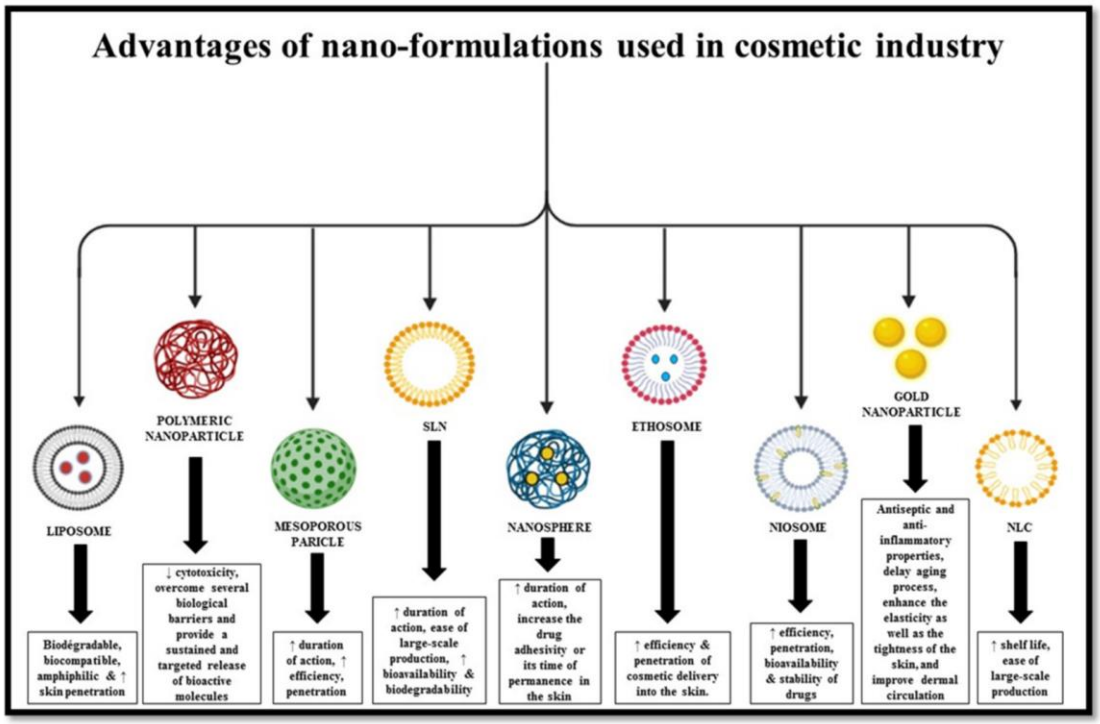

Fig. 4: Different nanoformulations employed in the cosmetics sector.

Empirical studies have demonstrated that the ethosomal formulation of melatonin and niacinamide can enhance their skin penetration effectiveness. According to a different research, ethosomes that included phenylethyl resorcinol effectively infused the active ingredient into the skin to achieve its skin-lightening effects. According to one of Yücel et al.'s investigations, the liposomal formulation was less effective than the transdermal administration of ethosomes laden with rosmarinic acid, which has anti-aging characteristics. In comparison to the rosmarinic acid solution and liposomes, the ethosomal formulation was shown to have a higher skin penetration profile with greater transdermal flux.

A different study that included chitin, tocopherol, and chemical UV absorbers in SLNs demonstrated improved UVB protective activity. They are ideal for cosmeceuticals that treat dermatitis and irritated, itchy skin since they are also employed for film development, which aids in the reinforcement and restoration of the skin barrier. In contrast to NLCs, which have relatively superior encapsulation, SLNs' crystalline structure results in lower drug encapsulation efficiency. In addition, SLNs release drugs more slowly than NLCs and have a shorter shelf life. According to an experiment conducted recently on an SLN formulation integrating fucoxanthin (which blocks UVB rays), the SLN carrier increased fucoxanthin's bioavailability and showed good sunscreen-boosting action. As a result, the SLN carrier has the potential to be a promising carrier for sunscreen cosmetics. In a different study, the inherent antioxidant properties of flavonoids were paired with NLCs to create

a powerful delivery mechanism for cells. Furthermore, the generated NLCs were well-integrated into the skin with minimal cytotoxicity, indicating potential use as moisturising and anti-aging cosmetics in the not too distant future.

In one work, durable poly-lactic acid nanocapsules measuring around 115 nm were created using nanoprecipitation, and odorous atoms were effectively encapsulated in a polymeric nano-transporter to enable continuous fragrance release. This kind of atom encapsulation in biocompatible nanocapsules can significantly improve the efficacy of antiperspirant compositions. In order to deliver vitamins and extracts, researchers have created unique stimuli-responsive nanocapsules, which were then added to semisolid formulations like creams. The application of these formulations on the skin caused the nanocapsules to release their active components at the specific region of the skin due to stimuli created by injured skin, such as pH change and an abundance of enzymes.

Because perfluorocarbon emulsions are inherently unstable, a recent study successfully integrated perfluorodecalin (an oxygen carrier) into a silica nanocapsule core as a novel approach for topical treatment of ageing skin. In addition, this mixture outperformed emulsions in terms of distribution and stability. Barbosa et al. created nanocapsules using Pluronic that contained benzophenone-3 and poly(ε-caprolactone) carrot oil as a sunscreen. These nanocapsules demonstrated synergistic SPF action with a non-irritating profile and enhanced the stability of the benzophenone within the topical formulation.

The hydrophobic characteristics of dendrimers' outer parts and the hydrophilic characteristics of their centre regions work together to cause surface movement and branching. Additionally, their reliability, polyvalence, and monodispersion make them the perfect transporters for the administration of drugs and cosmetics. The development of resveratrol dendrimers, which possess antioxidant and anti-aging properties, has improved the substance's overall solubility and skin penetration. Consequently, this has aided in the formulation's scaling up and commercialisation. According to a research, rutin nanocrystals exhibited more bioactivity than the typical rutin glycoside. The solubility and penetration characteristics of the anti-pollution agent SymUrban were found to significantly increase in its nanocrystal form in one of the most recent research on the substance conducted by Köpke et al. The little-soluble active component in SymUrban was made more dermally bioavailable by these nanocrystals, which also seemed to be a good way to administer the substance.

Khan et al. described a prolonged-release cubosome formulation that contained erythromycin. They determined that this non-invasive formulation had greater activity and efficacy in treating and preventing acne. Furthermore, a clinical study carried out by El-Komy et al. asserted that a safe and effective substitute for treating skin ageing issues is the developed cubosomal topical gel formulation containing alpha-lipoic acid.

5. Microbiomic research

Understanding the most recent methods and advancements in the field of microbiomic sciences is necessary to comprehend cosmetic preparations pertaining to microbiology. The significance of the human microbiome has become clear with advancements in the domains of genetics, biogenomics, and pharmacogenomics. An in-depth understanding of the microbiomic flora and fauna is necessary to comprehend the appropriate use of cosmetics. People everywhere need to be aware of the hidden connection between two crucial elements: dermal microbiome and attractiveness. The aforementioned claim unequivocally states that a person cannot be made to feel beautiful by cosmetics intended for external usage alone.

Certain dietary supplements, such as probiotics and prebiotics, can also improve a cosmetic product's overall effectiveness. These promote the growth of bacteria that are advantageous to our bodies and aid in the decomposition of harmful bacteria. The human body's microbiome is now moving in the direction of the regulated zone.

Numerous advantages come with this sort of method, including skin wellbeing and parking equity, among many others. It is evident from supporting the skin and gut microbiota that the human body engages in an almost infinite number of advantageous processes. For instance, the prodrug method can be started, which can be biotransformed into an active medication when coming into contact with a certain enzyme in a microbe. This kind of multifaceted method can lessen the risk of harm that the active medication may bring.

6. Nutricosmetics

Nutraceuticals are a family of supplements that support and enhance the nutrition of the skin. Numerous micro- and macronutrients process this behaviour, according to studies. The goals of nutricosmetics are shown by the subsequent instances such as:

i. A number of micronutrients, such as carotenes and Omega 3 fatty acids, help with hair care to a minimal degree in addition to supporting healthy skin.
ii. Ascorbic acid promotes the antioxidant action by assisting in the reduction of free radical presence.

Even skin-care items are divided into many categories according to the year, application place, goal, kind of therapy, and degree of targeting. As the benefits of targeting properties increase, the field of nutricosmetics is growing.

Nutraccosmetics is a movement that goes beyond lotions, ointments, and gels. This offers a whole new generation of skincare products that are more durable and effective. This strategy can only be implemented by combining nutritional and cosmetic components. The range of applications for nutricosmetics is extensive. Thus, it implies that though nutricosmetics is designed for skin care, by offering the right nutritional balance, it continues to have an influence on the well-being and health of hair and nails. Certain topical cosmetics have the potential to penetrate deeper than the dermal layer in a given area. However, compared to creams, nutricosmetics has a better level of accuracy.

Regulatory Guidelines of Cosmetics in India

With an expected 7.14% annual growth rate, the global cosmetic industry, which was valued at USD 532.43 billion in 2017, is expected to have a value of USD 805.61 billion by 2023. Given the growing market value of cosmetics, it is imperative to regulate the industry with suitable regulatory rules to safeguard customers' welfare. Legal requirements for personalised products are difficult to meet, but they are doable with the right strategy and consistent observance.

The retail category in India with the fastest rate of growth is known to be cosmetics, and international companies have flexibility in this vibrant market. It allows unrestricted access to importing cosmetic agents. Since a wide range of players have joined the Indian cosmetics sector over the past 20 years, stringent rules are being demanded in order to protect consumer safety. The Drug and Cosmetics Act and Rules govern all operations pertaining to cosmetics and cosmeceuticals in India, which are overseen by the Central Drug Standard Control Organisation (CDSCO). Additionally, the contents of cosmetic and cosmeceutical labels are governed by the Bureau of Indian Standards (BIS). It gives information on hair care items and creams and establishes the minimum quality of cosmetics for the goods that are documented. The Drug Controller General of India (DCGI) oversees all associated operations under CDSCO.

The name of the cosmetics and the manufacturer's address must appear on all labels, whether internal or external, in India as mandated by the Drug and Cosmetics Act. If the packaging is tiny, it is sufficient to provide the manufacturer's address name and pin code. The names of the components and the amounts of each in the formulation ought to be listed on the outside label. The inside label should list the product's usage instructions, the name and amount of any toxic or dangerous ingredients used, and any applicable warnings. All formulations for cosmetics or cosmeceuticals should include the unique batch number, denoted by the letter "B." However, in the case of soap, the production month and year have to be present, with the letter "B" missing from the label. This isn't the case, though, for liquid cosmetic formulations with a volume of no more than 25 mL and solid or semisolid cosmetic formulations weighing no more than 10 g. The Drugs and Cosmetics Act and Rules, 2013 stipulate that the manufacturing licence number, denoted by the letter "M," has to appear on the label.

The Indian government made investments in the nanoscience and technology project and gave several universities, academic associations, open research centres, and start-up businesses with R&D departments effective resources. The Indian Council of Medical Research, the Department of Science and Technology, the Council of Scientific and Industrial Exploration, and the Department of Biotechnology—all located in New Delhi, India—are significant organisations engaged in the public health research frameworks in that country. In India, the Ministry of Health and Family Welfare, located in New Delhi, is crucial to the prevention and management of health-related problems. Moreover, the Nanotechnology Sectional Committee is essentially in charge of the safety and standardisation of nano-based products. It is composed of experts who are affiliated with several research foundations and associations. Concerns with nanomaterials are now constantly changing in India and necessitate particular focus for increased public safety.

Future Conclusion

Currently, the fields of cosmetics, cosmeceuticals, dermatology, biomedical applications, etc. are using and appreciating nanotechnology, which is thought to be a promising and revolutionary sector. Cosmetics and cosmeceuticals are becoming more popular and have a larger market share thanks to the development of fresh innovations and innovative medication delivery technologies. These days, cosmetics are an essential component of every day life; moreover, the application of nanotechnology to the cosmetics industry has increased consumer acceptability globally. But because of its penetration, it is also very poisonous, which is a serious worry that is frequently disregarded and might have negative health effects. These days, innovative nanocarriers including liposomes, ethosomes, cubosomes, NLC, SLNs, nanoemulsions, niosomes, etc., are used to create a range of sophisticated cosmetics and cosmeceuticals.

Through a variety of methods, nanosystems transport and distribute these compositions throughout the skin, performing a number of tasks like moisturising, reducing wrinkles, and protecting against the sun. More thorough research is necessary since, despite these products' remarkable market value growth, there is a great deal of controversy around their safety and toxicity to people. Therefore, in order to ensure the safety of using cosmetic goods, laws pertaining to cosmetics should have a precise list of references along with the substances that have unexpected environmental impacts for every user of cosmetics, including consumers and professionals. Before such products are commercialised, long-term

toxicological or carcinogenicity studies on cosmetics, including nanocosmetics and nanocosmeceuticals (and their ingredients), should be carried out.

It is important to make nanocosmeceuticals in an approach that improves customers' health. In addition, cautious clinical trials for cosmeceuticals, like to those carried out for medications, have to be carried out to ensure the safety of the formulations in human subjects. Strict laws should also be put in place for the production, packaging, importation, and sale of cosmeceuticals and the nanoparticles that are used in them. To solve the current gaps in the relevant data and produce standard guidelines and regulations for the use of nanosystems in cosmetics, worldwide regulatory bodies and researchers must work together. Government agencies and non-governmental organisations ought to collaborate to create and disseminate consumer education materials that are successful.

They ought to provide specialised courses, including textual and video resources, through multimedia or seminars, in order to educate people on how to use cosmetics that contain nanocosmetics and nanocosmeceuticals sensibly. In order to create a stronger regulatory structure for security, efficacy, and marketing—which will eventually benefit the cosmetics businesses and shield consumers from any risks—international harmonisation of legislation is also necessary. Furthermore, by helping customers to make educated product choices, knowledge can also contribute to ameliorate this situation.

CONCLUSION

Its lifeblood is high-quality cosmetics, thus it must be used with caution. Cosmetics are the best alternative available for lessening skin issues. Cosmetics will be quite popular in the next years. The range of annual purchase positions for beauty salons is RS. 40000 to 60,000, with 6% of these positions falling below 10,000. It amply demonstrates that the purchase of cosmetics seems to be a worldwide trend.

When applied to the human body, a number of cosmetics ingredients utilised in their creation have the potential to cause various negative reactions. Therefore, applying cosmetics might not be bad for the body. For people who need sensitive skin care, cosmetic items are ideal and the current answer for beauty solutions. The use of cosmetics in the personal care system has multiplied many times over, and there is a strong market for them as well as enormous potential for growth in the future year. As a result, I will sum up by stating that cosmetics play a significant part in daily life and are used by people of both genders, which leads to a growth in their consumption.

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