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TECHNOLOGICAL ADVANCES AND FUTURE OULOOK IN BIOCOSMETICS.

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ABSTRACT: A priceless gift from nature, herbal cosmetics are in high demand on the global market. Different herbal active components are used in the formulation of herbal skin cosmetics, which are then mixed with the cosmetic foundation to hydrate and treat various skin conditions. In comparison to cosmetics made of chemicals, herbal cosmetics are safe to use because they are made of natural ingredients. Because they are free of all dangerous synthetic ingredients that could otherwise be damaging to the skin, herbal formulations have always garnered a lot of interest. It underlines the urgent requirement for natural, secure, and efficient components to take the place of conventional, fossil-based cosmetic products. In addition to fostering bio-based cosmetic packaging, it assembles recent technologies used in the production/extraction of the bioactive ingredient, product development, and formulation procedures. It also looks at businesses that could lead the way in developing biodegradable packaging, sourcing raw materials for the extraction of biobased chemicals for cosmetics, or weaving innovation into garments. The report also advocates for the introduction of stringent regulatory standards for all cosmetics sold internationally and explores what it takes to become the first generation of a circular economy.

Key word-Green synthesis,Nanoparticle, Herbal Drug, Chemical Evaluation, Biological Evaluation, Hair Care, Skin Care, Essential Oils

I. INTRODUCTION-

Biocosmetics are topical skin, hair, face, and dental care products that are manufactured from completely natural substances sourced from plants, animals, microorganisms, enzymes, insects, and organic crops. They are devoid of pesticides and chemical fertilisers. 27 The majority of current skin-care cosmetic formulas contain hazardous, non-biodegradable chemicals derived from petroleum or mineral oils. Many major cosmetic companies have switched their focus from fossil-based components to bio-based ingredients in order to build a circular economy, satisfy consumer demand for green cosmetics, and address environmental concerns. As a result of their fair treatment of nature, sustainable, natural, and greener cosmetics already command a sizable market. Big corporate players are benefiting from government backing for biocosmetics as well as quicker product approval, which is fostering a favourable business environment. Drugstores, pharmacies, organic food stores, health food merchants, department stores, beauty merchants, and internet shopping portals are some of the places where these products are distributed. This assessment evaluates the threats to the environment and human health posed by traditional petroleum-based compounds and emphasises the significance of essential constituents in cosmetic formulations.

New "bioactive" substances come from the soil, the sea, and the plant world. Chinese herbs, vitamins, minerals, antioxidants, enzymes, hormones, and a wide range of "naturals" are popular substances. Cosmetics contain both "selected extracts" and "total extracts" of herbs. The primary way that total extracts are used is in accordance with their long history of application. Conversely, selected extracts are used increasingly frequently due to research on their specific activity [03]

APPLICATIONS OF HERBAL MEDICINE-

• **Eco-friendly**- Conventional cosmetics or beauty products typically rely on a wide range of different chemicals for their building and exploit petroleum-based ingredients. In fact, aluminium, which has been linked to the development of breast cancer and Alzheimer's disease, is a key ingredient in several commonly used cosmetic products, including all antiperspirants and hair dyes. Despite this, the destruction of large areas of South American rainforests is attributed to aluminium mining [35]

• **Absence of harmful substances**- For the time being, conventional cosmetics may be effective in improving one's appearance, but some of the chemicals they contain frequently cause adverse reactions in people, including allergic reactions and inflammation. In addition, a few of the substances present in conventional cosmetics may be toxic to the posterior pituitary.[35]

• **Nutrient-dense** - Certain compounds can be absorbed by our skin. However, the stratum corneum (outer layer of epidermis), a protective barrier, can keep dangerous substances out of the skin to a certain extent. Extracts from apricots, green tea, pomegranate seeds, and grapes have antioxidant properties and may inhibit the enzymes elastase and collagenase, which tear down the skin's elasticity and structural integrity [35]

.

• **Fit budget** - Compared to conventional products, herbal cosmetics are moderately priced and less expensive. The World Health Organization (WHO) estimated that due to adverse effects and the higher expense of manufactured medicines, almost 80% of the world's population relies on herbal products for their healthcare. WHO currently suggests and proposes the use of natural goods from a wider perspective due to their accessibility and safer use of herbal cosmetics at a reduced cost.[35]

WHY HERBAL GOODS ARE SAFE TO USE [5] –

Herbal products are safer to use than synthetic ones. Additionally, compared to synthetic drugs, herbal remedies are hypoallergenic, dermatologist-tested, and proved to be safe for use anytime, anyplace. Since they are manufactured with natural ingredients, consumers don't have to worry about developing skin rashes or itching.

1) Standardization of the body Total Ash

In a tared silica crucible, 2 g of the powdered medication were precisely weighed. The bottom of the crucible was covered with a thin layer of the powdered medication. The crucible was burned until the carbon was removed at a temperature no higher than 450°C. The crucible was weighed after cooling. Up till a steady weight was noticed, the practise was repeated. Calculations were made using the air-dried medication to determine the proportion of the total ash.

2) Acid-insoluble ash

The ash collected in accordance with the instructions for calculating total ash was cooked in 25 mL of hydrochloric acid for five minutes. The insoluble ash was first collected on ash-free filter paper and then washed with hot water. A tared silica crucible was used to contain the insoluble ash, which was then fired, cooled, and weighed. Up till a steady weight was noticed, the practise was repeated. The amount of acid-insoluble ash was thought through in relation to the air-dried medication.

3) Water soluble ash

25 mL of boiling water was used to boil the ash produced as indicated in the determination of total ash for 5 minutes. On ash-free filter paper, the insoluble material was gathered and washed with hot water. The insoluble ash was put into a tared silica crucible and heated no higher than 450°C before being burned. The process was carried out once more until a steady weight was noticed. The weight of the total ash was calculated after deducting the weight of the insoluble material. The weight difference was interpreted as water-soluble ash. Based on the air-dried medication, the percentage of water-soluble ash was computed.

4) Ether-soluble extractive

100 mL of 95% ethanol were added to a stoppered flask containing 5 g of previously weighed air-dried medicament. On a magnetic stirrer, it was shaken constantly for four hours. After that, it was quickly filtered while taking safety measures to prevent solvent loss. In a tared flat-bottomed petri dish, 25 mL of this filtrate was evaporated to dryness, dried at 105°C, and weighed. With reference to the medication that had been air-dried, the percentage of ethanol-soluble extractive was computed. extraction, standardisation, and evaluation of a chosen plant

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5) Water-soluble extractive

In a stoppered flask, 100 mL of chloroform water was added to 5 g of previously weighed air-dried drug. On a magnetic stirrer, it was shaken constantly for four hours. After that, it was quickly filtered while taking safety measures to prevent

solvent loss. In a tared flat-bottomed petri dish, 25 mL of this filtrate was evaporated to dryness, dried at 105°C, and weighed. With reference to the air-dried medication, the percentage of water-soluble extractive was estimated.

6) Ether soluble extractive

100 mL of ether were added to 5 g of previously weighed air-dried medication in a stoppered flask. On a magnetic stirrer, it was shaken constantly for four hours. After that, it was quickly filtered while taking safety measures to prevent solvent loss. In a tared flat-bottomed petri dish dried at 105 °C, 25 mL of filtrate was evaporated to dryness and weighed. With reference to the air-dried medication, the percentage of ether-soluble extractive was estimated.

7) Foreign organic matter

The sample (weighing between 100 and 500 g) was evenly spread out on a white tile or glass plate to create a thin layer that did not overlap. The sample was examined with either the unaided eye or a lens (5x or above). The alien organic material was painstakingly isolated. The matter was weighed after complete separation, and the proportion of weight present in the sample was calculated in accordance with WHO recommendations.

II. TECHNOLOGICAL ADVANCES FAVORING BIOCOSMETICS-

Green nanoparticle synthesis

In personal care products, nanotechnology plays a significant role in improved performance, non-cytotoxicity, and bioavailability of active substances. The active chemicals adhere to the nanoparticle surfaces and aid in effective absorption, improved colour and finish quality, and better skin penetration. The formulation of cosmetic products can be further improved by changing the shape, chemical makeup, size, solubility, and chemical reactivity of the nanoparticles utilised. This improves cosmetic products' performance, efficacy, and shelf life [03]. Sunscreens, lip balms, and moisturisers all contain nanoparticles of TiO2, ZnO, and ZrO2 that work as UV filters. 11 Several studies discuss the benefits and drawbacks of using nanotechnology in cosmetic formulations and define the various types that give cosmetic products diverse properties. Environment [07]. In addition to their bactericidal qualities and potential for biomagnification, fullerenes are known to kill water fleas. Before putting nanotechnology-based products in direct touch with our skins, it is important to carefully assess their toxicity and regulatory aspects. Green synthesis of nanoparticles is gaining interest due to nontoxic, clean, and eco-friendly approaches which safeguard the ecology and restore the quality of the environment. This is due to problems connected with conventional ways of synthesising metal-based nanoparticles. Arroyo et algreen .'s synthesis of hybrid silver nanoparticles from the natural extract was discovered to be a highly efficient and cost-effective market alternative in 2019.

Ingredients made with biotechnology are secure and efficient.

Due to the synthesis of safe and effective active ingredients using inexpensive and contamination-free techniques, biotechnological processes have a significant impact on the cosmetic market. Sauerkraut, kimchi, cheese, tempeh, beer, and wine are just a few examples of fermented foods that are widely recognised and have a number of advantages. Similar to this, fermented cosmetic components like fermented coconut (lactobacillus/fruit extract of Cocos nucifera) [10] Fermented chilli, ten (lactobacillus and Capsicum frutescens fruit ferment extract) [29]. Fermented pumpkin (pumpkin fruit ferment filtrate/lactobacillus) [21] each have exfoliating characteristics, the ability to replace synthetic preservatives that are currently used, and to increase blood flow to the scalp and hair. Citric acid, lactic acid, glycolic acid, and other organic acids.

Bio-based cosmeceuticals

Cosmeceuticals are products that combine cosmetics and medications. Cosmeceuticals are products with both cosmetic and therapeutic benefits, however this phrase is used in marketing and has no official legal definition. Table 3 lists the common components found in cosmeceuticals. At low quantities, some substances are acceptable in cosmetics, but at greater concentrations, they are considered medications. Based on the causes of the target conditions, they are divided into categories such skin lightening, sunscreens, scar reduction, antioxidants, anti-aging, etc. When fermented with a mixture of Rhizopus oryzae and Aspergillus oryzae cultures, rice bran, one of the most prevalent agricultural by-products, was found to have anti-aging and anti-pigmentation properties for cosmeceutical potential [01].

Microbiomics:

Using biocosmetics to address the skin's microbiome

Maintaining the proper balance between our skin's microbiota, which is made up of millions of microbial species including bacteria, yeast, fungus, and viruses, is necessary for healthy skin [02]. Atopic dermatitis with Staphylococcus aureus species [15], acne with Cutibacterium acnes and Staphylococcus epidermidis [24], dandruff with Malassezia species [24], psoriasis with an increase in Firmicutes [13], etc. are just a few skin conditions that have been linked to altered microbial populations. Some bacteria modify body odour, especially auxiliary odour, by decomposing apocrine sweat and eccrine sweat-derived foot odors[16].

Organofilization

This process is used for cosmetic purposes. The combination of clay minerals (phyllosilicates) with organic surfactants is referred to as "organoclay" (quaternary alkylammonium salts and others). By altering the hydrophilic surface, organoclays are produced [05].

III. EVALUATION METHODS FOR CHEMICAL CONSISTENCY [39]

The Chinese Pharmacopoeia started compiling methods for testing the uniformity of the chemical content of pharmaceuticals in 1985 and outlined a requirement that the uniformity of the chemical content of solid preparations not deviate by more than 15%.

Chromatographic evaluation techniques

Currently, gas chromatography (GC), liquid chromatography (LC), and mass spectrometry are the primary chemical methods used to assess the consistency of a drug's quality (MS). Ultrahigh-performance liquid chromatography (UPLC), which has recently gained popularity, has been used to examine the chemical make-up of natural herbal remedies. Chromatography and MS can be coupled to study the composition of natural herbal remedies on a qualitative and quantitative level in order to assess the consistency of their quality.

Determining the contents of a single component

Single-component quality assessment is a technique for monitoring the quality of natural herbal medicines by figuring out how much of a certain component is actually there. Natural herbal medicine treatments, however, differ from synthetic ones in several ways.

Determination of multiple component contents

Measuring the contents of various active substances in natural herbal medicines or preparations allows for the control of multiple component contents, which is a technique for monitoring the quality of natural herbal medical preparations. The comparison of numerous target components chosen by it, as opposed to the determination of a single component, emphasises the overall concept and produces a more scientific evaluation of natural herbs and their preparations. The identification of many active constituents will eventually replace conventional techniques of assessment based on single components as the number of natural herbal medicines rises.

Chemical fingerprinting–

Chemical fingerprinting is a workable technique for determining the reliability of the quality and verifiability of natural herbal remedies. The entire state of the intricate system of natural herbal medicines can be clearly indicated through the examination of known and unknowable components. Sun et al. have recently put forth a multi-component quantitative fingerprint technique that combines metrological analysis with multiple wavelength measurement to demonstrate and validate the consistency of the quality of natural Chinese herbal medicine. Chemical fingerprints more accurately indicate the entire substance of natural herbs when compared to multicomponent testing. The quality of natural herbs may be truly combined with their potency thanks to fingerprint pharmacodynamics, which clarifies their mode of action.

Spectral evaluation techniques –

By measuring the essential qualities, qualities, and characteristics of the original medicinal materials and the materials being processed in real time, spectroscopic technology can quickly analyse the complete properties of the samples and design, control, and analyse the production and processing process. The chromatographic technique is similar to the spectrum evaluation technology. There are three stages to the development process: first, the spectrum technology analyses the content of a single element, then it gradually progresses to a multi-element analysis, and lastly it develops into a thorough analysis of all the elements of the sample as a whole.

Near-infrared spectroscopy

Near-infrared (NIR) spectroscopy is a sophisticated green process analysis tool that depends on computer support to perform rapid analysis and testing. It has many benefits over conventional analysis methods, including great efficiency, speed, minimal energy usage, and the avoidance of sample pre-processing, contamination, and sample destruction. NIR spectroscopy has gained popularity recently and has been used in a variety of industries, including the petroleum industry, agriculture, industry, and medicine. Numerous studies have demonstrated the broad range of applications of NIR spectroscopy and the ability to directly and quantitatively examine both compound and original natural herbal medications as well as natural herbal medical formulations.

Laser-induced breakdown

In order to conduct laser-induced breakdown spectroscopy (LIBS), a plasma must be created using a laser as the excitation source. It is used to quickly determine the concentrations and elemental compositions of materials using physical methods. The elemental properties of any type of material can be analysed qualitatively or quantitatively using the LIBS analytical spectroscopic approach, which has gained recognition and value over the past 20 years. In order to characterise numerous elements spectra integrally for the purpose of monitoring the quality of natural herbal medicines, LIBS can be applied.

Bioassay–

Based on the effectiveness of natural herbal remedies. To control or assess the internal quality of natural herbal medicines, quantitative pharmacology and pharmacological analysis are employed to qualitatively and quantitatively quantify the biological effects. Bioavailability techniques are used to compare the strength of the biological effect of the test substance to that of the reference substance. Biopotency refers to the specific biological effects of the test and control substances on a biological system under specific test conditions. The biological toxicity potency is another name for the biological titre that is used to assess toxicity. A method for evaluating the quality of Radix Isatidis was developed by Li et al. based on the examination of its in vitro activity against influenza virus neuraminidase suggested that oseltamivir phosphate and Radix Isatidis may have the same inhibitory mechanisms. The quality of Radix Isatidis can be evaluated biologically by analysing the form and phases of the curve using the method of determining the substance's potency, specifically by comparing its dose-effect curve with that of the positive control medicine oseltamivir.

Biological gene expression profile

With the quick advancement of genetic information, researchers are increasingly focusing on the identification of organisms using genetic data. The study of gene transcription and transcriptional regulation in cells generally is a field known as transcriptomics, and the biological gene expression profile is a specific application of this field. Sun et al. chose six batches of substance Dans hen dripping tablets and used (HepG2) human hepatoma cells as a bio detector. Ten mRNA sequences, which might indicate the biological activity of medications, were examined after treatment for 24 hours in accordance with the four corresponding criteria using a gene expression microarray and a quantitative real-time polymerase chain reaction. These sequences matched the EPGN, RUNX2, C8orf4, OLR1, CLMP, AKR1C1, MMP1, CYP1A1, IL24, and Likewise, APOL6 genes show notable dose-effect dependency.

IV. FUTURE OUTLOOK-

Zero waste cosmetic

Adopting a "zero waste" policy is a crucial first step in preventing cosmetic waste from entering the body through a polluted environment. The concept of "Green Growth" will be advanced by implementing zero waste and zero CO2 emission rules in the sourcing, extraction, manufacture, and packaging stages of cosmetics. Recycling industrial trash should be required in order to create a circular economy, not an alternative. These smaller-sized particles cannot be removed from the ocean; they mix with the environment and enter the food chain. Pesticides and other chemicals sprayed on crops that are used to extract components are extremely harmful to people's health. There is compelling evidence that nanoparticles enter our bloodstream through our lungs and go to our brains [23]. Wet wipes are flushable and eventually end up in the oceans. We use them to clean our faces, take off our makeup, and clean baby bums. When they absorb these wipes, sea creatures like turtles perish [02]. Synthetic antioxidants BHA and BHT, which are employed as cosmetic preservatives, infiltrate aquatic organisms and alter their genetic makeup. Recycling waste is more difficult than it first appears to be and is accompanied by a number of difficulties, including: (1) physical sorting and segregation of hazardous and non-hazardous garbage, where technology does not replace humans' capacity for judgement,

(2) occupational workers' exposure to airborne pollutants such dust,

(3) the protection of personnel from potentially harmful materials and training them on recycling tools; (4) the difficulty of recycling cosmetic packaging due to its combination of different materials. Making the conversion from conventional to waste-free natural cosmetics is a long-term sustainable option

.

Transformation to wellbeing and attractiveness using innovative natural ingredients

The present consumer perspective is shifting away from the vitality, prevention, long-term effectiveness, proactivity, and experience given by biocosmetics and toward the disease, treatment, fast fix, obligation, and reactivity of contemporary cosmetics. For start-ups involved in the formulation and customization of products based on unique skin characteristics, replacing fossil-based ingredients with natural, clean, vegan, sustainable, and high efficacy ingredients, encouraging social inclusivity, and developing niche-focused products based on gender, age group, price, etc., the cosmetics industry presents tremendous future opportunities. Among the most recent studies in this field are those on novel anti-infective short antimicrobial peptides as cosmetic ingredients [22], anti-aging, antioxidant, anti-wrinkle, skin-firming ingredients using plant-cell culture [09], stem cell-derived cosmetic products [30], and anti-aging, defensive compounds extracted from marine algae[25].

Commitment to sustainability

As the market for natural and environmentally friendly products grows, worries about sustainability surface. Water pollution is a concern in the manufacture of grains (oat, barley, and wheat) based extracts used in face creams and cosmetics. Cosmetic firms are eager to look for alternatives, such as coconut oil and babassu oil, as the vast deforestation and loss of plant and animal diversity associated with palm kernel oil-based items like lipstick, soap, shampoo, etc. are of concern. The "eco-conception approach" examines each processing step in terms of how it uses resources, uses energy, impacts the world, manages waste, consumes waste, controls quality, and reduces carbon footprints. Many cosmetic products on the market today disappoint customers by failing to live up to their promises. To solve this issue, regulatory rules on the usage and concentration of substances in cosmetic formulations must be followed, and transparency regarding the sourcing of raw materials must be accomplished. This will guarantee the product's quality, integrity, and safety.

Dealing with the difficulties of "going green"

Biocosmetics is environmentally friendly, safeguards our long-term health, naturally nourishes and heals the skin, and does not interfere with the creation of hormones or fertility. However, there are certain ambiguous areas in the biocosmetic sector that require further investigation.

(1) The slowness of natural materials derived from plants and animals;

(2) The high expense of biocosmetic products, especially when pure/concentrated bioactive substances are to be employed in the formulations;

(3) Low shelf life and non-vibrant colours with a restricted number of tints accessible; Using agriculturally based raw materials has an adverse effect on the environment, which is reason number four. There are also seasonal variations in the production of the desired component from plants, which is reason number five.

V. CONCLUSION

The review outlines issues with the everyday cosmetics we use today and argues for the switch to green cosmetics. The substances utilised in personal care products are silent killers that cause human health to decline covertly. The skin can be protected from external or internal irritants and various skin disorders by a cosmetic composition including natural active ingredients. Natural products can also be utilised for hair care and as dyes or colourants. For thousands of years, people have used aromatic herbs and oils in incense, perfumes, cosmetics, and for their medicinal and culinary uses.

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