Herbal Cosmetics: Natural Approach to Cosmeceuticals

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Abstract

Background: The concept of cosmetic is derived from ancient times. Cosmetics are used for cleansing, beautifying, and promoting attractiveness. Cosmeceuticals are a combination of cosmetics and pharmaceuticals. These are cosmetic preparations that also provide health-related functions. The chemical agents used in the manufacture of cosmetics causes undesirable effects and/or toxicity, which caused the scientists to look for a natural alternative. That natural alternative gave rise to herbal cosmetics.

Objective: Herbal cosmetics have gained widespread popularity recently in the field of fashion and beauty because these are free from chemical agents and suitable for every individual.

Method: To further enhance their effectiveness, novel techniques in herbal cosmetics were developed which includes the use of novel carriers such as liposomes, phytosomes, niosomes, ethosomes, etc.

Result: In this review article, we will discuss novel techniques in herbal cosmetics and some common disorders that can be treated with herbal cosmeceuticals.

Keywords: herbal, cosmeceuticals, skin, delivery, cosmetics

1. Introduction

The word cosmetics was derived from the Greek word "kosmtikos" meaning having the power, arrange, skill in decorating.[1] The concept of cosmetic and beauty is derived from ancient times. The cosmetics, according to the Drugs and Cosmetics Act is defined as articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into or otherwise applied to the human body or any part for cleansing, beautifying, promoting attractiveness or altering the appearance. The cosmetic does not come under the preview of a drug license.[2] Cosmetics are generally used to enhance the appearance of the face and other body parts including the mouth, hair nails, eye, etc. It includes powder, cream, lotion, hair oil, moisturizer, shampoo, nail polish, etc. The various chemical toxin, microorganisms, pollution,sunlight can cause damage to the skin.[3] Hence cosmetics along with active ingredient can reduce skin problems such as wrinkles, acne dark circles dullness by the synthetic or natural agent.[4] Herbal cosmetics hereinafter referred to as products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide defined cosmetic benefits only, shall be called as "Herbal Cosmetics".[5] Various herbal products are used nowadays such as herbal soap, herbal conditioner, herbal face wash, and many more.[6] Herbal cosmetics have low side effects compare to synthetic chemical and they also provide nutrients to the skin.[7] The herb which is used in cosmetic is coconut oil as a moisturizer, aloe vera as an antioxidant, ginkgo having an antiaging property,etc.

Herbal cosmetics have gained widespread popularity recently in the field of fashion and beauty. It is preferred by most women because it contains naturally obtained active ingredients that provide nourishment to the applicant.[8] Also, it is free from chemical agents that are responsible for side effects such as allergic reactions due to butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT),[9] carcinogenicity due to coal tar,[10] genetic mutations due to dibutyl phthalate (DBP).[11] Chemical cosmetics usually contain parabens as preservatives and these parabens are easily absorbed through the skin and can interfere with endocrine hormonal function. List of some commonly used chemical agents in cosmetics with their side effects is given in **table 1.** On the contrary herbal cosmetics are hypoallergic and tested by dermatologists and proven to be safe since they are formulated using natural ingredients.

Table 1: List of some commonly used chemical agents in cosmetics and their side effects.

Chemicals	Side effects	Usage	References
Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT)	Allergic reaction	Antioxidant and preservative	[9]
Coal tar	Carcinogenicity	Keratoplastic	[10]
Dibutyl phthalate (DBP)	Genetic mutations	Plasticizer	[11]

Herbal extracts possess various properties such as anti-aging, photoprotective, astringent, moisturizing, antioxidant, antimicrobial, etc. When skin is exposed to the sunlight, it produces several reactive species which can cause oxidative damage or react with cellular proteins and DNA. These can lead to skin cancer, pigmentation of the skin, aging of the skin, wrinkle formation, and loss of elasticity. Herbal extracts can help prevent these problems and also can recover, to some extent, if already occurred.[12]

2. Herbs used in cosmetics

1. Aloe Vera- Aloe Vera used in the cosmetic industry for its moisturizing and anti-inflammatory properties.[13] It is used for various skin problems such as cuts, rashes, and, sunburn due to its healing power.[15] Aloe vera gel contains sterols, tannins, mono-polysaccharides, saponin, vitamins, and minerals.[14,16] The interaction of glucomannan and gibberellin with the growth factor receptor increases the synthesis of collagen and hence promotes healing.[17] Abdul wadood khan et .al (2013) formulated aloe Vera gel for the management of wound healing and studied on the excision wound model and the result was found that Aloe Vera gel showed better wound healing and anti-inflammatory property.[18]

2. Elder - The source of elder *is Sambucus candensis* flowers, leaves, and berries are used for various cosmetic purposes. Leaf water of elder is used as a cooling and softening agent for skin. Berries boiled in vinegar or wine make a black hair dye. The floweris used to ease irritable skin.[13] It contains mainly polyphenols i.e. anthocyanins which show antioxidant property.[19] Rosa et al (2019) studied the antioxidant and tyrosinase inhibitory activity of *Sambucus nigra* which describes the anti-aging activity of elder.[20]

3. Henna- Henna powder is used for dying of hair, and skin of hands and feet. It also gives a shiny texture to hair.[15] Lawsone is responsible for dying property of gallic acid, sugar, henna, white resin, and tannins are other constituents.[16] Henna commercially used in the form of a paste, Lawsone in the paste reaches the outermost layer of skin and gives a red-brown stain. It also shows antibacterial activity due to a combination of hydroxyl with the carbohydrates and protein in the bacterial wall.[21] Elague et al (2019) showed the antioxidant property of *Lawsonia inermis* essential oil.[22]

4. Neem- Neem has antibacterial, antifungal properties that make the use of neem in the formulation/ production of lotion, toothpaste, shampoo, etc. It can also. It can also treat various skin related problems such as itchy skin, eczema, and psoriasis.[15] The main chemical constituents of neem are azadirachtin,nimbin,nimbidin,salonin, andnimbidinB.[14] Neem exerts an inhibitory effect on microbial growth by bacterial cell wall break down-regulates pro-inflammatory enzyme activity including cyclooxygenase (COX) and lipoxygenase (LOX) hence also shows anti-inflammatoryaction.[23] Sunday et al (2019) formulated a soap and cream containing secondary metabolites of *Azadirachta indica* and shows an inhibitory effect on pathogens like E *Cloacae, L. Ivanoxii, S. aureus* and also showed antioxidant property.[24]

5. Amla- Amla fruit is a rich source of vitamin C which makes it good for skincare. Oil is obtained from the fruit is good for various hair and scalp problems.[15] Apart from vitamin C amla also contain mineral and amino acid. Other constituents are tannin, gallic acid, and albumin.[14] The protection against oxygen radicals is provided by tannins such as embilicanin -B, embilicanin -A, punigluconin, and pedunculagin. Recycling of the sugar moiety and conversion of polyphenol into medium and high molecular weight tannins are responsible for antioxidant activity.[25] Takashi Fujii et al (2008) showed that amla Extract stimulates the proliferation of fibroblasts and also induced production of procollagen.[26]

6. Roses- Rosewater and oil are used as a moisturizing agent. Oil of rose has a high content of vitamin C and extremely hydrating properties. Rose oil contains alcohol i.e. citronellol, geraniol, nerol, and 2-phenylethanol.[27] Hydroalcoholic, ethanolic extracts, and essential oil showS antioxidant activity.[28] G.ozkan et al (2004) shows the antioxidant property of *Rosa Damanscena* using phosphormolybdenum method.[29]

7. Lavender- Lavender oil is a good moisturizer for the skin. Lavender having pleasant smell which makes it useful for perfumes, bath, and body care products. It also has an antiseptic property. The main constituent of lavender is mainly ester and high percent of alcohol i.e. borneol and linalool and camphor.[27] Hui et al (2010) showed the strong antioxidant activity of lavender essential oil against lipid peroxidation in a linoleic acid model system and antibacterial activity.[30]

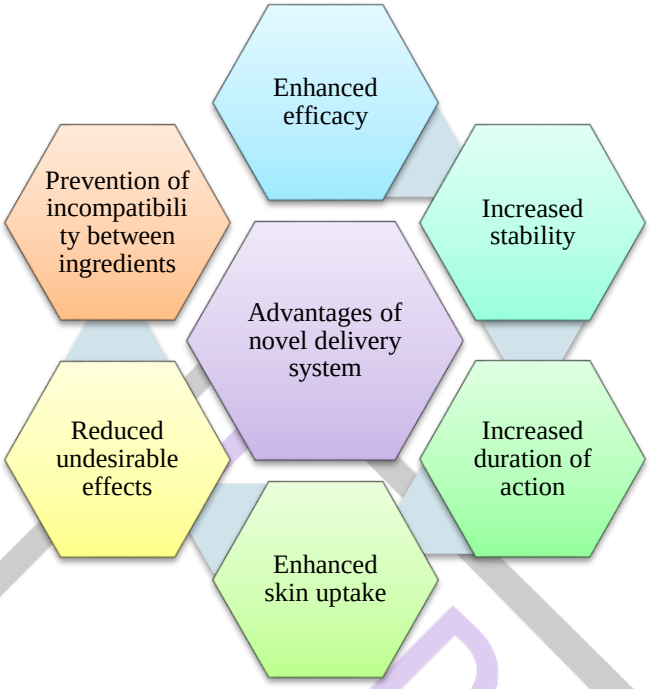
8. Jojoba- The oil obtained from the plant has identical properties to the sebum of human skin. Therefore, it is mainly used in face creams. It improves the elasticity of the skin and also hydrates the skin. Malgorzata et al (2015) showed the addition of jojoba oil in creams has an additive effect on the viscosity and increases their moisturizing effect.[31]

9. Green tea - it is having an antioxidant property that fights against the causes of skin aging. Green tea has tannins that contract pores. Epicatechin gallate (ECG), Epicatechin (EC), epigallocatechin (EGC), epigallocatechin gallate (EGCG) are the main constituent of green tea.[27] The activity of superoxide dismutase in the serum and the expression of catalase in the aorta are increased

after green tea intake and are responsible for protection against oxygen species.[32]Tariq et .al (2010) formulated and evaluated a green tea extract cream and in vivo result was found to be an increase in skin hydration level and reduction in transepidermal water loss.[33]

3. Novel techniques in cosmetics

Fig 1: Advantages of novel delivery systems



Consumers around the world are more attracted to the products which state 'natural', 'free from animal products', 'organic', and 'no added artificial preservatives' on their label. The novel delivery system of drugs has increased efficacy and reduced toxicity which resulted in consumers around the world expecting the same increased benefits and minimal side effects with the use of cosmetics. The novel delivery system involves the use of newer carriers to carry the active ingredient to the desired site. The advantages of the novel delivery system are shown in figure **1**. That is why formulators are developing cosmetics employing novel delivery systems.[34] Some novel techniques involved in cosmetics formulation are shown in **figure 2**.

Novel delivery systems in cosmetics include liposomes,[35] nanoparticles,[36] nanospheres,[36] phytosomes,[37] marinosomes,[38] ethosomes,[38] colloidosomes,[38] niosomes[39] and emulsions.[40] These newer delivery systems carry the active ingredient to the site where it is wanted, thereby increasing efficacy and reducing toxicity or undesirable effects. Most of these novel systems are amphiphilic and support both hydrophilic and lipophilic substances. List of novel formulations in cosmetics and their applications are given in **table 2.**

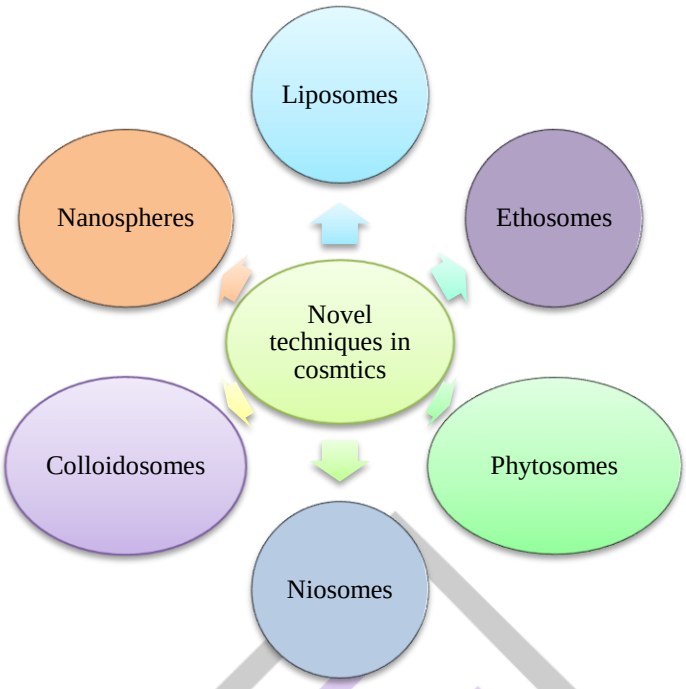


Fig 2: Novel strategies involved in cosmetics.

Niosome - Niosome or non-ionic surfactant vesicles are the microscopic lamellar structure, having advantages like controlled and targeted delivery, penetration is enhanced.[41] Niosomes diffuse through the layer of stratum corneum. Niosomes causes loosing of the cell of stratum corneum and increases permeation of drug.[42] Niosomes improves the solubility, photostability snd skin permeation ability of Quercetin.[43]

Ethosomes - Ethosomes are lipid vesicles containing phospholipid, ethanol, and water. It increases permeation through the skin. Ethanol present in Ethosomes is acting as a permeation enhancer by increasing cell membrane fluidity.[44] The ethosomal gel can increase the penetration of EGCG from green tea leaves extract.[45]

Phytosomes - Phytosomes are standardized extract complexed with a phospholipid, which hence improves bioavailability and increases activities. It having advantages like, good drug entrapment, improve percutaneous absorption of Cosmetics preparation.[46] PA2 Phytosomes containing proanthocyanidin is used for skin wrinkles, sericoside Phytosomes containing sericosides are used as a skin improver.[47]

Table 2: List of some novel formulations in cosmetics and their application.

Herbal extract	Formulation	Application	Reference
Aloe barbadensis juice	Liposome	Moisturizer	[48]
Avocado, rosehip and carrot oil	Liposome	Antiwrinkle	[48]
Tyrosine and aloe vera	Liposome	Sunscreen	[48]
Ginkgo biloba	Phytosome	Beauty cream	[49]
Curcuma longa	Transferosome	Antiwrinkle	[50]

4. Cosmeceuticals for common disorders

5. Cosmeceuticals are basically a cosmetic product with bioactive ingredients that is purported to have therapeutic action. Cosmeceuticals are able to penetrate the epidermis, the active principle are able to pass through the epidermis and act deep within the dermis. Whereas a cosmetic product is not able to treat specific disease directly, it can only protect, clean, maintain and change the appearance of the skin.[51] Some common disorders that can be treated with cosmeceuticals are listed in **table 3** with their causes, sign and symptoms.

Table 3: Some disorders, their symptoms, and causes.

Disorder	Description	Sign and symptoms	Causes	References
Aging	Thinning of epidermis, loss of elastic tissue and increased fragility of skin	Wrinkles, sagging, laxity, dullness and roughness	Sun radiation, air pollution, nutrition, lack of sleep, tobacco smoke, stress	[52,53]
Dry skin	Less production of sebum, lipids, and inability to hold skin moisture	Rough, scaly and less flexible skin which is tight to touch	Lack of water in stratum corneum, inadequate lipid synthesis, abnormal keratinization and/or advancing age	[60]
Sunburn	Response of skin to UV radiation, damage to vascular endothelium and inflammation	Pain, erythema, blistering, dermal edema	Exposure to too much UV light	[65]
Dandruff	Combination of dead skin cell with oil, dust particle form dandruff	Itchy scalp, flakiness, red and greasy patches	Secretion of skin oil, metabolic by-product of skin microorganisms e.g. Malassezia yeasts	[66]
Wrinkle	Visible crease or folds in skin form wrinkle and are classified as fine and coarse wrinkle based on its width and depth	Lines, crease in the skin	Aging, hormonal changes, exposure to UV light, and smoking are responsible for wrinkle formation	[74]
Body odor	Secretion from the sweat is odorless and changes into malodor due to microbial biotransformation	Unpleasant odor	Staphylococcus epidermidis and Corynebacterium species change odorless sweat into volatile odors molecule	[76]
Acne	Acne is infectious disease that is characterized by scaly red skin, it can be inflammatory and non-inflammatory based on severity	Red skin, papules, blackheads, and whiteheads, scarring	Increase in body androgen	[80]

5.1. Aging

Skin is act as a barrier that protects the body from microorganism and loss of water. Young skin looks attractive and having a positive effect on people's behavior.[52] This is the reason that both men and women spend their money on cosmetics to look young and attractive.

Skin aging is a biological process that is composed of various factors such as solar radiation, nutrition, air pollution, tobacco smoke, lack of sleep, stress, etc.[53] skin aging results in wrinkles, dullness, laxity, sagging, and roughness.[54] The aging of the skin is due to chronological changes or photoaging. Chronological changes are those which occur due to the passage of time. These changes are due to damage from the continuous formation of reactive oxygen species (ROS) generated during oxidative cell metabolism.[55]

Photoaging is changing due to chronic exposure to sunlight. UV radiation induces ROS synthesis which results in mutagenesis and photoaging.[55] The ROS also activates hyaluronidase, collagenase, and elastase that degenerate extracellular matrix (ECM) which also contributes to skin aging.[56]

Various herbal formulations/cream are in to reduce signs of skin aging. The herbal formulations contain antioxidants that play an important role in reducing skin aging and also provide stability to the formulation. Antioxidants are natural substances made up of vitamins and minerals. Antioxidants are molecules that can neutralize free radicals and protect the cell from both endogenous stress (oxidative metabolism) and exogenous stress (UVlight). Some of the herbs effective as anti-aging along with their mechanism of action are given in **table 4.** [57]

Table 4: Some herbs effective as anti-aging and their mechanism of action.

Herb	Biological source	Mechanisms	Reference
Wild carrot	*Daccus carota*	Free radical scavenging activity	[57]
Amla	*Emblica officinalis*	Promoting pro-collagen production	[57]
Liquorice	*Glycyrrhiza glabra*	Inhibit hyaluronidase	[57]
Aloe	*Aloe barbadensis*	Stimulate the synthesis of essential matrix component as collagen hyaluronic acid	[57]
Cinnamomum	*Cinnamomum zeylanicum*	Contains a good amount of phenolic Antioxidant	[57]

Surya et. Al (2014) formulated and evaluated *pumice grantum* based cream and in vitro result found that extract of pumice grantum leaves along with *Daccus carota* give multipurpose effect on skin i.e. antiaging, antiwrinkle whitening and sunscreen effect.[58] Mahawaret. Al (2019) developed and evaluated *Annnova Squamosa* based herbal antiaging cream formulation and *in vitro* result found that *A. Squamosa* leaf extracts are rich in antioxidants and they reduce wrinkles and fine lines, improves the health of skin.[59]

5.2. Dry skin

Dry skin is a dysfunction of the uppermost layer of the skin; stratum corneum of the epidermis. It can occur at any age but mostly occurs in older people. Individuals with dry skin have rough, scaly, and less flexible skin which is tight to touch. The exact cause of dry skin is not fully understood but it may occur due to lack of water in stratum corneum, inadequate lipid synthesis, abnormal keratinization, and/or advancing age.[60] Chemical agents that can be used for treating dry skin are petroleum jelly, humectants like glycerol, urea, α-hydroxy acids, and pyrrolidone carboxylic acid.[61] There are various herbs available which can be used in cosmetics for treating dry skin; these are coconut oil,[62] sunflower oil,[62] jojoba oil,[63] olive oil[63] and aloe vera.[64] Some of the herbs effective in dry skin along with their mechanism of action are given in **table 5.**

Table 5: Some herbs effective in dry skin and their mechanism of action.

Herb	Biological source	Mechanism	Reference
Coconut oil	*Cocos nucifera*	It is an excellent skin moisturizer and softener. It is rich in glycerides of lower chain fatty acids.	[62]
Sunflower oil	*Helianthus annuus*	It is considered as non-comedogenic and has skin smoothing properties. It contains waxes, tocopherols, and carotenoids.	[62]
Jojoba oil	*Simmondsi achinenesis*	It is identical to human sebum. It is a skin replenisher.	[63]
Olive oil	*Olea europaea*	It is a fatty acid penetration enhancer. It also contains tocopherols.	[63]
Aloe vera	*Aloe barbadensis*	It heals, softens, and moisturizes the skin. It contains saponin glycosides and vitamins A, C, E, B.	[64]

5.3. Dandruff

Dandruff is a common scalp problem having white flakes and itchy scalp due to excessive shedding of dead skin cells. Normally dandruff results from the over secretion of oil from the glands known as seborrhea.[67] The fungus Malassezia is responsible for dandruff formation, it breaks down sebum to oleic acid which then reaches the top layer of skin and causes increase skin cell turnover, hence results in Dandruff flakes.[68]

Dandruff can be treated by inhibiting the formation of dandruff cells in the horny layer of skin. The agent-free the scalp from grease,dirt, oil, and lipids which not provide a suitable condition for Malassezia to grow, this stops the formation of oleic acid and prevents the increase in skin cell turnover thus getting rid of dandruff.[69] Some of the herbs shown anti-dandruff characteristics are given in **table 6.**

Table 6: List of some herbs studied for the anti-dandruff property.

Author	Herbal formulations/ extract	Result	Reference
MeenaDeviha et al	Extracts of evolvulsalsinoides,AzadirachtaIndica, Hibiscus inermis,murrayokenigi	Plant extracts show inhibitory effect on fungus Malassezia furfur and show significant Anti-dandruff activity	[70]
Sawarkar et al	Formulate herbal shampoo containing rosemary leaf oil, lemon oil, tea tree oil, peppermint oil along with base Anti-dandruff ingredients like climbazole and triclosan	Clinical study reveals the Anti-dandruff shampoo is effective and reduces the dandruff fungi in scalp	[71]
Revansiddappa et.al	Formulate and evaluate Polyherbal shampoo containing Ritha,Liquorice, Bengal gram, Brahmi, Green gram,Pomegranate,Hibiscus,marigold, lemon	The Antifungal action of the formulation may be due to pomegranate and green gram and shows Anti-dandruff activity	[72]
Krishnamorthy et al	Formulated Dano - a Polyherbal hair oil having extracts of wrightiatinctoria(indrajev), cassia alata (damari) and bitter fraction of Azadirachta Indica (neem)	Growth of p. ovale is inhibited and dano is very effective in the management of dandruff	[73]

5.4. Wrinkle

Wrinkles are visible crease or folds in the skin and are classified as fine and coarse Wrinkles based on the width and depth of the wrinkle. Wrinkle can be caused by various factors such as aging, facial expressions, hormonal balance, ultraviolet light exposure, and smoking, which leads to elasticity loss, crease, epidermal thinning, and lines in the skin.[74] Some of the herbs effective in dry skin along with their mechanism of action are given in **table 7.**

Table 7: Herbs used for treating wrinkles

Herbs	Biological source	Mechanism	Reference
Aloe vera	*Aloe barbadensis*	Aloin A and B having property to inhibit the activity of collagenase	[75]
Cucumber	*Curcumis sativum*	Maintains elasticity of the skin	[75]
Black tea	*Camellia sinesis*	Anti- hyaluronidase activity	[75]
Rosemary	*Salvia Rosmarinus*	It neutralizes free radical by mimicking the action of superoxide dismutase	[75]
Wheat	*Triticum aestivum*	it increases the synthesis of collagen fibers in the dermis	[75]

5.5. Body odor

Body odor is an unpleasant odor that arises from sweat. The secretion from the sweat is odorless and changes into malodor due to microbial biotransformation. Staphylococcus epidermidis and Corynebacterium species change odorless sweat into volatile odor molecules. Deodorants work by inhibiting the growth of these bacteria which degrades sweat. Common antibacterials available in the market such as aluminum salts and triclosan have effective antibacterial activity but increases the risk of dermatitis, breast cancer, and Alzheimer's disease.[76] Herbs that are proven effective as an antimicrobial agent to prevent body odor are *Salvia officinalis, Arctopus monacanthus, Caesalpinia mimosoides, Camellia sinensis,* and *Chaenomelesspeciose.*[77] Some of the herbs with deodorant property are given in **table 8.**

Table 8: List of some herbs studied for the deodorant property.

Herb	Study	Result	Reference
Methanolic extract of salvia officinalis	Antibacterial and deodorancy	Deodorant containing 200, 400, and 600 µg/mL of sage extract reduced axillary malodor significantly	[76]
Methanolic extract of roots of arctopus species	Antimicrobial against S. epidermidis	MIC against S. epidermidis was found to be 20-50 ppm	[78]
Whole plant extract of caesalpiniamimosoides	Antimicrobial against S. epidermidis	MIC against S. epidermidis was found to be 3130 ppm	[79]

5.6. Acne

Acne is an infectious disease that is characterized by scaly red skin, blackheads, papules, and whiteheads and sometimes scarring.It can be inflammatory and non-inflammatory based on severity. Medical treatment includes oral and topical antibiotics and hormone therapy.[80] Herbal treatment of acne includes the use of Aloe vera, *Azadirachta indica*, *Curcuma longa*, and *Hemides musincidus*.[81] Some of the herbs with anti-acne property are given in **table 9.**

Table 9: Some herbs effective against acne and their mechanism of action.

Herb	Biological source	Mechanism	Reference
Aloe vera	*Aloe barbadensis*	Anti-inflammatory	[81]
Neem	*Azadirachtaindica*	Anti-inflammatory	[81]
Turmeric	*Curcuma longa*	Antibacterial, anti-inflammatory	[81]

6. Conclusion and future prospects

Natural herbs are rich in vitamins, minerals, and antioxidants and due to its low side effect, herbs are used continuously for beautifying purposes by mankind. Herbal cosmetics are made by adding one or more herb in a permissible Cosmetic base. Plants part such as leaves, roots, flowers, and fruits are used for Cosmetics purposes. Herbal cosmetics can be used for beautifying purposes such as skin whitening, moisturizer, soothing, etc or can be used for treating various disorders such as aging, sunburn, acne, dry skin, body odor, etc. A novel formulation such as microspheres, liposomes, niosomes, transferosomes, nanoparticle, phytosomes, etc has been used in herbal cosmetics due to its targeted and sustained delivery. Various herbal formulations such as cream, lotion, gel, oil, etc are in the market.

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Conflict of interest

Conflict of interest declared none

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