

Study of phytocompound-based Nanocosmeceuticals

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Abstract:

Nanotechnology is one of the fast developing scientific fields and in current scenario, it is used in manufacturing of skin care products. The merchandise of the nanoscience has grown to be a phase of our day-to-day lives. Cosmeceuticals are the fast developing sector in worldwide as remedies for many conditions like hyperpigmentation, photoaging, and wrinkle, pores, dandruff and hair damage. The exclusive kinds of nanocarriers are used in place of conventional delivery system like liposomes, solid lipid nanoparticles, niosomes, microemulsion, nanoemulsions and nanostructure lipid carrier. Nanotechnology based on phytocompounds has been extremely used in manufacturing of cosmeceutical for different type of beauty products including antiaging cream and lotion, sunscreen, moisturizer etc. Phytoherbal cosmeceutical accelerates the different type of skin rejuvenate process by activating proliferation and mobilization for skin cells. It is also beneficial in increasing different types of antioxidants in cells. This review is focused on synthesis of silver phytonanoparticles, with a short description of the essential use of plants and their functions in cosmetic.

Key Words: Nanocosmeceuticals, Phytocompound, Skin care, Silver Nanoparticles.

1. Introduction:

Nano-Cosmeceutical is frequently used in the cosmetics zone to evoke new characteristics in beauty products with less side effects. Nanoscience is considered to be the most coming fasten to science of twenty first century and is contemplated as a massive boon inside the beauty enterprise. The time length of nanotechnology is the combination of phrases: namely, technology and the Greek numerical “nano” which has a capability of dwarf. As a consequence, nanotechnology is regarded as the science and technology used to develop or handle the particles inside the dimension vary from 1 to 100 nm ^[1, 2]. In 1959, nanotechnology has appeared in divergent fields of science like biology, engineering, physics and chemistry. It has been genuinely forty years of nanotechnology when it was launched into the discipline of cosmetics, fitness merchandise and dermal preparations. The use of nanotechnology has been recorded through the Greek, Romans and Egyptians, with thinking of hair dye training and making use of nanotechnology ^[3]. Establish member of US society of Cosmetic Chemists, Raymond reed, coined the time period “cosmetics” in 1961. Cosmetics can be described as the products, which make skin looks better, reinforce the cleaning and assist the splendour of the skin ^[4]. The usage of cosmetics end up attributed to Egyptians round 4000 BC and later Romans, Eastern, Greeks, Americans and Chinese humans started out the usage of cosmetics. Inside 19th century, the utilization of cosmetics grow to be secretly finished by using the female with dwelling hold objects in western nations and by 20th century the cosmetics have been completed the barring concealment. While in the 21st century, the cosmetics have being excessively used with the improvement in generation. Revolutionary beauty products are being superior with the usage of commercial enterprise organisation in the cutting-edge applied sciences ^[5].

Cosmeceuticals are the beauty products which include biologically active component having curing advantages at the surface implemented. These are utilized as cosmetics and declare to be embellishing look ^[6]. Cosmeceutical products have measurable curing efficacy on the pores and skin, as pills and formulations have distinct from pores of skin to physique the hair and these are used for the remedy of quite a number pre-requisites like hair damage, wrinkles, photoaging, pores, skin dryness, dark spots, uneven complexion, hyperpigmentation etc ^[7]. Cosmeceuticals are meditated as the quickest developing fragment and growing extremely as personal care enterprise ^[8].

Nanotechnology is the study of nanoparticles and by means of potential definition, a nanoparticle is a material measuring lesser than a 100 nm. These elements have specific physical properties like thermal, optical, electric or magnetic. Nano sized particles have been utilized in manufacturing of cosmetics products [9]. Nano substances provide improved sensory quality and give more strength to cosmetics. Silver nano particles moreover have a superior antimicrobial spectrum, than its macro particles [10]. But the toxicity and protection is major concern when nano silver particles are used in beauty products. There is no united thinking amongst scientists about toxicity of this debris. There are disagreement and scarcity amongst researchers on protection for dermal use of nanoparticles. These particles also cause injury into the cellular structures and DNA of skin cells [11]. However it is also reported that, silver nanoparticles get thrilled away from blood stream and reducing toxicity [12].

The explanation of defending effects is however no longer understood. It is a long caution that silver nano particles can interrupt the bacterial cell wall [13]. Antibacterial and antifungal features of silver nanoparticles should be used as preservatives in cosmetics preparation. The silver nanoparticles reduce the development of dermatophytes and making them effective antimicrobial agent [14]. Silver nanoparticles had been studied significantly on regard of antimicrobial activity of silver nanoparticles might also be due to the silver ions and it is additionally viable that they show off extra impact on the discharge of silver ions in solution [15]. Nano-Cosmeceuticals make cosmetic formulations which are higher effective and they also amplify the efficiancy of sunscreens by means of the use of increasing UV protection. With the useful resource of having very small measurement of the particles, the surface area is expanded which lets in the lively transport of the lively factors into the pores and skin.

2. Production of phyto silver nanoparticles (AgNPs):

Plant and plant extracts are used in nanoparticle synthesis. Plant based synthesis is considered as the advantageous over microbial based system; it reduces the long process of maintaining cell cultures. The size of the particle development increase can be controlled by using the altering synthesis conditions like temperature, pH and ratio of the reactants etc. The plant based synthesis can be carried out by two processes: extracellularly and intracellularly. Intracellular synthesis takes place inside the plant whereas the extracellular synthesis occurs in vitro. The studies reveals that extracellular synthesis using plant extracts has been considered better as compared to

intracellular synthesis ^[16] because it eliminates the extraction and purification procedures. The mechanism and role of active biomolecules in synthesis of AgNPs are described in figure 1. It is reported that presence of phytochemicals in plant extracts are the key component in reduction and stabilization of silver ions ^[17].



Figure 1: Synthesis of silver nanoparticles by biomolecules of plant extract

3. Production of metallic NPs from different parts of plant:

In 21st century, the scientific and commercial interest in the discovery of new therapeutic metallic nanoagents is increasing rapidly ^[18]. Different varieties of plants and their biomass are abundantly available in the nature so the scientists and the researchers are working in the field of nanotechnology. They are focussed mostly on the plant mediated synthesis of metallic NPs. The metabolites of plant are normally present in the extracts of seeds, bark and leave ^[19]. Currently, the plant mediated nanomaterial has increased interest due to its enormous application in number of fields because of their physiochemical properties. Many metallic nano- particles which include gold, silver, platinum, zinc, copper, titanium oxide, magnetite and nickel have been synthesized from natural extracts. The particular elements of plant inclusive of stem, root, fruit, seed, callus, peel, leaves and flowers are used in synthesis of metallic nanoparticles in a number of shapes and sizes. Biosynthesis response can be altered by the way of great range of metallic awareness capacity and quantity of plant extract in the response medium, it may also moreover remodel the shapes and size of the nanoparticles. There are many use of plant extract such as soothing irritated skin, as moisturizer, and used in treatment of acne. Many plants have multiple skincare properties and can be used for a range of skin conditions.

3.1 Herbs for skincare: plants for healing damaged skin ^[20, 21].

3.1.1 Aloe Vera (*Aloe barbadensis*): The gel inside its leaves is used to smooth burned skin and reduce inflammation. Aloe can also be used as an oil-free moisturizer though regular use can make over-dry your skin. For daily skincare it's better to use aloe vera as a part of a light lotion. We can extract it by cutting the leaves open and scooping out the gel. Aloe can be used on its own but they are also used in creams and lotions though it needs blending and straining first.

3.1.2 Echinacea (*Echinacea purpurea*): Extraction of Echinacea can help in speeding up of skin regeneration, reduce inflammation, and treat acne. Echinacea liquid can also be used to make creams and lotions. As a tincture it is helpful for treating blemishes. Decoction of Roots and water infusion of flowers are used as a toner.

3.1.3 Comfrey (*Symphytum officinale*): Comfrey leaves and flowers have powerful anti-inflammatory properties which make it a good option for treating inflamed skin. Infusions can be made from these parts which are used as a toner or in creams and lotions. It's especially good for promoting skin healing and treating eczema, psoriasis, acne and other skin eruptions. Infusions of the root are best for spot-treating pimples.

3.2 Skincare herbs for acne and blemishes ^[20, 21].

3.2.1 Green tea (*Camellia sinensis*): Green tea is a popular drink which is rich in antioxidants. It has the ability to control sebum (oil) production, inhibit bacterial growth, and reduce inflammation. Infusion of the fresh or dried tea leaves can be used in creams, lotions, or as a facial toner. Green tea has been shown to help in repairing skin damaged by age and environmental factors.

3.2.2 Lavender (*Lavandula angustifolia*): Lavender is a common fragrant which is a garden shrub. It has antiseptic and anti-inflammatory properties. Lavender is beneficial for skin irritation and inflammation. Lavender oil can be used to help in increasing the speed of the healing of cuts, burns, and abrasions and their flowers are also used to make an oil infusion, creams, lotions, facial toner and lavender water.

3.2.3 Burdock Root (*Arctium lappa*): Burdock is a unique skincare herb. It should mostly be taken internally. It's a cleansing herb and works from the inside to help heal acne, boils, psoriasis, and eczema.

3.2.4 Thyme (*Thymus vulgaris*): Recent studies have shown that thyme is more effective at clearing acne than treatments using benzoyl peroxide. Scientists used a tincture to conduct the study and presumably dabbed it, on spots. As it kills the bacteria and also responsible for blemish within five minutes.

3.2.5 Lemon (*Citrus lim8 on*): The astringent properties of citrus juice, can help remove excess oil and brighten your skin

3.3 Herbs for aging and mature skin ^[20, 21].

3.3.1 Roses (*Rosa gallica*): Rose water is a mild astringent and great as a toner for all skin types. Roses are especially great for mature skin with dehydrating properties. Rose water is a by-product of the distillation of rose petals to make essential oil. Both wild and cultivated rose petals are suitable.

3.3.2 Ladys mantle (*Alchemilla vulgaris*): Ladys mantle leaves are used in making of anti-wrinkle creams, toner, creams and lotions. It helps in reduce pore size of skin.

3.3.3 Helichrysum (*Helichrysum italicum*): Helichrysum has natural anti-inflammatory properties that reduce redness and promote regeneration. It is also an effective skincare herb for conditions ranging from acne to aged and damaged skin. These flowers are used in tincture, an oil and water infusion to help diminish fine lines and wrinkles. The solutions can be used on their own as a toner, or in creams and lotions. Helichrysum is also known as the curry plant due to its distinctive scent.

3.4 Herbs for skincare: astringent and toning herb ^[20, 21].

3.4.1 Witch hazel (*Hamamelis*): Witch hazel is used in many commercial toners. It contains high levels of natural astringent tannins. These help in removing of oil and tighten the skin. Witch hazel is used to make a tincture by first making a decoction of the bark and mixing it with alcohol. Water infusion of the leaves used as a natural toner.

3.4.2 Yarrow (*Achillea millefolium*): Every garden has 'weeds' but some weeds are more useful than others. In a skincare garden you might want to encourage yarrow, a common wild plant is

used in herbal medicine. A water infusion of the leaves and flowers can be used as an astringent toner, helping in removing oil, improving in skin tone, and reduces inflammation.

3.4.3 Lemon Balm (*Melissa officinalis*): A lemony and minty plant that works as a refreshing toner for oily and acne-prone skin. Use of water infusion of leaves as a toner and oil infusion used in lighting lotions. Lemon balm has also shown anti-viral properties which make it an ideal extract to use in cold sore creams and lip balms.

3.4.4 Rosemary (*Rosmarinus officinalis*): An infusion of Rosemary leaves can be used as an aromatic astringent for all skin types. It also helps in promoting healing by stimulating blood flow in the skin. Use of an oil or water infusion of this herb in making massage oils, toners, creams, hair rinses, balms, and lotions.

3.5 Herbs for skincare: plants that moisturize skin ^[20, 21].

3.5.1 Violet (*Viola odorata or Viola canina*): It has fragrant or only slightly astringent. Violet leaf and flower extract is juicy and moisturizing. It's extraction is perfect for dry skin. Violets are also anti-inflammatory and help in heal cuts and wounds. Infuse fresh plant material in oil and water is used to make creams, lotions, balms, massage oil, and toners.

3.5.2 Common Plantain (*Plantago major or Plantago lanceolata*): Another 'weed' that growing in most gardens, plantain leaves contain moisturizing mucilage. It's also an effective skin healer that can use to help heal wounds and bruises. Prepare the leaves by water or oil infusion for use in salves, creams, lotions, balms, and massage oils.

3.5.3 Marsh Mallow (*Althaea officinalis*): The roots, leaves, and flowers of marsh mallow contain rich sources of mucilage, pectin, and sugars that soften and moisturize the skin. The roots contain the highest amounts though. Soak the root in cold water overnight and use the liquid to make silky lotions and creams.

3.6 Plants for red, puffy, and inflamed skin ^[20, 21].

3.6.1 Speedwell (*Veronica chamaedrys*): An anti-inflammatory flower used to relieve the redness, itch caused by eczema and other skin conditions. Use a water infusion of the leaves and flowers as a toner or in creams and lotions.

3.6.2 German Chamomile (*Matricaria recutita*): A gentle herb, it's used to soothe dry and irritated skin such as caused by dermatitis and eczema. Use oil or water infusions in balms, creams, lotions, toners, or massage oil.

3.6.3 Cucumber (*Cucumis sativus*): The moist flesh of cucumbers reduces puffiness, soothes irritation, and tightens the skin. Water infusion of cucumber used in creams, lotion and as a facial mask. Slices of cucumber also used over the eyes to soothe, tighten, and brighten dark circles.

3.6.4 Chickweed (*Stellaria media*): Chickweed is an effective anti-inflammatory. Infuse the leaves in water or oil and use it to make balms, salves, creams, lotions, and other beauty products, also used in reduce redness, irritation, and to soothe chronic itching.

3.7 Plants used for naturally lighten and darken skin ^[20, 21].

3.7.1 Elderflower (*Sambucus nigra*): Flowers of elderflower can be used in fade freckles, age spots and scars. The extract with water and oil has also an anti-inflammatory properties and can help in maturation of skin.

3.7.2 Sage (*Salvia officinalis*): Sage helps to clean oily skin and can be used as a rinse for dark hair. Infuse the fresh or dried leaves in water and apply to hair daily. Though it won't permanently tint hair, it can gradually darken hair. Grey or coarse hair may be resistant to picking up color though. Sage also uses in combination with rosemary, crushed black walnut hulls, nettles, and coffee for increased darkening effects.

3.7.3 Rosemary (*Rosmarinus officinalis*): Rosemary can be used to darken hair. It use as a water infusion to rinse the hair.

3.7.4 German Chamomile (*Matricaria recutita*): Chamomile is a natural hair lightener. Infusion of the flowers in water used in conditioners, increase the lightening power of chamomile, use it together with lemon juice.

4 4 Major Applications of Nano-Cosmeceuticals:

4.1 Sunscreens

Sun-screens are a product applied on skin to protect from the hazardous consequences of the solar ultraviolet rays. Many manufacturers of sunscreens are available in the world, containing a diffusion of substances along with titanium dioxide (TiO₂) and zinc oxide (ZnO). These energetic materials work through soaking up, reflecting and scattering a few or all of the sun's

rays. Most sunscreen products incorporate combos of components, bureaucracy barrier for material on the skin, shows UVB and UVA rays from entering all the way to the deepest layers of the skin; it is a good deal with lesser worrying ^[22]. The most important drawback of ordinary standard sunscreen is that, at the same time it is carried out, it leaves a white chalky layer on the skin ^[23]. This is the target where nanotechnology comes with improved suns-creams to overcome this problem. Nanoparticles of TiO₂ or ZnO are used in suns-cream to make less greasy and accelerate aesthetic appeal.

4.2 Moisturizer

The preliminary barrier for the pores of skin is stratum corneum. Water from the stratum corneum gets evaporated speedily main to dehydration. This dehydration of skin may additionally be removed by applying potential moisturizers which provide grant flexibility to the skin. Use of moisturizers is carried out to the skin, a skinny layer of humectants is common which maintains water content and offers higher look to the surface of skin. SLNS, nanoemulsions and liposomes are broadly applied on formulations of moisturizers due to their long time results; these are viewed to be the most beneficial skin product (e. g., psoriasis, pruritus and atopidermatitis).

4.3 Hair Care

Hair-care is a class of cosmeceutical. Formulation companies are used nanotechnology in hair-care merchandise and researchers are ongoing to find out the strategies on use of nano-particles to maintain shine, silkiness, health of hairs and prevent loss of hair. Unlike everyday straightening of hair, nanoemulsion in hair cosmetics does no longer injury the shape of fibers in the hair, referred to as cuticles, to penetrate into the hair strands ^[24]. Sericin is made of cationic sericin nanoparticles which is an active vicinity of hair cosmeceuticals. Studies have established that sericin nanoparticles in hair cosmeceuticals besides situation adhere to the floor of hair seal and deal with the broken cuticles ^[25].

4.4 Antiaging Products

Chemicals and their product, stress, pollutants irradiation from UV sources and infrared are involved in skin aging. Tissue (Collagen) performs an integral position in skin wrinkle and

rejuvenation reversal impact. In the skin the quantity of collagen reduced with age. The getting older of the skin manifests itself in many ways like drying out, loss of elasticity, texture, thinning, broken barrier function, look of spots, change of surface line isotropy, and, quicker or later, wrinkles. Maximum of the cosmeceuticals had been developed with claims of antiwrinkle and firming, moisturizing and lifting, skin firming and whitening. Antiaging merchandise is the fundamental cosmeceuticals in the market presently being made using nanotechnology. Use of retinol can increase epidermal hyperplasia, epidermal watercontent, and cell renewal whilst enhancing synthesis of collagen ^[26]. Retinol moreover interferes with melanogenesis and inhibits matrix metalloproteinases, which would possibly be worried in breakdown of collagen. The scientific blessings consist of a reduction in the introduction of splendid traces, wrinkles and lightening of lentigines ^[27].

4.5 Skin Cleanser

A hydro lipid film is covered the skin and depending on the body area, consists of secretions from apocrine eccrine sweat glands and sebaceous gland. Decomposition merchandise from cornification and corneocyte (stratum corneum lipids and cell particles) interior the manner of being cover additionally are available. Its offers an herbal safety in the direction of pathogenic organisms however it attracts dirt and air pollution from the surroundings. The microorganisms existing at the pores of skin surface, act on components of the surface film and create undesirable via way of-products, such as these due to the metabolism of compounds observed in apocrine sweat that create odor in the body ^[28]. Hereby, periodic cleaning to remove dirt, debris and scent is essential to maintain pores and skin health. Skin cleaning is additionally necessary to eliminates oil (which may also moreover encompass micro organism) from the pores of skin surface; it is acquired with the useful resource of incidental contact or by means of intentional application (medicines and different Cosmetic products). Nanoparticles of silver are used as decontamination and skin disinfectant. Nano cyclic inc. produces nano cyclic cleaner crimson soap it's a scientifically balanced combination of nanosilver and herbal components and claims that it kills unsafe micro organism like bacteria and fungi, diminishes age spots, solar damaged skin and fight sacne.

4.6 Nail Care

Nanotechnology-primarily based totally nail Nano laboratory (a nanotechnology research and improvement enterprise) grew to become supplied a provisional patent for its special nano nail-polish and lacquer having benefits that it dries to a absolutely hard nation, cracking, chipping, scratching and resists surprise and its elasticity offers superior ease of utility with out cracking . A look at located that nail paint shaving nano sized particles beautify sturdiness and have an effect on resistance of the mammalian nails [29].

4.7 Lip Care

Lip-care is one another class of cosmeceuticals. Distinct nanometallic particles can be included into lipstick and lip gloss that approves you to soften or soothe the lips with the resource of stopping water loss from transepidermal. According to Korea research institute of biotechnology and bioscience hold sapatent, it is miles attainable to put together pigments exhibiting sizable range of colorings the use of silver or gold nanoparticles by way of mix together in different concentration ratios, coloration can be maintained for a prolonged length of time [30]. Nanoparticles (Silica) utilized in lipcare enhance the distribution of pigments by homogenously; they stop the bleeding in to the lips [31].

5. Nanocarriers

Nanocarriers have nanosize particles play an important role in the cosmetic industry. Nanocarriers have different properties include enhanced skin hydration, stability, biocompatible, low toxicity, antioxidants etc. It can be found in many skincare and hair care cosmetic products. There are different types of nanocarriers composed in cosmetics such as nanosomes, nanocapsule, liposomes, fullerenes, Nanocrystals, solid lipid nanoparticles, dendrimers etc. (Table-1) [31].

Table 1: Different types of nanocarriers

Sr No.	Name of nanocarriers	Properties	Main ingredients	Applications	References
1	Liposomes	Spherical, selfclosed vesicles, biocompatible, biodegradable, nontoxic, and flexible vesicles	Phosphatidylcholine	Skincare products (moisturizer,lotions, creams,etc.) and haircare products (shampoo,conditione)	[32]
2	Nanocapsule	Encapsulated	Vesicular systems	Skincare products	[33]
3	Solid Lipid Nanoparticles	Low toxicity, physical UV blockers	Composed of physiological and biodegradable lipids	Sunscreen	[34, 35]
4	Nanocrystals	Photoprotective, nondissolved crystal	Nanocrystal in cluster form	Skincare product	[36]
5	Dendrimers	Water and sebum resistance, glossiness, tangible sense and bonding agent properties to the skin & hair	Carbosiloxane dendrimer	Dendrimersin hair, skin & nail care products	[37, 38]
6	Cubosomes	Oil-in-water emulsion stabilizers and pollutant absorbents	Cubic liquid crystalline phase	skin & hair care, antiperspirants	[39]
7	Niosomes	Nonionic surfactants, enhanced chemical strength and penetration	Nonionic surfactant vesicles	Drugs and cosmetics	[40]
8	Fullerene	Antioxidative properties	carbon fullerene	Preparation of skin rejuvenation cosmeceutical formulations	[41]

1. Toxicity :

Nanotoxicology is a sub-branch of toxicology which is associated with harmful substance of nanoparticles and their effects on atmosphere and living organisms. Nanotoxicity of NPs depends on their doses, physical and chemical properties. Size of silver nanoparticle plays important role but particles are not evaluated by their toxicity^[42]. Silver nanoparticles are frequently touted as being highly effective as antimicrobial agents while being nontoxic to mammals, they are used in cosmeceuticals. A nanomaterial does not penetrate to attain cutis^[43]. Concentration of silver which is lethal for micro organism is likely wise deadly for every keratinocytes and fibroblasts^[44].

7. Conclusion:

Natural materials are present at all places and these materials are continuously acquiring popularity. The use of plant extracts is to increase encompasses rosemary, sage, thyme and calendula in formulation of cosmetic. A formulation of cosmetic method such as full of life requirements of herbal basis can defend the skin towards exogenous/endogenous risky agents, and assist to cure many skin conditions. Vital oils transmit many more benefits, inclusive of improving the elasticity of the skin. Skincare herbs contain natural vitamins, antioxidants and emollients which make their manner for your skin from below and outside. Making skin products with them is a bit greater concerned however it can supply benefits.

Nanotechnology is viewed to be the most revolutionizing and prominent field. Nanotechnology is notably over the years, getting use of this is beneficial in the discipline of cosmetics, dermatology and biomedical applications in proper manner. Novel science technology and novel transport system had been invented with the useful resource of scientists, which nowadays being used inside the cosmeceuticals manufacturing. By the capacity of the boom it is in use of cosmeceuticals, the normal transport constructions are being modified through way of the novel transport system. The synthesis of AgNPs is in utilization of plant has described in detail. The process of synthesis the utilization of plant or the plant extracts is taken into consideration comparatively cheap, green and can be effortlessly scaled up. The bio-molecules located in flowers reduce the silver ions into nano size. The number of bio-molecules existing internal the flowers catalyze the reduction of silver into nano and supply special property to them.

With the collected data, we assume that the metallic (silver) nanoparticles are secure as to observe the cosmetics product. The silver nanoparticle may additionally be used for anti pimples, recovery agent, anti dandruff, anti scarring in cosmetics formulation. In extra research of this factor will be beneficial and vital. But, in a similar fashion lookup additionally they had to have a seem to be at cytotoxicity of nanoparticles toward human cells earlier than the usage of them. The interior of the cosmetics merchandise and thus, higher lookup is also wanted to be higher apprehend and the secure use in cosmetics always containing silver nanoparticle and toxicity.

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