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Comprehensive implementation of metal nanoparticle in pharmaceutical and Cosmeceuticals.

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ABSTRACT: Nanotechnology is speedily growing technology in pharmaceutical and cosmeceutical. Metal nanoparticle are nanosized metal with scale 10-100 nm and also possess the property which are totally different from bulk metal. Noble metal like gold, silver is use from ancient time in day-to-day life. Nowadays it is used in nanoform for various purpose like drug targeting, gene delivery. synthesis of metal-based nanoparticle by biological method is advantageous than the physical and chemical method. Also, the green synthesis is eco-friendly and economical then chemical and physical approach. When the metal with herbal gives the synergistic effect. Metal nanoparticle like AgNPs, AuNPs, Al_2O_3NPs, γ-Fe_2O_3NPs, Fe_3O_4NPs, SiO_2NPs, TiO_2NPs and ZnONPs are used in pharmaceutical for various activity like anti-microbial agent, anticancerous, anti-oxidant, etc. silver nanoparticle shows excellent antimicrobial activity while gold nanoparticle shows anticancerous activity. Silver nanoparticle are also used in textile industry and also in wound dressing as it shows wound healing property. Metal nanoparticles are implemented in gene delivery as they show promising technology for the treatment. In cosmeceutical metal nanoparticle have high revenue due to properties like sun protection and anti-aging. The scientist also said that metal nanoparticle gets easily washed out from body. Inthis review the broad scope of metal nanoparticle in pharmaceutical and cosmeceutical are described.

Keywords:Nantechnology, Metal Nanoparticles, Silver Nanoparticles, Cosmeceutical, Green Synthesis.

I. INTRODUCTION:

Nanotechnology is one among the foremost effective and novel space of analysis in modern material science. This field of science is developing day by day and is creating a valuable impact within the bioscience, especially biotechnology and bioscience. Nanoparticle exhibits utterly new properties, as they contain specific characteristics like shape, size, and distribution(1).Nanotechnology science, that deals preparation of nano-size particles starting from 1 to 100 nm using various synthesis ways, and particle structure and size modification. The employment of nanoparticles in several fields like biology, physics, organic and chemical science, drugs and material science is unexpectedly increased today(2).The term 'nanoparticle' was coined from Greek work 'nano' meaning 'dwarf or small' and once used as prefix it indicates size 10-9 one billionth of meter is equals to at least one nanometre(3). From ancient time to the centre age, the history of the nanoparticles has been summarized by Daniel and Astrum(4). Metal nanoparticles or metallic nanoparticles, a brand new word has been originated within the field of nanoparticles in recent few years. Metallic nanoparticle is nanosized metals with the scale vary of 10-100nm(5). Metallic nanoparticles have received abundant quality thanks to their uniform size and sharp size distribution in nanometres. Moreover, thanks to their totally different physical and chemical properties from bulk metals. Metallic nanoparticles have specialty with acceptable useful teams. It may be synthesized and changed that will enable them to bind with ligands, antibodies, drugs (6). The metallic element like gold, silver, and Pt having useful effects on health square measure used for the synthesis of nanoparticles and selected as aluminiferous nanoparticles (2).

Today researchers square measure that specialize in metal nanoparticles, nanostructures and nanomaterial synthesis thanks to their conspicuous properties that square measure helpful for chemical process(7), composite like chemical compound preparation(8), malady diagnosing and treatment (9), detector technology(10), and labelling of optoelectronic recorded media(11). Chemist (1908) initial recognized the existence of metal nanoparticles in answer and Mie gave the

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quantitative clarification of their colour. In medieval era, metal nanoparticles were really to adorn cathedral windows(5). Metal particles gift within the product like cosmetic product, detergents, toothpaste, soaps, shampoos, medicines and pharmaceutical product square measure directly coming back in grips with human. Gold is wide utilized in the medicines and Ayurvedic preparations in Republic of India and China(2). Whereas, the employment of silver nano is concerning twelve-tone system of all nano particles utilized in cosmetics (12). Silver is standard for its antimicrobial and inflammatory potential. This property is by selection to elevate quicker wound healing and commercially adopted in wound dressing (2). Metal nanoparticles like Pt nanoparticles conjointly evaluated for his or her health useful impact and with success utilized in medical specialty applications in either pure type or metal alloyed as one or together with different metal nanoparticles. Zinc oxide, titanic oxide not solely provides higher feel and spread-ability to the cosmetic formulation however conjointly provides higher sun protection. The major NPs created by the trade square measure AgNPs, Al_2O_3NPs, γ-Fe_2O_3NPs, Fe_3O_4NPs, SiO_2NPs, TiO_2NPs and ZnONPs. Globally, production of preceding types of NPs was a number of tons annually (13). Characteristics of aluminiferous Nanoparticles square measure giant surface energies, As compared to bulk they need giant extent to volume magnitude relation, Quantum confinement, Plasmon excitation, exaggerated range of kinks (5).

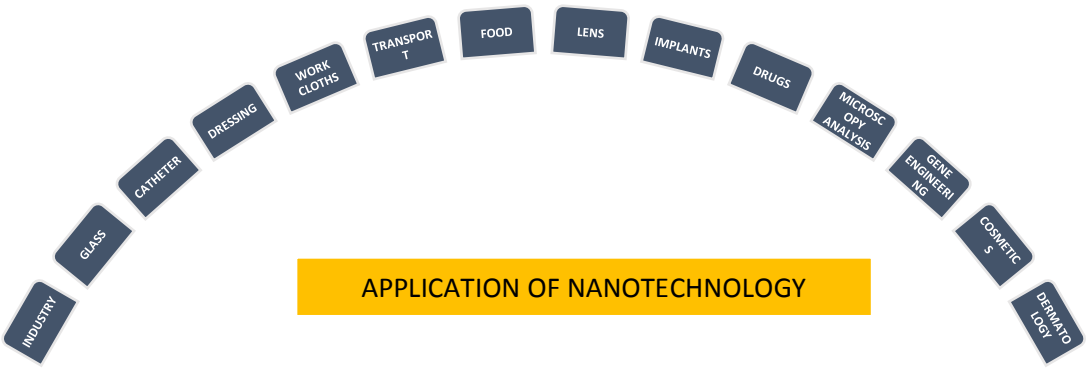

Fig No 1: Application of nanotechnology in various field

II. NANOTECHNOLOGY -SUPPORTED METAL NANOPARTICLE

Drug loading into NPs is achieved by 3 techniques:

1. Valency attachment to the chemical compound backbone
2. Surface assimilation to the chemical compound surface
3.Entraptment within the chemical compound matrix throughout preparation of the NPs.

In most cases metal drug chemical compound system has been developed by valency attachment of metal-based drug to chemical compound backbone(4). Drug delivery system potency is optimized; for that, carriers should be sufficiently little for the spectacular diffusion of the drug carrier composite into the targeted cellular surroundings. Hence, metal nanoparticle, thanks to their nano size, is wonderful candidates as drug carriers (14).

III. CLASSICAL APPROACHES FOR THE SYNTHESIS OF METAL NANOPARTICLES:

There are two approaches for preparation of metal nanoparticles that istop-down methods and bottom-upmethods enlisted in table 1. In top down method bulk material is used for synthesis of nanoparticle in that various physical, chemical as well as mechanical process are involved(15). The top down approach based on the principle of dispersion cutting, milling,shaping, decomposition of material into nanoobjects(16).Whereas, In

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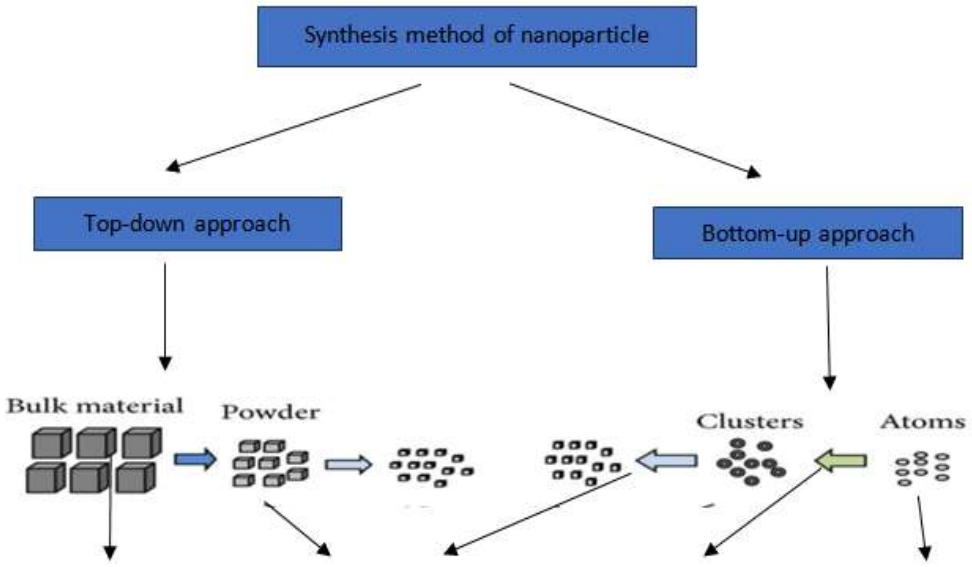
bottom up method the atom or molecules are used as a starting material which form cluster(17). Arrangement or organisation of individual element (atoms, molecule and biological cells) to build a nanoobjects e.g growth of a crystal, synthesis of nanoparticles by colloidal dispersion.



Physical method	Chemical method	Biological method	Other green synthesis
Ball mill	Sol-gel process	Bacteria	Vitamins
Thermal evaporation	Chemical vapour deposition	Archaea	Enzymes
Lithography	Chemical reduction technique	Actinomycetes	Monosaccharides and polysaccharides
Laser ablation	Solution based synthesis	Fungi	Proteins and amino acids
Ultrasonication	Solvothermal	Algae	Polymers-copolymers
Photoirradiation	Reverse micelle	Plants	Microwave assisted synthesis
Radiolysis	Co-precipitation	Viruses	
Spray pyrolysis			

Fig no 2: Classical approach for synthesis of nanoparticles

Green synthesis benefits over physical and chemical method:

The main advantage of plant-based synthesis approaches over classical chemical and physical technique is additional eco-friendly, cheaper, and simply scale-up method for the large-scale synthesis of nanoparticles apart from there's no would like of to use exceed temperature, pressure, and toxic chemicals (18). This is often because of their reducing or inhibitor properties that are responsible for the reduction of metal nanoparticles (1). Biosynthesis of nanoparticles is associate degree approach that's compatible with green chemistry approaches within which the biomolecules secreted by the biomass will act as each reducing and stabilising agents throughout the reaction. In recent years, plant-based synthesis of nanoparticles gained a lot of attention because of its quickness and its simplicity (19). In nanoparticle synthesis mistreatment plant extracts, the extract of

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plant is just mixed with the solution of the metal salt at temperature, in order that these processes may be thought-about as a green synthesis approach (20). Green synthesis is easy, rapid, one step, eco-friendly, non-toxic and another standard physical/chemical strategies (21).

Sr.no	Application of metal nanoparticle in in various sector:	Metal used for synthesis of nanoparticle
1.	Clinical and pharmaceutical	Gold, silver, platinum, selenium
2.	Drug delivery	Gold, silver, zinc, platinum
3.	Anticancer	Platinum, gold, silver, iron, selenium
4.	Anti-microbial	Silver, copper, selenium, gold
5.	Catalytic	Palladium
6.	Biosensor	Gold
7.	Molecular imaging	Iron
8.	Cosmetic coating	Zinc oxide
9.	Optical properties	Titanium oxide
10.	Food industry	Zinc, silver
11.	Textile industry	Zinc oxide, silver, titanium oxide
12.	Agriculture	Silica, titanium, copper

Fig no 3: Application of metal nanoparticle in various field(22)

IV. APPLICATION OF METAL NANOPARTICLE IN PHARMACEUTICAL:

4.1 Metal nanoparticle in drug delivery:

Metallic nanoparticle acquired much more attention in pharmaceutical due to their properties. applications of metal nanoparticles are still under research and in development, such as magnetically responsive drug delivery, photoimaging, and photothermal therapy(1). Metal nanoparticles have emerged as a new drug delivery strategy for transporting drugs and gene through the nano-sized delivery systems, because they have high surface area, low toxicity, and tuneable stability(1). Metallic nanoparticle in drug delivery system includes nanospheres, nano capsules, nanowires or nanotubes and nano discs.

Antimicrobial activity: Metal nanoparticles are well known for their antimicrobial activities, especially for their antibacterial, antifungal, anti-inflammatory, and antiviral activities. It's been found that silver nanoparticles inactivate the microbes by interacting with microorganism enzymes, proteins or desoxyribonucleic acid to inhibit their multiplication (23). Elechiguerra et al. (24) carried out a study in which they found silver nanoparticle are having shape dependent activity. They use silver nanoparticle on Gram −ve bacteria such as E. coli They found that truncated triangular nanoparticles show the strongest activity as compared to spherical-shaped nanoparticles and nanorods (24). Sondi and Salopek-Sondi (25) found that silver nanoparticles are highly active against pathogenic bacteria. It has been found that high concentrations of silver nanoparticles have higher permeability than those of lower concentration of silver nanoparticles and consequently rapture the cell wall of bacteria (26). Biologically synthesized silver nanoparticles have the highest antibacterial activity due to their stronger surface interactions with the bacteria which is achieved by their biological capping agents (21). Antibacterial properties of silver nanoparticles can be used as disinfectant to clean the materials and devices used in hospitals (27).

Fungicidal effects of biosynthesized metal nanoparticles have more potential than the commercially available antibiotics such as amphotericin and fluconazole. Plant extract-based synthesized silver nanoparticles have been used against fungus Candida species. They showed membrane damage and damage in fungal intracellular components and then finally lead to the death of fungal cell (28). Fungal cell is principally made up of fatty acids and proteins. When fungal spore is bound with metal nanoparticles, it showed significant changes in their membrane structure (29).

Anti-inflammatory effect is important for wound healing mechanism. Anti-inflammation is biological channel process which produces some compound such as cytokines and interleukins, which is produced by specific T lymphocytes, B lymphocytes, and macrophages (30). Nanoparticles have a more robust penetrating capability in animal tissue cells and inflammatory cells that ends up in

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better effectiveness and better persistence within the treatment (31). They also have a better selectivity of target sites such as inflammatory cells or tissues (32). Several metal and metal oxide NPs have been reported with anti-inflammatory properties like silver(33) , gold (34), selenium (35), copper (36), nickel (37), zinc oxide (38), zinc peroxide (39), cerium oxide , iron oxide (40) and titanium dioxide (41).

silver nanoparticles conjointly extremely active against HIV (human immunodeficiency virus). In vitro study of silver and gold nanoparticles of size range of 1–10 nm, and they could bind with the glycoprotein of HIV-1 and suppressed the binding of virus to the host.

Anticancer activity: Gibson et al.(42)with success synthesized gold nanoparticles of 2 nm size that is incorporated among a chemotherapeutical drug, Paclitaxel. TGA analysis of this reveals that regarding seventy molecules of paclitaxel might be connected with one gold nanoparticle. Renu Sankar et al. (43) conclude the Anticancer activity of Ficus religiosa engineered copper oxide nanoparticles. The green synthesized copper oxide nanoparticle cytotoxic potential was evaluated against human lung cancer A549 cells with different concentration. colloidal copper oxide nanoparticles induce cytotoxicity against A549 cells through induction of apoptosis with enhanced ROS generation and alteredmitochondrial membrane potentiallevel. G. Ravi et al. (44)synthesized gold nanoparticles using aqueous flower extract of C. guianensis and perform the anticancer activity on human leukaemia cell line (HL-60 cells). Mukherjee et al. (45) found that gold nanoparticles attached with VEGF antibodies can be effectively used in treatment of B-chronic lymphocytic leukaemia. proposed an eco-friendly method for gold nanoparticle synthesis using plant extracts. Toxicity of plant latex capped silver nanoparticles was tested against human respiratory organ i.e.,lungs carcinoma cells, and through this study, researchers found that these silver nanoparticles are unit noxious to-AS49 cells in a dose-dependent manner. Later, elaborated study of this recommended that plant latex will act as stabilising agents for the silver nanoparticles in water and may even be accountable for the transportation of nanoparticles to the target cells(46).

Anti-oxidant: metal nanoparticle also have antioxidant property which trap the free radicle Mohamed S. Abdel-Azizb et al. (47) b-carotene oxidation demonstrated also a higher antioxidant activity of plant-AgNPs than the extract alone and this activity increased in a dose dependent manner. Antioxidant efficiency of silver nanoparticles was found much higher than that of other synthetic commercially available materials such as ascorbic acid(1). Scavenging effect of antioxidants is found to be useful for the management of several chronic diseases such as diabetes, cancer, AIDS, nephritis, and metabolic disorders(48).

Anti-diabetic: Diabetes mellitus is a metabolic disorder that characterized by high blood glucose(49). A large number of people suffer from diabetes all over the world. DM is usually merely thought of as polygenic disorder, a syndrome of disordered metabolism with abnormally high blood sugar levels (hyperglycaemia). The two most common forms of diabetes are type 1 diabetes (diminished production of insulin) and type 2 diabetes (impaired response to insulin and b-cell dysfunction). Each cause hyperglycaemia, excessive pee production, counteractive thirst, inflated fluid intake, blurred vision, unexplained weight loss, lethargy, and changes in energy metabolism (50). Ali Alkaladi et al. report the possible therapeutic effect of zinc oxide and silver nanoparticles on streptozotocin-induced diabetic rats as well as their compared effect to insulin treatment(49). B.Abolfazl et al. bio-synthesized ZnO NPs which showed great treating efficacies on alloxan diabetic rats in comparison to the chemically synthesized ZnO due to synergistic effect of the extract Vaccinium Arctostaphylos L. dried fruits (51).

4.2 Metal nanoparticle in gene delivery:

Gene delivery has been used as a promising technology for the treatment of inheritable and bought diseases ensuing from abnormal gene expression(52). Presently, 2 vectors, viral and nonviral, are employed in analysis and clinical application. In spite of low potency, nonviral vectors are wide employed in a large vary of factor gene delivery application, thanks to their versatile and facile chemistry, cost effectiveness, and superior safety profiles.within the past decade, nonviral vectors that include polymeric systems (i.e., dendrimers, micelles, and nanoparticles)(53), liposomes(54), ceramic particles, carbon nanotubes, and metal nanoparticles (i.e., nanorods and nanoparticles) are wide used as carrier systems(55). Among the long list of carriers systems, gold nanoparticles (AuNPs) are the leading metal nanoparticles for gene delivery applications along with other biomedical

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applications, such as diagnostic and therapeutic delivery vehicles (56). Gene delivery techniques with efficiency introduce a gene of interest so as to specific its encoded protein in anappropriate host or host cell. Nanoparticles emerged as promising vectors for sequence and drug delivery. Nanoparticles used for cistron delivery Examples of metallic nanoparticles square measure gold nanoparticles (AuNPs) that may be functionalized with many molecules, e.g., short hairpin model Ribonucleic acid (shRNA) for cistron silencing (57). Cistron delivery victimisation AuNPs was accompanied within the early 1990s via particle bombardment(58) where DNA-coated AuNPs were introduced into target cell victimisation physical forces (59). Among the long list of carriers systems, gold nanoparticles (AuNPs) are the leading metal nanoparticles for cistron delivery applications alongside alternative medical speciality application, such as diagnostic and therapeutic delivery vehicles (60). Recently, AuNPs are used in these applications as a result of being stable, uniform, and biocompatible metal nanoparticles with distinctive electronic structures; size-related intensity display; and extremelytuneable electronic, magnetic, and optoelectronic properties (61). AuNPs are used as a typical platform to construct nonviral vectors in gene delivery. These constructs area unit composed of a monolayer of genetic materials/or stabilizer molecules generated either by valence bonding or by electrostatic interaction. Ideal valency bonding is the gold-thiol bonding, that is developed by the soft characters of gold and sulphur atoms (52).

4.3 Other application of metal nanoparticle in pharmaceutical:

Metal nanoparticle also used as Catalysts. Catalyst is also essential in converting hazardous waste into less harmful products as, for example, in the automobile exhaust system. The economical, controlled, and cost-efficientstyle of catalysts is so goal of nice importance; one that guarantees to followgift trial and error approaches. One of the most interesting model systems for researchers in the field of catalysis is gold NPs (62). sensing a broad vary of molecules at low concentrations with high specificity has actuated the event of sophisticated devices that incorporate nanoscale materials, biological components, and advanced materials, that square measure together referred to as nonobiosensor(63). Metal nanoparticles (MNPs) have several advantageous properties that build them helpful within the electrical device element of biosensors. Several metal and metal-organic nanoparticles (NPs) are utilized in nanobiosensors. Metallic element like gold, silver, and platinum NPs are the foremost in style and are extensively studied(64). Molecular imaging could be a field of medical imaging that focuses on imaging molecules of medical interest among living patients. The foremost common example of molecular imaging used clinically of late is to inject a distinction agent (e.g., a microbubble, metal ion, or radioactive isotope) into a patient's blood Associate in Nursing to use an imaging modality (e.g., ultrasound, MRI, CT, PET) to trace the movement within the body(65). Among the first nanoparticle structures to allow molecular imaging were superparamagnetic iron oxide nanoparticles (SPIONs)(66), used for contrast generation with magnetic resonance image MRI (67). The current emphasis lies on their clinical translation, especially given the renaissance spurred by ferumoxytol, which is now FDA-approved for systemic injectionas an iron replacement therapy(65).Semiconductor and aluminous nanomaterials and nanocomposites possess gripping linear absorption, photoluminescence emission, and nonlinear optical properties. Nanomaterials having small particle sizes exhibit enlarged optical emission still as nonlinear optical properties owing to the quantum confinement result (68). The optical properties of metal nanoparticles are ruled by collective excitation of the conduction electrons.The electrons oscillate coherently beneath irradiation by light-weight within the visible and near-IR regions of the spectrum. These coherent oscillations are unit referredto as native surface plasmon resonances. Metallic element particularly gold (Au) and silver (Ag) nanoparticles exhibit unique and tuneable optical properties on account of their surface plasmon resonance (SPR) (69). Metal or metal oxide-based nanocomposites square measure utilized in food packaging and coating or generally as ingredients of food. Silver nanoparticles and its nanocomposites unit most ordinarily used nanomaterials as antimicrobials at intervals the food trade (70). The textiles with antimicrobial propertieshave become an appealing field for each the maker and researchers. These novel merchandise possess sensible antimicrobial properties because of the presence of the bioactive metals like silver, copper, and zinc within the sort of nanophases containing ions, oxides, or complexes(71).With the fast-developing nanotechnology, metal primarily based nanoparticles (NPs) production and application are square measure inflated considerably. These metal

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primarily based NPs will enter agricultural land through each direct and indirect pathways(72).

V. APPLICATION OF METAL NANOPARTICLE IN COSMECEUTICALS:

"Cosmeceuticals"—a fusion of the terms "cosmetic" and "pharmaceutical"—represent one among the foremost promising, nonetheless difficult treatment choices on the market to physicians. The term is attributed to the a medical specialist dermatologistDr. Albert Kligman, who defined a cosmeceutical as a cosmetic product that exerts a pharmaceutical therapeutic benefit however not essentially a biological therapeutic profit(73). In the U.S., as a result of cosmeceuticals disappoint of the legal definition of a drug however will exert therapeutic effects on top of and on the far side those of straightforward cosmetics, they reside during an area of the 1938 Federal Food, Drug, and Cosmetic Act governing the established classes of medicine and cosmetics (74).

In 2005, the U.S. cosmeceutical market was calculable to be $12.5 billion and projected to grow to over $16 billion by 2010 (73). The primary cosmetic product factory-made victimisation engineering were the liposomes-containing moisturizing creams, launched 40 years past(74).The nanoparticles (NPs) of metals and metal oxides are more and more utilized in medical specialty and cosmetology, particularly in prevention and treatment of bacterial and fungal infections, in protection against the harmful effects of the sun and in preparations reducing the visibility of scars by quick repair processes of skin cells (75).MetalNPs and their oxides, because of the broad spectrum of biological activity and distinctivephysical science properties, have attracted great interest in diagnosis and treatment of dermatologic disorders as well as in cosmetics (76). Nanotechnology is widely considered to be the future of the wonder trade and modern antiaging programs (77).the most objectives for study of nanotechnologies in active ingredient/cosmetic delivery space embody specific targeting, decreasing toxicity whereas maintaining helpful effects, additional safety and biocompatibility, and quicker progress in new medicines (78). The major NPs produced by the industry are AgNPs, Al2O3NPs, γ-Fe2O3NPs, Fe3O4NPs, SiO2NPs, TiO2NPs and ZnONPs. Survey results for the product distribution showed that cosmetics products contained approximately 70-80% of TiO2NPs, 70% of ZnONPs and 20% of AgNPs(79).

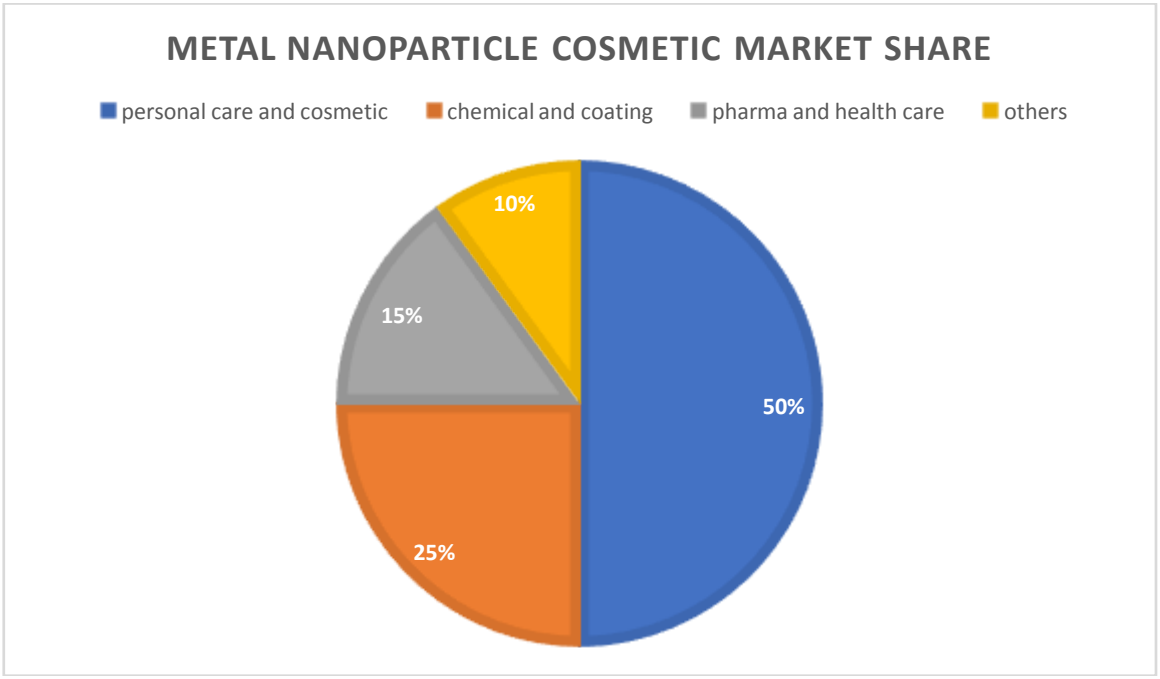

Fig no 4: Metal nanoparticle cosmetic market share

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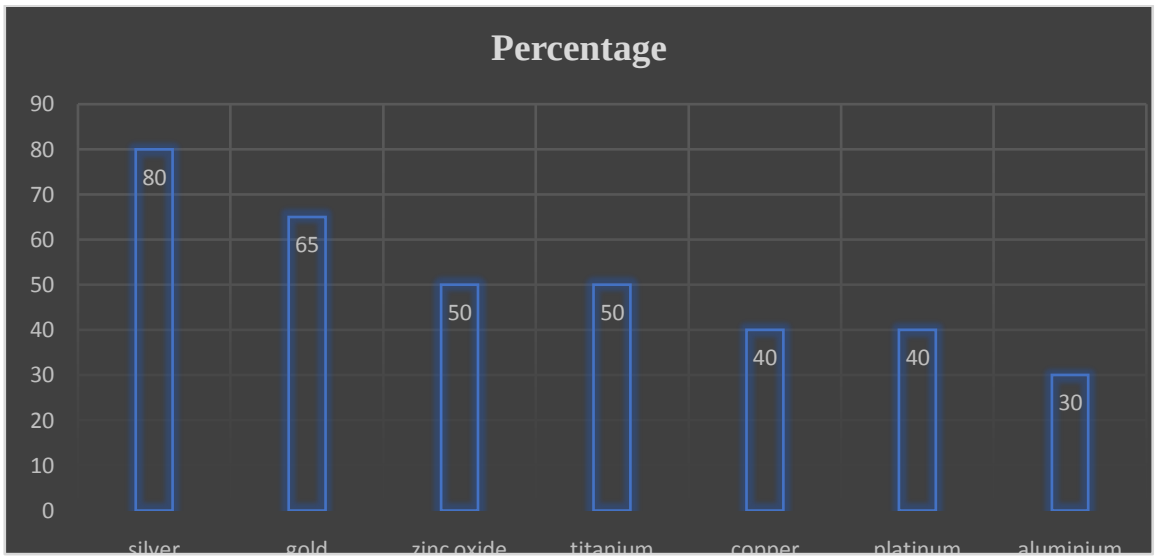

Fig no 5: Percentage of metal nanoparticle used in cosmeceutical product

The world famous cosmetic industries are incorporating metal nanoparticles in their product due to their vast application and also having medicinal properties in them (80).The most popular companies which use nanoparticles are e L'Oréal, Johnson & Johnson, Avon, Henkel, Unclever, Estee Lauder, Revlon(75). L'Oréal S.A., which invests a great amount of revenue in nanotechnology, ranks sixth in the United States in the number of obtained nanotechnology-related patents (81).In cosmetology, metal and metal oxide nanoparticles are commonly used in creams, deodorants, soaps, shampoos, colour cosmetics.These nanoparticles may improve the stability of the skin based cosmetics(82). A bunch of scientists at the university of CaliforniaSantaBarbara claimed that, silver nanoparticles get flushed away, from blood stream, reducing toxicity significantly. It's conjointly rumoured that silver nanoparticles will defend some skin problem like atopic eczema atopic dermatitis (83).

Sr no.	Product	Types of nanoparticles	Description of product
1.	Facial moisturizer, face wash	AuNPs, AgNPs, ZnONPs, TiO_2NPs	Antibacterial,anti-fungal, anti-inflammatory properties, prevention of skin ageing and plums the skin, hydrate skin by restoring water. (92)
2.	Body cream	ZnONPs, TiO_2NPs	Moisturize soothing skin and also protect the skin from harmful sunrays UVB and UVA
3.	Sunscreen	ZnONPs, TiO_2NPs (99)	Protect skin from harmful sunrays like UVA and UVB.
4.	Shaving cream	TiO_2NPs	Antibacterial properties
5.	Antiaging cream, eye cream	AuNPs, AgNPs, ZnONPs	Rebuild and regenerate the skin by working on protein which responsible for collagen production and antioxidant protection.Antioxidants help to fight surface free radicals

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			that can cause premature ageing. (7,100)
6.	Soaps	AgNPs, (98)	Antimicrobial properties
7.	Shampoos	TiO_2NPs, AgNPs,	Antimicrobial properties and also maintain shine and health of hair also prevent the hair loss
8.	Nail polish	AgNPs, TiO_2NPs	Treatment of fungal infection
9.	Eyeliner, mascara	TiO_2NPs, ZnONPs	Increase stability
10.	Deodorants	TiO_2NPs, ZnONPs, AgNPs	Antimicrobial properties
11.	Bandages fabric	AgNPs, ZnONPs	Antimicrobial properties and also prevent wound infection (93)

Fig no 6: Types of commercial skin care product containing metal nanoparticle.

TiO2 and ZnO area unit wide utilized in cosmeceutical formulations. there's a desire for associate degree in-depth study into the toxicity effects of those materials because the studies thus far have brought mixed results. Pulit-Prociak et al. (84) studied the applying of gold and silver nanoparticles in cosmetic formulations. They reported embedding variation between silver and gold nanoparticles into the structure of a cream. Silver nanoparticles introduced to the cream mixture agglomerate;however gold nanoparticles failed to agglomerate once introduction to cream mixtures. Gold(26) and silver(85)(25)(27)nanoparticles(36), aside from various applications that they need additionally show antibacterial and antifungal properties(26) Nano-In Hand and Nail Moisturizing Serum and Foot Moisturizing Serum (Nano-Infinity Nanotech): ZnO nanocrystals, prevent hand and nails from being hurt and restore skin health. Nano Gold Firming Treatment (Chantecaille): pure gold nanoparticles, anti-inflammatory, healing, and age defying power. Nanorama—Nano Gold Mask Pack (LEXON NanoTech): reduces pore size, and prevents and treats acne(86,87).

VI. SUMMARY AND OUTLOOKS:

The broad scope of metal nanoparticle is extending day by day. Many multinational companies are investing in nanoparticles manufacturing and the product made from them. The synthesis of metal nanoparticles is dynamic and complex process as they belong to nanoscale measure several approaches for synthesis of nanomaterial are there but green synthesis is most appropriate and free of cost as compare to physical and chemical process are time consuming, toxic, hazardous, and costly biological process are advantageous over chemical and physical process. Biological process is environment free and safe. Also, it takes short time and economical. Metal nanoparticles are used in pharmaceutical for many activities as they possess the anti-microbial, anticancer, anti-oxidant, antidiabetic, and also in gene delivery. Silver nanoparticles are mostly used as antimicrobial agent and also microbial resistant properties. Gold nanoparticles having anticancerous activity and also leading metal in gene delivery. Cosmeceutical industry having great market revenue in metal nanoparticles. The most popular companies like L'Oréal, Johnson and Johnson, Avon, Henkel, Unilever, Revlon having share nanotechnology. Many metals nanoparticle and used in cosmeceutical and it also work great and gives more stability than other. The major conclusion is that in future metal nanoparticle will acquire pharmaceutical and cosmeceutical world in extent manner.

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