NANOTECHNOLOGY IN COSMETICS: USEFUL OR HARMFUL

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ABSTRACT

In the era of globalized world, the technology is the most important thing which connects each and everything across the globe. But, nowadays, technology can be mixed with molecules, particles, etc. there is a term nanotechnology means that an engineered material or end product at least one dimension in nanoscale range (1 to 100 nm), or exhibits unique properties to enable new applications. The author presents nanoparticles mixing with other particles and creating a new product specifically in the area of cosmetics. This is the most common industry which has high use of nanotechnology. The author deals with the impact of use of such nanoparticles in cosmetics which affects the health of an individual and at times its affects in very hazardous manner due to which person's skin effected for long life and no solution available to curb such problem. The paper covers certain cosmetic products which are of daily use, its impact and the regulating body to curb such activities and conduct proper test prior to launching of any product and also other measures taken by state to curb such activities. It will mention about suggestions pertaining to curb such activity as there are no clear rules/regulation by our legislation on this point of nanoparticles in cosmetics.

Introduction:

Nanotechnology is the science of manipulating atoms at the nanometer scale, which creates a new structure and present totally different behaviors and properties of materials. This is a new development in the field of science. This concept has been started with physicist Richard Feynman in his talk "There's Plenty of Room at the Bottom" at an American Physical Society meeting in California Institute of Technology on 29th December, 1959. He explained the concept as a process

in which scientists would be able to manipulate and control individual atoms and molecules. The term Nanotechnology was given by Norio Taniguchi in 1974. The same terminology was expanded by Eric Drexler in his book titled as Engines of Creation: The Coming Era of Nanotechnology in 1986.[1] It has acquired prominence in many fields of science, such as medicine, chemistry, environment, energy, agriculture, information and communications, heavy industry and consumer goods. But technology has increasingly being put to use in our daily life as well as raw in cosmetics[2] and pharmaceuticals products, in the manufacturing of packages also.

The major countries which have initiated research and development are US, Japan and Germany. The US national Science Foundation (NSF) has found out the total expenditure in such technology research and development in 2007 was around $14.5 billion, more than 2006 expenditure.[3] This nanotechnology has certain nanoparticles has increased area/volume ratio rather than the larger particles of the same material[4]. It has certain advantages over other larger particles like improved texture, enhanced stain resistance, and improved aesthetics, longer shelf life, and improved UV protection. Therefore, such nanoparticles are highly being used in cosmetic and pharmaceutical products. At the market level, it has major impact in three industries like materials and manufacturing (coatings, composite for products like automobiles and buildings), electronics (displays and batteries) and health care and life sciences. [5]Due to many more advantages which give protection as well long life to the product increases such technology more in the cosmetic market rather than any other market.[6] These nanoparticles are being produced out of the human activities like welding fumes, burning of wood, etc and also present in volcanic ash, ocean spray, fine sand and dust.

The research has shown by National Science Foundation that this nanotechnology has major impact on the overall economy of about $ 1 trillion by 2015, which requires approximately 2

[1]*Amit Kumar*; Nanotechnology Development in India An Overview; RIS Research and Information System for Developing Countries; Discussion paper

[2] **Section 3(aaa**), Drugs and Cosmetics Act, 1940: it means any article intended to be rubbed, poured, sprinkled, or sprayed on, or introduced into or otherwise applied to, human body or any part thereof for cleansing, beautifying, promoting attractiveness or alternate the appearance and includes any article intende for use as as component of cosmetic.

[3] http://www.fda.gov

[4] The role of nanomaterials in cosmetics: national and international legislative aspects; www.scielo.br,

[5] http://www.fda.gov

[6] www.cosmeticsinfo.org/nanotechnology

million workers. These nanoparticles are mostly used as UV filters. Titanium dioxide and zinc oxide are the main compounds used. Another use of such nanotechnology is in improving skin hydration, bioavailability, stability of agent and controlled occlusion. There are certain products in which nanoparticles have been used like penetration enhancer in case of lotions or creams or moisturizers for skin known as Nano emulsions. The product of L'Oreal used for anti-wrinkle cream, sunscreens, hair products.[7]

There are many types of nanomaterials used in cosmetics like Liposomes, Nano emulsions, Nano capsules, Solid Lipid nanoparticles, Nanocrystals, Nano silver and Nano gold, Dendrimers, Cubosomes, Hydrogels, Buckyballs. These nanomaterials have different use and also have different impact.

Evolution of Nanotechnology in India:

India, being a developing country has also adopted the concept of Nanotechnology, though the term has already been generated in the year 1974 but India has mentioned about the concept in the 9th Five Year Plan (1998-2002) that national facilities and core groups were set up to promote research in the areas of S&T includes superconductivity, robotics, neurosciences and carbon and Nano materials. There comes the different program on the technology like Program on Nanomaterials: Science and Devices 2000 by the Department of Science and Technology to generate and support certain projects which are related to process, products and technologies because of nanotechnology and its impact. In 2001-2002, another program was set up Nanomaterials: Sciences and Devices to start a Nanomaterials Science and Technology Mission in 10th Five Year Plan (2002-2007). In this plan certain areas were identified for the use of such technology like bamboo products, drugs and pharmaceutical research, etc. this technology was given more importance in the 11th Five Year Plan(2007-2012) to look upon the impact of use of technology on health and the diseases.[8]

[7] *Silpa Raj, Shoma Jose, U.S. Sumod and M. Sabitha J Pharm Bioallied*; Nanotechnology in Cosmetics: Opportunities and Challenges; Sci. 2012 Jul-Sep; 4(3): 186–193; https://edisciplinas.usp.br

[8] *Amit Kumar* ;Nanotechnology Development in India An Overview ; RIS Research and Information System for Developing Countries; Discussion paper

The nanotechnology mission has certain objective:

1. Infrastructure Development for Nano Science and Technology research.

2. Public Private Partnerships and Nano Applications and Technology Development Centers.

3. Human Resource Development.

4. International Collaborations.

5. Academy Industry partnerships to be nurtured under these programs.

In 12th Five Year Plan 2012-2017), the government agreed to continue the mission to promote application oriented R&D so that certain useful items emerges.[9]

Products using Nanotechnology:

1. Anti-Aging Creams: These are the cream which are being used by people to make them look younger by reducing visible wrinkles, lines, blemishes, pigmentation changes, and other related conditions of the skin.

2. Sunscreens: it provides protection to skin form sun rays. It includes UVA and UVB. The high level of UVA radiated is in association with ageing effects such as wrinkles, and mostly used because of ant ageing formulation.

3. Moisturizers: It is an important component in any of the cream to prevent dryness. If water level reduces then skin becomes dehydrated and loses its flexibility and dryness of aged skin is due to UV exposure.

[9] Nanotechnology Development in India: the need for building capability and governing the technology. The Energy and Resource Institute http://www.teriin.org/div/ST_BriefingPap.pdf

4. Dipigmentation Agents: it is a skin lightening agent and has corrective formulations. The ingredients of such cream are Hydroquinone, ascorbic acid, kojic acid, and liquorice extract.

5. Exfoliants: it promotes skin turnover by removing cells and it has Salicylic Acid, Lactic Acid and Glucolic Acid which are used to remove dirt and makes your face fresha as new life has been achieved by the face.

6. Inorganic Nanomaterial minimizes the unnecessary white color and sticky feel of materials. It is helpful because everybody needs such stream which is less sticky.[10]

Types of Nanomaterials used in Cosmetics:

1. Liposomes: It is an aqueous core surrounded ny hydrophobic lipid bilayer. It is mostly used in cosmetic delivery system. It can vary in size, can be single layer or multi layer structure. It is mostly being used in anti-ageing cream.
2. Nanoemulsions: It is being applied in personal Care products, being transparent due to droplets size and remains stable for long time period. It is being used in deodorants, sunscreens, shampoos, and skin and hair care product.
3. Nanocapsules: It is being used as nanocapsules to decrease the penetration of UV filter.
4. Solid Lipid nanoparticles: it protects the ingredients from degradation. This is used for controlled delivery of cosmetic agents over a period of time.
5. Niosomes: It is highly chemically stability of surfactant which requires no special conditions for preparation and storage, no purity problem.[11]

Risk:

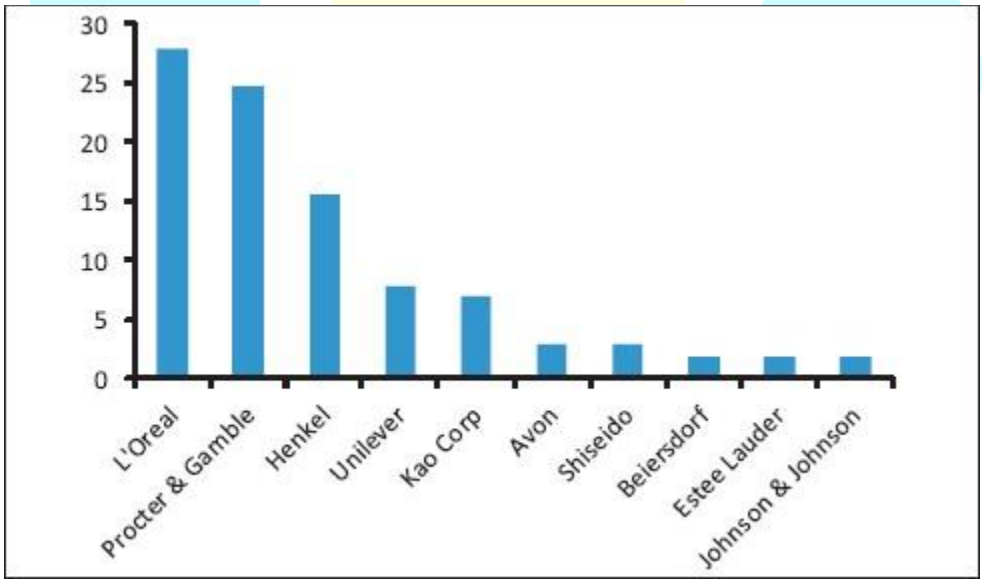
[10] *Ruchira Wijesena*; Nanotechnology Cosmetic products in the world; https://ninithi.com/2015/08/16/top-five-nanotechnology-cosmetic-products-in-the-world/

[11] Shilpa raj, Shoma jose, U S sumod, M sabitha; Nanotechnology in cosmetics opportunities and challenges by Department of Pharmaceutics, Amrita School of Pharmacy, Amrita Viswa Vidyapeetham University, AIMS Health Care Campus, Ponekkara P.O., Kochi, India 26/07/2015; http://www.jpbsonline.org/

The nanoparticles can cause risk to humans as well as to the environment because of its chemical properties. It is small in size so toxicity is main concern as it can easily react with any other particle present in the environment and causes serious health problems. These are so small that when care products of such ingredient is put on skin and mixes with blood stream via skin or inhalation and through this way it can reach to the various organs. It can cause stress, inflammation, damage to skin membrane and DNA.

There is another risk of such nanoparticles is due to its shape as it can be produced in different shapes like spheres, tubes, sheets, etc and leads to damage to abdominal wall of humans. Along with the shape, there comes the surface area of nanoparticles, which has properties of high reactivity and because this it has potential to get explode and/or photoactive.

Later comes the inhalation which is the common route of exposure of nanoparticles. For example when any worker is working in the cosmetic industry producing certain things at that time it highly possible he may inhale such nanomaterials while using spray versions of sunscreens containing nanoscale titanium dioxide.[12]



[12] Shilpa raj, Shoma jose, U S sumod, M sabitha; Nanotechnology in cosmetics opportunities and challenges by Department of Pharmaceutics, Amrita School of Pharmacy, Amrita Viswa Vidyapeetham University, AIMS Health Care Campus, Ponekkara P.O., Kochi, India 26/07/2015; http://www.jpbsonline.org/

The graph shows that use of nanoparticles is highest in the products of L'oreal as compared to the products of Johnson & Johnson. Therefore, the Johnson & Johnson is least reactive and not harmful to the skin. The use of nanoparticles has major impact on anybody's health if in case any person is standing out and spray any fragrance in front of your eyes such things cause tears, redness, irritation. Even when we take breath at that time also certain particles are inhaled by us and cause some throat or lungs infection like cough, sneeze and wheez also.

There are lots of cosmetic products which have use of nanoparticles and have different reaction to different people. The most important cream which is mostly been used by females so that their skin does not get damaged when they are expose to sun directly. The cream is Sunscreen, which has nanoparticles as it easily dissolve in the other chemicals but cannot easily penetrate into skin and protect from the UV rays. More the use of Sunscreen more the risk of Skin Cancer because when sunscreen has zinc oxide in highest quantity. When such material directly exposed to sunlight then it undergoes a chemical reaction which releases certain unstable molecules known as free radicals. These radicals bonds with other chemicals and causes cancer.[13]

Risk Assessment Technique:

The use of nanotechnology has been started few years back in cosmetic industry. It has major use in sunscreen products. It is also being used for other cosmetic as well as personal care products to alter color, transparency, solubility and chemical reactivity. In case one has to assess the technique then it has to be followed by the same doctor. In present context sunscreen contains insoluble nanoparticles which easily reflect UV rays more effectively than bigger particles.

TiO2 and ZnO are widely used in cosmetic formulations. However, there is a need for an in-depth toxicity study these materials as the studies so far have brought mixed results

[13] Sunscreen ingredient may increase skin cancer risk by Missouri University of Science and Technology. https://www.sciencedaily.com/

. • The type of nanotechnology is Liposomes and nanoemulsions do not disturb the integrity of the skin and are not washed out while cleansing the skin. So, these formulations are believed to have a great future in the cosmetic science.

• Encapsulation techniques and trigger-release mechanisms have been developed for the active delivery of cosmetic molecules. However, there is a need for reliable, cost effective triggers for controlled release.

• Improvements in the drug loading efficiency of lipid based nanoparticles (SLNs and NLCs) and nanocapsules are required.

• Better understanding of how lipid nanoparticles modify drug penetration into the skin, how they affect the drug penetration and how they interact with lipids of the stratum corneum is required.

• Fundamental conditions for the formation of SLNs and NLCs and the effect of surfactants used for modifications need to be studied further.

• Further in vivo studies on the effect of cosmetics that contain nanomaterials.[14]

Regulation:

The nanotechnology operation has raised concerns over nanotechnology risk and safety aspects with respect to environment and health safety. It is very difficult to lay down the separate rules and regulations to address these concerns of society. It requires lot of safety measures to check the technology and how it is properly working. India needs tight control on nanotechnology in cosmetic industry. The main programe has been initiated to check certain aspect of such technology i.e. REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). It regulates the use of chemical substance. There should be proper mechanism something a different version by the acct of sunscreen or moisturizers. In India, the technology has been raised in relation to Human Health Safety, environmental pollution, toxicity and towards general societal impacts related to labour dislocation and likelihood disrupted. There are three important areas for

[14] The current role of nanomaterials in cosmetics, *Kurapati Srinivas*, Journal of Chemical and Pharmaceuticla Research 2016, 8(5): 906-914

regulatory measure in application of nanotechnology in the health sector i.e. there should be regulatory sieve that all health products and devices have to pass through this before commercially available. Secondly, there should be clinical testing and other testing procedures which are prescribed for drugs and other health products. Thirdly, there should be contract research. In this case, manufacturers do not want to directly deal with commercial aspects is also supposed to follow regulatory measures.[15] Indian industries are developing of their products especially in the cosmetic industry by using nanotechnology. To curb any kind of wrong committed by using such technology there is no regulation which mentions that before going any product out of the market first has to be on trial basis.

Though India does not have specific regulation for nanotechnology or nanoparticles but it can be seen the points involved in regulatory interventions in any given technology at five main stages i.e. 1) R&D and IP Rights; 2) Production and Marketing; 3) Occupational health and safety Environmental risk management; 4) Waste Disposal.[16] There are so many different acts which are talking about safety of health and clean environment but there is no specific legislation dealing with the Nanotechnology in Cosmetic industry.

There is legislation in USA and UK, which is in pursuance to regulate the use of nanotechnology in cosmetic industry. The regulations are same as of traditional safety assessment in nanomaterials being used. The provision states that nanomaterial would be evaluated on the basis of physical and chemical properties. It can also be assessed by exposing, uptake, absorption and toxicity testing, such testing method address the key chemical and physical properties which may affect the toxicity of nanomaterials and the effects of those properties on the functioning of cosmetics.[17]

[15] Nidhi Srivastava and Nupur Chowdhury, *Regulation of Health related Nano Applications in India: Exploring the limitations of the Current Regulatory Design* in International Conference: Mapping the uncertainty of nanotechnology. Challenges to law, ethics and policy making; May 2008; http://www.teriin.org/div/Rovigo_FPaper.pdf

[16] Regulatory Challenges posed by Nanotechnology Developments in India by The International Development Research Centre, Canada; *Indrani Barpujari; Nupur Chowdhury, Nidhi Srivastav, Ligia Noronha.*

[17]Guidance for Industry: Safety of Nanomaterials in Cosmetic Products, June 2014; :www.fda.gov

Conclusion and Suggestion:

The nanotechnology is a new concept which had already being in existence in the year 1974 but its implication was very less and most of the people were not aware about such technology. Slowly and gradually people started knowing about the technology and use has been increased in drastic way. This technology has good use in the cosmetic industry especially in sunscreen products which are protecting our screen from UV rays while you are exposed directly to sunlight. There is growth of cosmetic industry and highly diversified with the products coming from major, small manufacturers and local companies around the world. The rapid spread and commercialization of the nanotechnology have given rise to great technical and economic aspirations but there will always be a question about the risks to health and safety of consumers. There are so many types of chemicals have been used to make any product available in the market for various purpose like sunscreen, moisturizing, anti-ageing, etc. all such products are useful for a female but at the same point of time it has certain bad effects which may damages your whole health. The reason for damage or risk involved in this is because whenever any cream has been put then it is on our skin and in case our hand has certain cut due to which cream gets mixes to our blood and causes different variety of diseases. There is one more point that in case anybody is using perfume or Deo and anybody is standing next to him catches any diseases because of sand, dust, spray wind may causes irritation, etching, etc, to the body. At the same point of time it is not only harmful for us i.e. consumer but will also harmful and life threatening to workers, who are involved in making such products. Therefore, there is lack of legislation as well as no proper guidelines through which the use of technology can be used to protect the environment as well as health of an individual, who is worker or normal consumer.

There is lack in regulating such work which involved use of nanotechnology while manufacturing any of the products of cosmetic industry. There should be one regulating authority which must be under the supervision of expert and accordingly product must be developed. There is no specific legislation which is governing the Nanotechnology. The use of product which is made up of nanotechnology has to be carefully used and no proper legislation to govern such technology, so this is big lacuna in the eyes of law. Therefore, the products made out of industry needs to be environment friendly and does not affect any kind of health of anyone, because such products made up out of nanotechnology are affecting health of an individual at large scale. There should

be set up of standards to use nanomaterials in different kinds of cosmetics because the nanoparticles have different chemical and physical properties and easily soluble with any chemicals so proper measurements to be given. Along with that proper testing should be made and for all these things an expert should be there which is under the supervising authority. The US and UK already had the testing of such use of nanotechnology in cosmetics.