A Review on Risk posed to Drinking water by Manmade Nanoparticles.

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Abstract:

At nanoscale, man-made nanoparticles show different properties which do not match with the bulk dissolved particles. These nanoparticles do not only have advantage but also have disadvantages like, they producevarious types of toxicity due to interaction of these particles in various cellular activities. In this review article we discuss about the routes of entry of nanoparticles in our body, their application and risk posed to drinking water by man made nanoparticles. We further explore the passage of nanoparticles into water and soil ecosystem, resulting in diverse enviromental impacts. We have to find the risk assessment strategies and risk management to reduce the potentiality of hazardousnanomaterials.

Key words:- Nanoparticle, Cellular activity, Toxicity, Ecosystem, Enviromental impact.

Introduction:-

Nanoparticles are particles with size range from 1 to 100 nm. Although nanopartices have existed in the environment throughout the history of the earth and have been in use for centuries, the systematically used and designed nanoparticles called engineered nanoparticles are new to environment. These have originated in last few decades. Enginneered nanoparticles can be more toxic than larger particles because they can move more freely than bulkier molecules.

As a particle decreases in size, a greater proportion of atoms are found at the surface compared to those inside. At a particle diameter of 10 nm,20% of the approximately 30,000 atoms on the entire particle are positioned on its surface. At a particle diameter of 5 nm, the value increases to 40% and at 1 nm diameter , almost all the atoms are on the surface. The surface atoms, as opposed to thise inside the material, have fewer direct neighbours and therefore, contain so-called unsaturated bonds. These are responsible for the higher reactivity at the particle surface.

Thus, nanoparticles have a much greater surface area per unit mass compared with larger particles. As growth and catalytic chemical reactions occur at surfaces, this means that a given mass material in nanoparticulate form will be much more reactive than the same mass of material made up of larger particles.

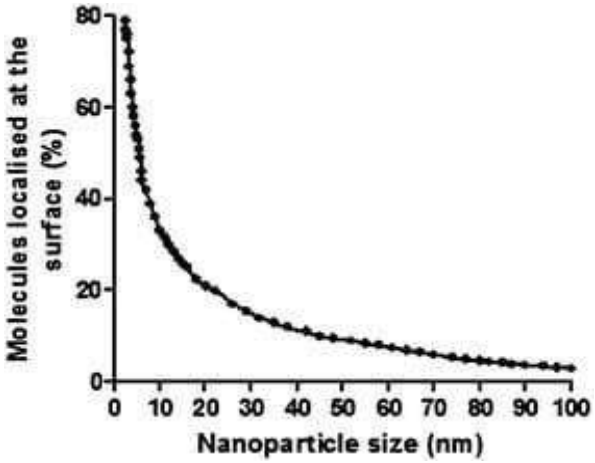

Fig. 1 The percentage of molecules localized at the surface of a nanoparticle, expressed as a function of the nanoparticle size. When the size of a nanoparticle decreases, the amount of molecules present at the particles surface increases in an exponential trend.

Commercial products containing nanoparticles are increasing dayby day.When people use these commercial products like colour, various cosmetic personal care products, the nanoparticles are likely to slip intoour daily lives unknowingly. Some insoluble an stable nanoparticles like silver and gold nanoparticles and polymeric nanomaterials enter the body and cause safety issues directly. Once these nanoparticles are in the environment, they may potentially interact with metabolic network and cellular constituents. Nanoparticles interact with the metabolic activities of cells. These nanowastes are very dangerous for human health due to its high chemical reactivity. When these type of nanoparticles are present within drinking water, it is very difficult to prevent its entry into the body. So, we have to be very careful inhandling these nanoparticles and is not to say that toxicity tests regarding presence of these nanoparticles into the drinking watermust be done before its use.

Route of nanomaterial exposure :–

Nanoparticles can be ingested directly via food, drinking water, drugs, cosmetics and many other sources. Due to their small size, nanoparticlespenerate deeply into all available region of lungs through inhalation of air. Once they are deposited, they are able to cross the air tissues and enter to blood. Then, through blood to different body parts as to taget an organ.

Nanoparticles in Drinking water and Aquatic system :-

Nanoparticles may invade aquatic system directly in industrial dischargeor wastewater system effluents or from surface runoff from soil. Aquatic nanomaterials accumulate in bottom sediment of aggregation. The toxicity of nanomaterials to aquatic biota involves adsorption atcell surfaces and disruption of cell membrane.

Physicochemical determination of toxicity:-

Physical and chemical properties are like to be important in determining the hazardous potentiality of engineered nanomaticls. Future research should be done on other physical and chemical properties so that the risk should be minimized many NMs are available in an amorphous fromand/or different crystalline structures, each of those having specificproperties and hence possibly specific toxicities.

Charge:-

Although different research groups used different NPs and experimentalmodels, it seems that in genral, in vitro, positively charged NPs aretaken up more easily into the lysosomes and cause more cytotoxicity which is attributed to the acid environment.

Size:-

It has been found that 20-30 nm size nanoparticles are thermodynamically less stable and undergo dramatic change in structure in their crystalline structure compared to large particles of same composition. Consequently, it is harder to predict their toxicological behaviour based on information obtained for larger size particles including these at nano scale.

Surface area:-

As the size of a partice decreases the surface area to mass ratio increases. Therefore, area of interaction is increased compared to largeparticles.

Shape:-

The shape of nanoparticles can influence the toxicity. This can be demonstrated by high aspect ratio of nanomaterials (HARN). It means that one or two of the three dimensions of a particle are much smaller than the other dimension. **WHO** defines respirable fibre of length greater than 5 μm width less than 3 μm and length to width ratiogreater than 3:1 will be considered as HARN.

Global Regulatory trends:-

Properties of nanomaterials are not only altered by minor changes in raw materials but also by slight modification in manufacturing process. So, it is fundamental to identify and control the critical points during each manufacturing process and similarly, the water purifiers which provide nanoparticles to waterduring water purification process, should also be checked. It provides drastic effect on human health, skin, inhalation insue,dermatological insue, etc.

Conclusion:-

Due to various health hazards coupled with engineered nanoparticles, their complete life cycle should be scrutinized from manufacturing to storage. Further, we have to manage ways of disposal of nanoparticles. People must be aware of nanotoxicity to get rid from it. Policies must be developed for safely managing of nanomaterials manufacturing, uses, recycling, and opportunities in this field of nanotechnology.

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