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Commentary

A Small Note on Nano Science and Nanotechnology

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ABOUT THE STUDY

Currently “nano” is a commonly & extensively used prefix in numerous fields of science and everyday life so much so that today we are living in a "nano" generation. This word that describes the material in use is as ubiquitous as the word "plastic" that had this status just a few decades ago. Numerous definitions are being constantly introduced to describe areas within nanoscience and nanote56+0chnology. Not only materials, products, or techniques that freely use "nano" prefix but companies such as Nanotero, NanoInk, NanoSight, etc. also do exist. The "nano" particles and materials are revolutionizing some research and manufacturing processes in life sciences, electronics, and imaging. While 20-30 years ago, particles were measured in the micrometer range, today the trend in measurement has gotten even smaller and now it's a "nano" world. Several restrictions were placed on what exactly nanotechnology and nanoscience mean. The most common consensus as described by National Nanotechnolon Initiative (NNI) is that nanotechnology should deal with investigation and manipulation of materials and phenomena where at least one length scale is below 100 nm.

Since the innovative drug delivery systems that incorporate "nano" techniques, the medical practitioners have to be well oriented toward the nano-biotechnology and he proficient in accepting and using the delivery systems efficiently. Besides the high cost of new technologies, there might be a cause for concern for healthcare providers. Therefore, especially in the current economic environment, cost effectiveness, risk assessment, safety, and the benefits provided are needed to be thoroughly studied and confirmed in order to convince the skeptics that some of the new "nano" techniques might actually reduce the overall cost of healthcare.

In this only introductory material on several "nano" aspects that deal with particles, structures, materials, medicine, pharmaceuticals, biologics, and technologies, for example, are presented; the main thrust, however, is the discussion of particular usefulness as the drug delivery systems'. Dendrimers have been investigated for potential drug delivery roles in nanotech¬nology. Dendrimers exhibit low polydispersity and a reproducible pharmacokinetic profile making them ideal candidates for drug delivery.

The functional groups present on the dendrimer surface provide an easy access to conjugate drug to the surface in addition to physical encapsulation during dendrimcr synthesis. Consideration of properties such as molecular weight, architecture, surface charge, hydrophilicity/hydrophobicity, toxicity, blood clearance or blood half-life is important in the development of dendrimer-based drug delivery systems. They’re in vivo characteristics and hemolysis of red blood cells play an important role in determining structure function relationship of dendrimerinduced biological response in animal models. These aspects of dendrimers are surveyed as various dendrimers such as cationic PAM AM. anionic PAM AM, PEGylation and other surface modifications PAMAM-PEG-PAM AM triblock copolymer, PEI-bawd dendrimers cores such as Diaminobutane (DAB) and Diam inoethane (DAE), carbosilane, polyether, and melamine-based dendrimers.

These authors have concluded that cationic surface charge increases toxicity through membrane destabilization and the structure of the dendrons plays a role in membrane destabilization as seen especially with melamine and polyether GO dendrimers. These authors have also discussed fullerenes as a new carbon form. Fullerenes contain carbon rings similar to graphite and contain odd-numbered rings such as pentagonal or heptagonal conferring a three-dimensional (3D) spherical shape. These structures have been called fullerenes or after Buckminster Fuller, the developer of the geodesic dome. Fullerenes have high aspect ratio and modulus as scavengers or producers of Reactive Oxygen Species (ROS).

In a mini review on Nano particulate systems besides polymeric nanorrarticles, I iposomes, solid-lipid nanoparticles, polymeric micelles and dendrimers, the authors have included discussion on metal-organic systems, Nano Tubes (NTs), responsive systems, and personal care products. Modification of the nanocarrier composition controls the release of the active agent from the carrier. This can be achieved by using various types of polymers or lipids, changing the molecular weight and architecture of these components in modifying the surface characteristics such

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as cross linking or adding a separate entity like PEG. Nanoparticles can entrap an active agent within the polymer matrix or the active agent can be adsorbed or conjugated to the outside of the particle.

The matrix structure of a nanomaterial can entrap the drug molecules or it is conjugated at the surface of the particle. Many techniques have been used successfully to prepare nanoparticles are generally classified as: methods that can use preformed polymer and methods involving the polymerization of monomers. These methods include techniques such as emulsion-solvent evaporation, salting out and production using supercritical fluid technology, phase separation and in situ polymerization. Polymers usually used in the mutoscale release systems are polyesters poly (ortho) esters, poly-anhydrides, chitomn, and gelatin. Other structures used in nanoparticle delivery systems are polymeric micelles, liposomes, solid-lipid nanoparticles, dendrimers, viral vectors, metal-organic nanoparticles and their complexes, metal nanoshells and NTs. Responsive drug delivery systems are those that are able to act in response to a trigger that could be an external signal or due to changes in the surrounding environment.