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Nanoparticles:A Boon For Future

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ABSTRACT: Nanoparticulate systems have great potentials, being able to convert poorly soluble, poorly absorbed and labile biologically active substance into promising deliverable drugs. It will definitely form the next generation of drug delivery system. Here, we review various aspects of nanoparticles including synthesis , types, toxicity and their applications in delivery of drug molecules and therapeutic genes.

KEYWORDS: nanoparticles, drug delivery, applications.

I. INTRODUCTION

Nanoparticles are materials with overall dimensions in the nanoscale, ie, under 100 nm[1]. The drug is dissolved, entrapped, encapsulated or attached to a nanoparticle matrix[2]. Numerous nanoparticle-based drug delivery and drug targeting systems are currently developed or under development[3-5]. Presently, different metallic nanomaterials are being produced using copper, zinc, titanium, magnesium, gold, alginate and silver[6]. In spite of these advantages, nanoparticles do have limitations. For example, their small size and large surface area can lead to particle particle aggregation, making physical handling of nanoparticles difficult in liquid and dry forms.

II. SYNTHESIS OF NANOPARTICLES

Nanoparticles can be prepared from a variety of materials such as proteins, polysaccharides and synthetic polymers. The selection of matrix materials is dependent on many factors including: (a) size of nanoparticles required; (b) inherent properties of the drug, e.g., aqueous solubility and stability; (c) surface characteristics such as charge and permeability; (d) degree of biodegradability, biocompatibility and toxicity; (e) Drug release profile desired; and (f) Antigenicity of the final product [7].

Nanoparticles can be synthesized chemically or biologically. Many adverse effects have been associated with chemical synthesis methods due to the presence of some toxic chemical absorbed on the surface. Eco friendly alternatives to Chemical and physical methods are Biological ways of nanoparticles synthesis using microorganisms, enzymes, fungus, and plants or plant extracts [8-13]. The development of these eco friendly methods for the synthesis of nanoparticles is evolving into an important branch of nanotechnology especially silver nanoparticles, which have many applications [14-16].

III. TYPES OF NANOPARTICLES

Silver nanoparticles have proved to be most effective because of it's good antimicrobial efficacy against bacteria, viruses and other eukaryotic micro-organisms [17,18]. Gold nanoparticles are used in immunochemical studies for identification of protein interactions. They are used as lab tracer in DNA fingerprinting to detect presence of DNA in a sample. Alloy nanoparticles exhibit structural properties that are different from their bulk samples [19]. Bimetallic alloy nanoparticles properties are influenced by both metals and show more advantages over ordinary metallic nanoparticles [20]. Magnetic nanoparticles like Fe₃O₄ (magnetite) and Fe₂O₃ (maghemite) are known to be biocompatible.

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IV. APPLICATIONS OF NANOPARTICLES

1. Nanotechnology has potential to revolutionize a wide array of tools in biotechnology so that they are more personalized, portable, cheaper, safer, and easier to administer.
2. Nanomedicine has tremendous prospects for the improvement of the diagnosis and treatment of human diseases.
3. Nanoparticles can be used for the Reversion of multidrug resistance in tumour Cells.
4. Nanoparticles are used for oral delivery of peptides and proteins.
5. Nanoparticles are used for gene delivery
6. Nanoparticles are used for drug delivery into the brain

V. TOXICITY OF NANOPARTICLES

Humans have been exposed to nanoparticles throughout their evolutionary phases; however, this exposure has been increased to a great extent in the past century because of the industrial revolution. Nanoparticles constitute a part of particulate matter (PM). The respiratory system, blood, central nervous system (CNS), gastrointestinal (GI) tract and skin have been shown to be targeted by nanoparticles.

VI. CONCLUSION

Due to their incredible properties, nanoparticles have become significant in many fields in recent years such as energy, health care, environment, agriculture etc. Further advances are needed in order to turn the concept of nanoparticle technology into a realistic practical application as the next generation of drug delivery system. Increasing demands of nanoparticles cannot be neglected, due to their vast applications, and therefore, for better and safe use of nanoparticles in the future we have to be very attentive in understanding the toxicity of nanoparticles. The diversity of engineered nanoparticles and of several possible side effects represents one of the major challenges for nanopharmacology and therapeutics.

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