Global Scientific and Academic Research Journal of Multidisciplinary Studies
ISSN: 2583-4088 (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journals-gsarjebm-home/

Review on Application of nano technology in Pharmaceutical Field

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Article History

Received: 28/09/2023
Accepted: 05/10/2023
Published: 07/10/2023

Vol – 2 Issue – 10

PP: - 01-04

Abstract

The term nanotechnology has been most commonly used in many fields of science. Nanotechnology has shown tremendous progress in these fields. Similarly, various nonmaterial, such as Nanoparticles, nanostructures, nanotubes, and nanowires, synthesized by different approaches like physical, chemical, and biological were also found to have enormous application in biomedical and pharmaceutical fields. Nanotechnology has provided the possibility of delivering drugs to specific cells using Nanoparticles. Nanosystems are an emerging part for this strategy. The Present article focus the Various application of Nanotechnology in Phrmaceutical Field.

Keyword: *Nano Particle, Drug delivery, Oxidative stress, Operation, Nano cell*

Introduction

Advancement in the field of nano technology and its application to the field of medicines and pharmaceuticals has revolutionized the twenth century .nanotechnology [1] is the study of extremely small Structures. The prefix "Nano" Is a Greek word which means "dwarf". The word nano means very small and miniature size. Nano technology Is the treatment of individuals atom and molecules Or compound into structure to produce material and devices with special properties. Nano technology involve work from top to down I.e.reducing the size of large structures to small structure e.g. Photonics application In nano electronics and nano entering, top to down or the bottom up, which involves Changing individual atoms and molecules into nanostructures and more closely resembles chemistry biology.

Nano technology works on matter at dimensions in the nanometer scale length (1-100nm) and thus can be used for a broad range of application and creation of various type of nano materials and nano devices

Application of nano technology

The different fields that find potential applications of nano technology are as follows:

a. Health and medicine
b. Electronics
C. Transportation
d. Energy and Environment
e. Space exploration

Even today various disease like diabetes, cancer, parkinos disease, cardiovascular diseases, and multiple sclerosis as well as different Kind of serious inflammatory and infectious diseases constitute a high no of serious and complex illness which are posing a major problem from the mankind . Nano medicine is the application of nano technology which works in the field of medicine. Nano medicines makes a use of nano materials, and nano electronic biosensors . In the future nano medicine will Benefit molecular nanotechnology. The medical area of nano science application has many projected benefits and it potentially valueable for all human races.

Nano technology has made excellent contribution in the field of stem cell research. For examples, magnetics nano particles have been successfully isolate and group stem cells. Quantum dots have been used for molecular imaging and tracing of stem cells. For delivering of gene or drug into stem cells, nano materials such as carbon nano tubes , flurosent CNTs, and flurosent MNPs have been used . Unique nano structures were designed for controllable regulation of proliferation and deferentiation stem cells is done designed unique nano structures . All these advances speed up the development of stem cells toward the application in regenerative medicine [3].

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Application of nano materials

Nanomaterials is relatively new field of science and technology. By interacting with biological molecules of nano scales, nanotechnology broadenens the field of research and application. Interactions of nanodevices with bio molecules can be understood both in the extracellular In the extracellular medium inside the human cells. Operation at nano scale allows exploitation of physical properties different from those observed at micro scale such as the volume\ surface ratio.

Two form of nanomedicine that have been already tested In mice are awaiting human trials; Use of gold nano shells to help diagnose and cure cancer cells, and the use of lipos ome of vaccine Adjuvants and as vehicles of drug transport [4,5]. Similarly drug detoxification is also another application for nanomedicine which has been used successfully in rats. Medical technologies can make use of smaller devices are less invasive can possibly be implanted inside the body, and the biochemical reactions time as much shorter. As compaired to typically drug delivery nano devices are more faster and more sensitive [6].

The applications of nano particle in drug delivery

Nano particle chain was used to delivered the drug doxurubicin to breast cancer cell in a mice study at case western university, The scientist prepared a 100 NM long nano particle chain by chemically linking the magnetic , iron - oxide nano spheres, to one doxurubicin loaded liposome After penetration of the nano chain inside the tumor magnetic nano particle were made to vibrate by generating radio frequency file which resulted in the ruptured of the liposome, thereby dispersing the drug in it's from throughout the tumor. Tumor growth was halted More effectively by nano technology then the standard treatment of doxorubicin and is less harmful to healthy cell as very less doses of doxurubicin Were used [7,8].

"Minicell" nano particle are used in early phase clinical trail for drug delivery for treatment Of patient With advanced an untreatable cancer. The minicells are built from the membranes of mutant bacteria and were loaded with paclitaxel and coated with cetuximab, antibodies are used for treatment of a variety of cancers. The tumor cells engulf the minicells. one side the tumor, the anticancer drug destroys the tumor cells. The larger size of mini cells plays a better profile inside effects. The minicells drug delivery System uses lower dose of drug and has less side effects can be used to treat a number of different cancers with anti-cancer drugs. [9,10]

Applications

Nano particles were found useful in delivering the myelin antigens, which induce immmune tolerance in a mouse model with relapsing multiple sclerosis. In this technique, biodegradable polystyrene Micro particles coated with the myelin sheath peptides Will reset the mouse immune system and thus prevent the recurrence the disease and reduce the symptom as the protective myelin sheath from the coating on the nerve fibre on the central nervous system . This method of treatment can potentially be used in treatment of various other autoimmune diseases.[11,12]

Applications in Opthalmology

The aim of nano medicine is the to monitor, control, construct, repair, defence, and improve human biological systems at the molecular level with the help of nano devices and nano structure that operate massively in parallel at the unit cell level, in order to achieve medical benefit. Principle of nano technology are applied to nano medicine such as bio mimicry and pseudo intelligence. Some application of nano technology to Opthalmology are include treatment of Oxidative stress, Measurement of intraocular pressure, therogonostics, use of nanoparticles for treatment Of choroidal of new vessels to prevent sears after glaucoma, surgery and for treatment of retinal degenarative diseases , using gene therapy, prosthetics, and regenerative nano medicine. The current therapeutic challenges in drug delivery, postoperative scarring will be revolunized with the help of nano technology and will help in various unsolved problems such as side restoring therapy for patient in retinal degenarative diseases [13].

Treatment of opthalmonolic diseases are expected for emerging field. A novel nano scale dispersed eye ointment for the treatment of severe evaporative dry eye has been successfully developed [14].

Applications of nano technology in modified medicated textiles

Using nanotechnology newer antibacterial cotton has been developed and used for antibacterial textiles. Developmentel works using nanotechnology, new modified antibacterial textiles have been developed. Application of conventional antimicrobial agents to textiles has been already reported. This technique has been advanced by a focus on inorganic nano structured materials that adequate good nano material that acquire antimicrobial activity and thsese application to materials to textiles. (15)

Nanomaterials in pharmacological and biomedical applications:-

ENMs and their applications to biomedicine and pharmacology has become a distinct and active area of scientific and technological developments over the last decade. Numerous advances have been achieved concerning new synthesis of nanoparticles: NPs with unique physicochemical properties, biomolecular functionalization, for detection of biomolecules and cells, applications of gold and other metals in nanoparticles for enhanced targeted action, new biomedical applications of magnetic nanomaterials, special nanoparticle-cell interactions, polymer nanoparticles for drug delivery, and nanoparticle applications in gene delivery, diagnostic imaging, molecular diagnostics and therapeutics.

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Significance of nanomaterials in drug delivery;-

Transport barriers are vital in all biological organisms for restricting chemical molecules to pass through biological membranes and tissues towards their site of action. Inevitably, drugs in the human body face several restrictions on their journey from the time are delivered (by injection or orally) to their site of therapeutic action. Rapid filtration in the kidney and clearance via the reticulo-endothelial system is one of the important barriers in the human body. In the case of drugs, substantial time is spent swimming in the bloodstream until reaching to target cells in the interior of tissues. But in front of biological tissues or cellular targets drugs meet a formidable barrier and must cross the plasma membrane. Even when they are inside the cell, the drug must escape the harsh acidic environment of endolysosomes (acidic intracellular organelles playing a key role in protein turnover and cellular homeostasis), within which biomolecular substances such as proteins and oligonucleotides may be inactivated or degraded. In addition, another barrier is the nuclear membrane (protecting the DNA and RNA of the nucleus). Also, resistance mechanisms can be encountered by drugs within pathological cells. A whole field has been developed by scientists to explore some promising ways in which nanomaterials (acting as drugs or vaccine carriers) can navigate through these barriers to reach the site of action [16].

Most of engineered nanomaterials are sized from 1 to 100 nanometers (1 nm = 000000001 m or 1 × 10−9 m) which is smaller than eukaryotic or prokaryotic cells. Nanomaterials can help to bind, adsorb, and carry drug molecules, probes, and proteins. Also, the drug particles itself can be engineered to form nanoscale-size materials that can reach inaccessible areas, such as inflamed tissues because of their enhanced permeability and retention effect. At present, there are several examples of inorganic and organic nanomaterials that demonstrate unique properties, such as biocompatibility and tissue interaction for pharmacological purposes, especially effective drug delivery [17,18]. The engineered nanomaterials can be designed to carry drugs that target the reticulo-endothelial cells (collective term for cells of the immune system that is comprised of macrophages and monocytes). In this way nanoparticles facilitate the passive targeting of drugs to the macrophages of liver and spleen and give the opportunity to a natural system to fight intracellular infections. Encapsulation of antimicrobial drugs in nanoparticle systems has emerged as an innovative and promising alternative that enhances therapeutic antimicrobial effectiveness. There are many examples for synthesizing nanoparticle platforms for delivering various antimicrobial drugs [19].

Nanomedicine products and promising clinical applications:-

Scientific progress in nanomedical products is slow because involves health and safety issues as well as scrutiny by national and international agencies that regulate clinical trials of new pharmaceuticals or therapeutic methodologies. Scientists are hopeful that new developments in nanotechnology for pharmaceuticals will provide solutions to many of modern medicine's problems. A review searching the scientific literature in 2013 found 247 nanomedicine products that are approved or in various stages of clinical study. Also, a number of nanomedicine products are already in use showing clear benefits in the treatment of human diseases. The most overwhelming trend observed in the data of this review was the large number of nanotechnological cancer treatments under development. It was found that 47% of all the confirmed in vivo products were intended for acutely life-threatening conditions (mostly advanced cancers). The majority of the cancer treatment applications identified in this study were aimed at increasing the efficacy of therapeutic delivery [20]. Other biomedical and pharmaceutical applications of novel nanoproducts are bio-molecular sensing, nano antibiotics for infectious diseases, tissue engineering scaffolds, and immunoassays applications with quantum dots. These techniques use nanoscaled electrochemical detection, functional nanomaterial-amplified optical assays, colorimetry, fluorescence, and electrochemiluminescence [21].

Nanotechnology and scaffolds in tissue engineering applications:-

For many years of medical practices for tissue and bone engineering has developed functional substitutes for damaged tissues, bones, and organs. Before the process of transplantation, cells are generally seeded on biomaterial scaffolds that recapitulate the extracellular matrix and provide cells with information that is important for tissue development. The prospect of applying nanotechnological materials (nanocomposites) for tissue engineering and extracellular matrix is considered very promising but also offers certain challenges to medical specialists. Nanomaterials exhibit unique properties that make them suitable for incorporating in tissue engineering scaffolds. At present various nanoparticles, nanoporous scaffolds, nanopatterned surfaces, nanofibers, and carbon nanotubes are used for advanced fabrication of tissue engineering scaffolds and biomimetic substitutes of damaged tissues and organs. A challenge for these ENMs is the inflammatory responses they elicit in vivo [18]. Nanotechnological tissue-engineering scaffolds must be analogous to native extracellular matrix of tissue in both chemical composition and physical structure. Some polymeric nanofiber matrix materials are quite similar, with its nanoscaled nonwoven fibrous matrix proteins, suitable candidates for extracellular matrix-mimetic materials. Electrospinning to produce polymeric nanofibers have stimulated researchers to explore the application of nanofiber matrix as a tissue-engineering scaffold [18].

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