International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 30, Issue 12, December 2024 **ijppr.humanjournals.com** ISSN: 2349-7203

Some Notes Nanotechnology Diagnostics and Infectious Diseases

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Received: 2024-12-07 Revised: 2024-12-18 Accepted: 2024-12-24

ABSTRACT

There are two types of methods for infectious diseases diagnosis includes Simple nanotechnology, Nanomaterials which used to construct sensors in three different platforms for simple diagnostics, (1) nanoparticle (NPs labels in ICT assays, (2) nanoparticle aggregation assays and (3) nanoparticle labels of whole pathogens. , Multiplexed detection methods, which detect a multitude of molecules or whole viruses or bacteria simultaneously. Immune Response modulation by (NPs) for Efficient Vaccination Nanoparticles (NPs) can be used as a vessel to deliver encapsulated vaccine, Nano-Based Drug Delivery System for Infectious Diseases. Nanoparticles as Therapeutic Drugs, NPs have novel immunotherapeutic properties by surface modifications are able to interact with biomolecules such as proteins and DNA.

Keywords: Nanotechnology, Diagnostics and Infectious Diseases

Background

Applications of nanotechnology includes human biology and medicine. Nanotechnology also plays a vital role in treatment, cost-effective prevention, and the realization of diagnostic tools [1-3]. Nanotechnology used for many medical purposes such as clinical diagnosis, pharmaceutical research, and activation of the immune system and extraction of biological materials.

Methods

Nanotechnology diagnostics for infectious diseases;

1/Simple nanotechnology-based diagnostics

Nanomaterial using for construct sensors in (3) different platforms for simple infectious disease diagnostics: (1) nanoparticle labels in ICT assays, (2) nanoparticle aggregation assays and (3) nanoparticle labels of whole pathogens. These tests are based on the same concepts as ELISA and detect antibodies in blood or other body fluids [3,12].

2/ Multiplexed detection with nano-diagnostics: A major focus in nanotechnology research is developing of multiplexed assay systems which detect a multitude of molecules or whole viruses or bacteria. Many types of barcodes available quantum dot barcodes and the genomic bio-barcode assay(BCA). Semiconductor quantum dots (QDs) are bright, photos table fluorescent markers and used in both proteomic and nucleic acid detection schemes QD barcodes generally consist of polystyrene microspheres containing different ratios of fluorescent quantum dots, with each unique color label corresponding to a particular antigen or oligonucleotide target. A positive detection event occurs when there is simultaneous detection of the barcode signal and a secondary fluorophore [19,8,20].

Nanotechnology and Infectious Disease.

Modulation of Immune Response by Nanoparticles(NPs) for Efficient Vaccination Nanoparticles (NPs) used as a vessel to deliver encapsulated vaccines (anti-genic proteins) to selective sites and release them over a long period of time to boost the immune response, NPs are reported to enhance specific cellular and humoral immune responses to the HIV-1 Tat protein.Nanoparticles (NPs) used as a vessel to deliver encapsulated vaccines (anti-genic proteins) to selective sites and release them over a long period of time to boost the immune response .The NP formulation can be lyophilized into a powder form, which prolongs shelf life of vaccines over a wide range of temperatures (i.e., 0 C to 40 C) [2,7].

Nano-Based Drug Delivery System for Infectious Diseases Nano-scale drug delivery systems (nano-DDS) have the following unique physical features: high solubility due to their inherent hydrophilicity and solubilizing moieties thermo-sensitivity, and capability for controlled release of encapsulated drugs, easy surface modification, and high surface area-to-volume ratios.[1,4]. The unique features of nano-DDS allow for medical scientists to overcome the problems associated with the increased drug resistance of infectious agents. By scaling down the size of compounds, nano-DDS can modulate and improve the performance of many drugs to an extent not achievable with conventional drugs.Nano-DDS can encapsulate drugs and thereby enhance their stability, solubility, and absorption. Nano-DDS can also increase blood circulation time, deliver drugs to specific cells or tissues, and release them in a controlled manner in response to a specific stimulus. [1].Targeted and efficient drug delivery becomes possible with the use of NPs.[4] Nanoparticles have the ability to encapsulate therapeutic agents or vaccines at high density. Because these NPs protect encapsulated drugs from diffusion and enzymatic degradation, the drugs can be delivered at high doses to a particular target site. [4].

Nanoparticles as Therapeutic Drugs NPs that have been developed to have novel immunotherapeutic properties can themselves be used as drugs. Under UV light, metallic NPs and their oxides produce reactive oxygen species that possess antimicrobial activity. Nanomaterials with antimicrobial activities are called Nano antibiotics. Nitric oxide releasing NPs (NO- NPs) act through many simultaneous antimicrobial mechanisms. NO exerts its antimicrobial activity largely through reactive nitrogen oxide intermediates (RNOS), which are formed after NO reacts with superoxide (O^{-}_{2}). The RNOS react with amino acid residues of bacterial proteins and plasma membrane proteins, leading to death of bacterial cells. RNOS also directly damage bacterial DNA through strand breaks, formation of basic sites, and deamination of nucleotides [13].

Nano-Based Diagnosis of Infectious Diseases NPs with appropriate surface modifications are able to interact with biomolecules such as proteins and DNA. The physical and chemical properties of NPs allow accurate, rapid, sensitive, and cost-efficient diagnostics. For example, NPs with enhanced fluorescent properties can improve sensitivity in diagnostic molecular bioimaging. In antibody-based diagnoses, primary antibodies recognize antigenic proteins of cells or viruses and secondary antibodies recognize the primary antibodies, specifically the constant regions. Labeling the secondary antibodies with fluorescent NPs can remarkably enhance detection sensitivity. [14] Quantum dots (Qdots) are special nano-crystal semicon-ductors made of metals such as Si or Ge that range in size from 1 nm to 10 nm. 21 Qdots possess very strong fluorescence intensity that makes them suitable for sen-sitive image acquisition and signal amplification in real time.[9].

Results

1.There are two types of methods for infectious diseases diagnosis. Simple and Multiplexed nanotechnology.

2. immune response against, NPs, Modulation, drug delivery systems, Nanoparticles as Therapeutic Drugs, and NPs with appropriate surface modifications are able to interact with biomolecules such as proteins and DNA.

Conclusions

Nanotechnology is important for medical applications.

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How to cite this article:
Samer M. Al-Hulu Ijppr.Human, 2024; Vol. 30 (12): 259-261.
Conflict of Interest Statement: All authors have nothing else to disclose.

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