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A Review on Current and Future Prospects of Nano Drug Delivery System

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ABSTRACT:

Nano drug delivery systems are new but fastly developing science for diagnose of disease or deliver therapeutic agents in a specific target site. Nanotechnology is used for treating chronic diseases and delivery of targeted drugs. It may help to fight against various diseases(biological agents, chemotherapeutic agents) and deliver active pharmaceutical agents on their target sites. Now a days, nano drug delivery systems comprehensive detection of nanomaterials for the improvement of new drugs and diagnose the disease. Nanomedicines are provide from natural and synthetic sources for their clinical use and included information about prospective in nano drugs.

Keywords: Nanomedicine, Nanotechnology, Nanoparticles, Polymer.

INTRODUCTION

Current time, natural products are widely used to make medicines, which may help to fight against various diseases. Medicines are made from herbs on the behalf of knowledge and practices. In between 30 years, the development of nanotechnology is successful for discover and diagnose the disease. Nano drug delivery system is fastly developed in nano medicine technique.[1]

Nano drug delivery system in 1995 is used for the treatment of cancer and AIDS with less side effects. From some years, there are many types of nano drug delivery system like liposomes, micelles, nano emulsions, polymer based nanoparticles, nanogels, inorganic and organic nanoparticles for preclinical and clinical studies. They are bio therapeutically chemically bonded with nanoparticles. Nano drug delivery system enhance efficacy of drug resistance and less toxicity.[2]

Food and drug administration have approved only 51 nanomedical products till now. It develops pharmacological and pharmaceutical products. Nano drug delivery system is good manufactured properties with less side effects and low cost. Nanoparticles are present in blood circulation system for a long time and not able to release of amalgamated drugs as per the dose. Nanomaterial size range in between 1 to 100nm. Current time nanostructures are utilized for encapsulating drugs. Nano drugs are used for treat chronic disease by target oriented delivery of medicines.[3]

Classification of nano drug delivery system

- liposomes
- polymeric micelles
- polymeric nanoparticles
- nanoemulsions
- nanogels

Liposomes

liposomes are based on bipolar vesicles which are synthetic phospholipids or natural phospholipids. Phospholipids are consist of two hydrophobic fatty acids and bipolar structure. Phosphate groups are outer and inner surface in hydrophobic fatty acids. It is a

spherical vesicle with lipid bilayer and it may contain small amount of molecules. Liposome size range from low micrometer to tens of micrometers.[4]

Polymeric micelles

Polymeric micelles size ranges various from 10nm to 100nm. It consist of amphiphilic copolymer which may form hydrophobic and hydrophilic groups and amphiphilic may also contain hydrophobic and hydrophilic blocks. Polymer micelles may enhance the solubility of the drug. It may form self assembly with the concentration of critical micelle concentration. It may help to increase the drug concentration in an aqueous form.[5]

Polymeric nanoparticles

Polymeric nanoparticles size range from 40nm-400nm. It is classified in two ways firstly nanospheres and secondly nanocapsules which is depend on the polymer. It is obtained from natural polymers. In 2018 it follows two kind of the lipids: butanoate and polyoxyethylene. It carries active pharmaceutical ingredients on the surface of the particle.[6]

Nanoemulsions

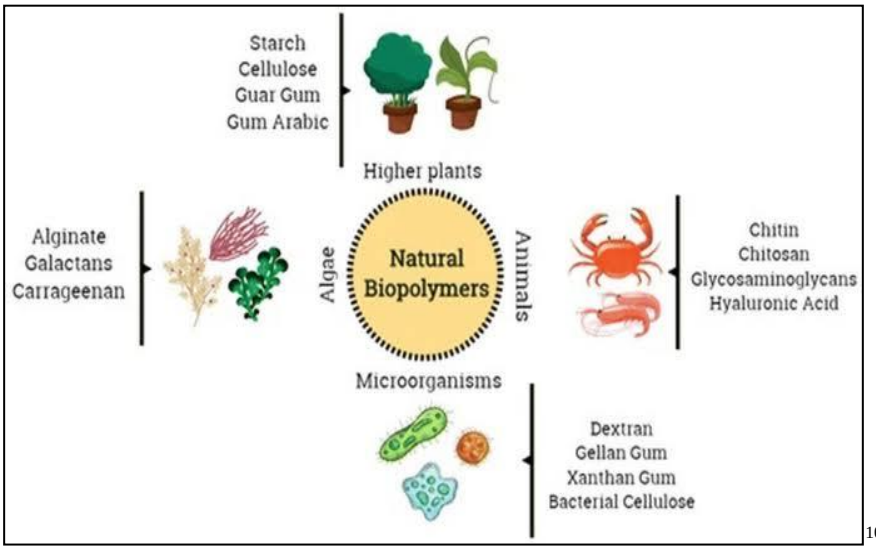
Nanoemulsions are oil-in-water or water-in-oil type of emulsion. It is dispersion of two types of immiscible liquids. In nanocarries both are hydrophilic and hydrophobic drugs. It is prepared by low energy and high amount of surfactants. Polysorbate 80 is the emulsifying agent it has been approved by food and drug administration (FDA) in 2002.[7]

Nanogels

Nanogel size ranges from 100nm-200nm. Hydrogels are cross linked by hydrophilic polymer network. It is capable of absorbing water. It carries delivery from both hydrophilic and hydrophobic drugs. It may form 3D framework, polymers and dispersed phase of liquid. There are shrinking property and large amount of water content for sustained release can be achieved.[8]

Natural product based nanotechnology and drug delivery

As per the WHO report, in developing countries, basic health needs of approximately 80% of the population are met and complemented by traditional medicine. Scientific community focus on the study related to the bioactive compounds, its pharmacological potential of various plant species, to produce active ingredients that relatively minor side effects than existing molecules. Plants are documented as a source of natural compounds of medicinal importance for long time and it holds sample of resources for the discovery of new and highly effective drugs. The pharmaceutical industries have chosen to combine their effort in the development of synthetic compounds.[9]



[10]

Fig.1 Different sources of natural biopolymers to be used in nanomedicine applications, it could be obtained from higher plants, animals, microorganisms and algae.

Currently, many of the nanomedicines under development for modified release systems for active ingredients that already employed in the treatment of patients. This type of approach is evaluated for the sustained release of these active ingredients modified the pharmacokinetic profile and biodistribution. It can be ascertained that the nano formulation of the active ingredient is directed towards the target tissue shows increased absorption by the cells and lower toxicity profile for the organism. This is focused on berberine, curcumin, resveratrol, curcumin and quercetin.[11]

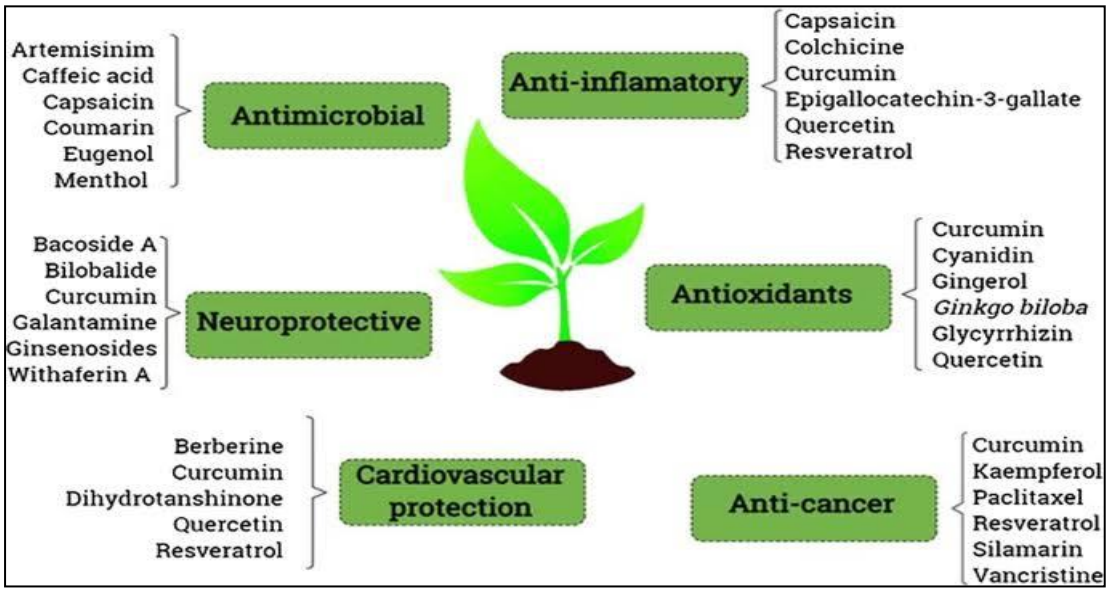


Fig.2 examples of natural compounds extracted from higher plants used in nanomedicine for different approaches.[12]

Nanoparticles for diagnosis, detection and imaging

In nanoparticles biopolymeric therapy is used for diagnose the disease and it is used for detection of cancer for treatment. It may help to provide information about the treatment. Nanoparticles provide the necessary information of the therapeutic agent for the external stimuli. Nanoparticles provide various particles they perform for multiple functions for the potential use for the detection and diagnose of diseases. They help to examine tumor cells through magnetic resonance imaging.[13]

Nanoparticles are prepared for colorectal cancer cells with light mediated mechanism. Nanoparticles are synthesized by hyaluronic acid form various diameters by changing the hydrophobic replacement of hyaluronic acid. Nanoparticles also detect the colon cancer.[14] Dextran is useful for nanoparticles it is non toxic and biodegradable with no side effect in human body. Dextran nanoparticles are conjugated for near infrared and magnetic resonance imaging. Nanoparticles are used for paramagnetic and chemotherapeutic properties.[15]

Future prospectives on nanomedicines

In this development of medicines or drugs is involved for the clinical significance it form nature of formulations and also development of approval process in nano drugs. It is based on recent trends in nanomedicine development and guidelines of the food and drug administration, simple algorithm to guide the absorption, distribution, metabolism and elimination evaluations of nanomedicines. In this evaluation is based on orally administered nano drugs in nano forms or non nano forms in the gastrointestinal tract. Research with uniformity and drug loading with release capacity in future. Nano drug delivery system in future for health care and cancer therapy.[16]

Conclusion

Nano drug delivery systems are active drug pharmaceutical ingredients they are sustained release and enhance stability, solubility and targeting drugs. Nano technology is used for analysis diagnosis, detection of encapsulated drug for example encapsulated such as oleic acid for diagnose through infrared detection of cancer using folic acid and in cancer therapy with dextran.

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