A Systemic Review on Nanoparticles

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Abstract

From the ancient time nanotechnology is widely used for various treatment like cancer based treatment and presently Ndds is used for treatment of psoriasis and it play good role in healthcare field nowadays one of the focused area in nanotechnology which is Nanoparticles. Nanoparticles are at the forefront of the rapidly developing field of nanotechnology with several potential applications in drug delivery, clinical medicine and research as well as in other varied sciences. Due to their unique size-dependent properties, Nanoparticles offer the possibility to develop new therapeutics. The ability to incorporate drugs into Nanocarriers offers a new prototype in drug delivery that could be used for secondary and tertiary levels of drug targeting. Hence, Nanoparticles hold great promise for reaching the goal of controlled and site specific drug delivery and hence have attracted wide attention of researchers. In this review presents a broad treatment of Nanoparticles discussing their advantages, limitations and their possible remedies. The different types of Nanocarriers which were based on solid lipid like solid lipid Nanoparticles, nanostructure lipid carriers, and different production methods which are suitable for large scale production and applications of Nanoparticles are described. Appropriate analytical techniques for characterization of Nanoparticles like photon correlation spectroscopy, scanning electron microscopy, differential scanning calorimetry are highlighted.

Keywords: Nanoparticles (NPs); Drug carriers; Homogenization; TEM; Nanotechnology; Novel drug delivery system

Introduction

The prefix nano comes from the ancient Greek Havoc through the Latin names meaning very much. Nanoparticles are defined as particulate dispersion or solid particles with size range of 10 nm to 1000 nm. The drug entrapped, dissolved, encapsulated or attached to Nanoparticles matrix surrounding interfacial layer [1-10].

Nano capsules - The nano capsules are the system in which the drug us confined to cavity surrounded by a unique polymer membrane.

Nanospheres - The Nano spheres are matrix system in which the drug is uniformly and physically dispersed (Figure 1).

Ideal Properties of nanoparticles necessary for drug delivery

- Stable in blood
- Biodegradable

Advantages of nanoparticles

- Non-Immunogenic
- Non-thrombogenic
- Non inflammatory

Figure 1: Microsphere and Microscope.
• Targeted drug delivery
• Increased bioavailability
• Retention of drug at the active site

**Disadvantages of nanoparticles**
• Toxicity
• Cytotoxicity
• Disturbance of autonomic imbalance
• Limited targeting abilities
• Discontinuation of therapy is not possible

**Nanomedicine for drug delivery**

There are lots of medicine is available Dendrimer, Silica gold nanoshell, colloidal gold, polymer- protein conjugate, functionalized quantum dot, single walled carbon nano tubes, PEGylated carbon tube, fullerene, nano liposomal vesicle, solid Nanoparticles, functionalized nanoparticles, polymeric micelle, functionalized magnetic, polymer-antibody conjugate, functionalized Nanodiamonds (Table 1) [11-13].

**Table 1: Types of Nanoparticles and its classification, application.**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Types of Nanoparticles</th>
<th>Material Used</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Solid lipid Nanoparticles</td>
<td>Melted liquid dispersed in aqueous surfactant</td>
<td>Least toxic more stable colloidal carrier system</td>
</tr>
<tr>
<td>3</td>
<td>Polymeric Nanoparticles</td>
<td>Biodegradable polymer</td>
<td>Controlled and targeted drug delivery</td>
</tr>
<tr>
<td>4</td>
<td>Polymeric Micelles</td>
<td>Amphiphilic block co-polymers</td>
<td>Controlled and systemic delivery of water insoluble drugs</td>
</tr>
<tr>
<td>5</td>
<td>Carbon nanotubes</td>
<td>Metals, semiconductors</td>
<td>Gene, DNA Delivery</td>
</tr>
</tbody>
</table>

**Routes**
• Topical Application, Non-Biodegradable implants, injectable nano rod, biodegradable implants.
• Functionalized Nanoparticles pulmonary delivery.
• Permeation enhanced Nanoparticles loaded delivery.
• Growth factor delivery [Future technology]
• Functionalized Nanoparticles oral smart drug delivery.

**Polymer**

Polymer of drug delivery system play great role in the advancement of drug delivery controlled therapeutic agent for longer time cyclic dosage both hydrophilic and hydrophobic drugs [14,15].

**Polymer used in preparation**

Natural Hydrophilic
- Proteins
- Polysaccharides

Synthetic Hydrophobic
- Pre- Polymerized
- Polymerized in Process

**Natural hydrophilic polymer**
- Protein Polysaccharides

- Gelatin Alginates
- Albumin Dextran
- Lectins Chitosan
- Legumin Agarose
- Vicilin Pullulan

**Techniques of Preparation**

These techniques is using for preparation of Nanoparticles preformed polymers, ionic gelation, Polymerization (Figure 2).

**Evaluation Parameters of Nanoparticles**

1. Yield of Nanoparticles
2. Drug Content/Surface Entrapment/Drug Entrapment
3. Particle Size - Particle size and its distribution is important characteristics in Nanoparticles as they plays major role in distribution, pharmacological activity, toxicity and targeting the specific sites [16,17].
4. Particle Shape - Particle shape of the nano suspensions is determined by scanning electron microscopy SEM.
5. Zeta Potential - Zeta potential is the potential difference existing between the surface of solid particle immersed in conducting liquid and the bulk of the liquid.

**Conclusion**

The main goal of this review was to describe the different preparation technique available for productive of polymeric Nanoparticles & Drug will be loaded Nanospheres can be produced by simple, safe, reproducible technique available. One technique is not sufficient for all drugs, post preparative steps, such as preservation. These all challenges in terms of technology, Nanoparticles have been showed great promise for the development.

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**References**