

# A REVIEW ON NANOBIO TECHNOLOGY AND DRUG DELIVERY

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## Abstract

Nano technology is the use of matter on an atomic and molecular scale. Nanotechnology helps to deal with materials, devices, and structures with minimum one dimension range from 1 to 100 nanometres. In Drug delivery we administer a compound in human or animals for therapeutic effects. We can also control the amount and bioavailability of the drug. In Drug delivery we can modify drug release profile, absorption, distribution and elimination for improving product performance and safety. We can further do pharmacokinetic and pharmacodynamic studies as well.

**Key words** – Nano drug delivery, Pharmacokinetics, Pharmacodynamics, Sustained release.

## 1.Introduction

Drug delivery research is moving from the very small- to the nanosize level. Nanotechnology is that's why emerging as a field in medicine that is expected to elaborate many significant therapeutic benefits. The advancement of effective nano delivery systems capable of carrying a drug accurately and safely to a the site of action is one of the most important tasks of pharmaceutical industry. Pharma industries are trying to formulate and add new things to the existing drugs for positive scientific outcomes and therapeutic effects. The systems mainly are nanoemulsions, lipid or polymeric nanoparticles, and liposomes. Nanoemulsions are primarily used as vehicles of lipophilic drugs following intravenous administration. On the other side, the ultimate goal of other nanodelivery systems is to alter the normal fate of potential drug molecules in the body following its administration to improve their effectiveness and reduce their adverse effects. Extreme research on liposomes as drug delivery systems, is a quite novel research that has changed several parameters in the pharmaceutical industries.

Most of the main ingredients used to treat severe diseases can be administered through the systemic route. Ongoing efforts are being made to develop different nanocarriers for delivering molecules to the target organ. This involves the modification of the pharmacokinetic profile of various therapeutic drugs through nano systems.

Most of the orally drugs, targeting is not a primary issue and it is intended for drugs to go to the general circulation. That's why most systems are of the sustained release type. Increasing concentration will increase circulating blood levels, which will promote

more concentration of drug at the desired site. Drug delivery by these systems usually depends on some type of dose. There are both physicochemical and biological factors that play a major role in designing such systems.

## 2. Nanobiotechnology

- Nanobiotechnology is the combination of nanotechnology and biotechnology to treat various disease and performing biological operations at nano level. With the help of nanobiotechnology whole tissues or organs can be formed outside the body. Many clinical trials are going on in the United States on this technology. Artificial DNA computers are probably be available for research in near future which would be made up of certain biochemicals.
- Nanotechnology is about to affect almost every field of human life. It is an enabling technology that will impact electronics and computing, medicine, materials and manufacturing, catalysis, energy and transportation. It will revolutionize future world by changing the current using materials in durability and reactivity. We have great opportunities to make things smaller in size, lighter in weight and stronger. Therefore scientists and engineers have great interest in this emerging field. From the present activities going on in the world particular by no. of conferences, seminars and the money injected in this field we can say that this rapidly expanding field is going to bring about an innovative transformation in upcoming years.
- Nanobiology may play a role in a radical level of change. Various aspects of applied and theoretical nanotechnology could help to function as virtual assets on the Internet; which may become a newly formed socio-economic substrate system making up the "virtual landscape." Expanding technologies and a changing socio-economic system might reshape every aspect of life that is currently understood. A matrix of mass media may come out of all these technological advances related to nanobiology. This could create an interactive bi-directional experiential knowledge conveyance system experience. Biological metaphors in computing are being used to create the biological and physical materials that are needed in order to guide the next step in human evolution. The P53 protein, a product of nanobiology, can literally shut down the metabolism of living cells. This protein is considered to be a prime candidate as a cure for certain cancers.
- While nanobiotechnology is infact a new field , but this technique will probably search new advance technologies in the field of biotechnology and other releated fields. Living beings, as humans, can be considered to get great benefits in near future by this field.

## 3. Drug delivery

Drug delivery is a method of a compound into the human or animal body. Through drug delivery we can modify the properties of releasing the drug into the body of human and animal. There are different mechanism of administering a compound into the body. There are several different routes of administering the drug into the body which are mentioned below.

1. Peroral

2. Topical
3. Transmucosal

Peroral drug delivery is the mean of delivering the compound through mouth. In topical delivery the drug is delivered through skin. And in transmucosal the delivery is done by buccal, ocular, vaginal or rectal routes. The main problem of delivering the drug through these routes are protein and peptides. The reason behind this is that these molecules are charged and can have high molecular weight. More over they can also go through enzymatic degradation and can not be available more to the targeted part of the body. That is why these drugs are delivered through injections or nano needles. The main things which are in consideration now a days are as below.

1. Bioavailability
2. Targeted drug delivery
3. Sustained release.
4. Biodegradability.
5. Controlled drug delivery.

A) Bioavailability refers to how much drug is available at the desired site into the body. So with the help of nanobiotechnology we can increase the bioavailability of the drugs that is beneficial in treating any specific disease.

B) Targeted drug delivery means that the drug should reach at the specific site without losing its amount. That means maximum amount of drug should reach to the concerned site.

C) Sustained release means a constant release of drug for the targeted site. That means it should not like that sometimes it is much and some time it is less. So the amount of drug released should be constant.

D) As far as biodegradability is concerned it means that the shell in which we are encapsulating the drug should be biodegradable so that the drug can be released for the specific site of action.

E) Further controlled drug delivery means to control the amount of drug released. That means we can control the amount of the drug that have to reach at the specific site of action.

That's why many drug delivery vehicles are used now a days to fulfill the need of the above mentioned things. Also nanoparticles are also loaded in these vehicles. Some examples of these drug delivery vehicles are as follows –

1. Liposomes

2. Dendrimeres
3. Polymeric shells
4. Nanoparticles

Structure of nanoparticles can be in the form of spheres that is called nanospheres, more can be nanorods or nanocages. These things can be controlled in a specific manner to get the desired structure.

Liposomes are the structures which do have at least one lipid bilayer. These are used as drug delivery vehicles to transfer any therapeutic substance into the body. Hydrophobic layer surrounds this structure. Now a days liposomes are manufactured so that they can be escaped by the body defence system, as Reticulo endothelial system.

Dendrimers are highly branched molecules and are used as drug delivery vehicles. They can be manufactured by two methods.

- a) Convergent synthesis.
- b) Divergent synthesis.

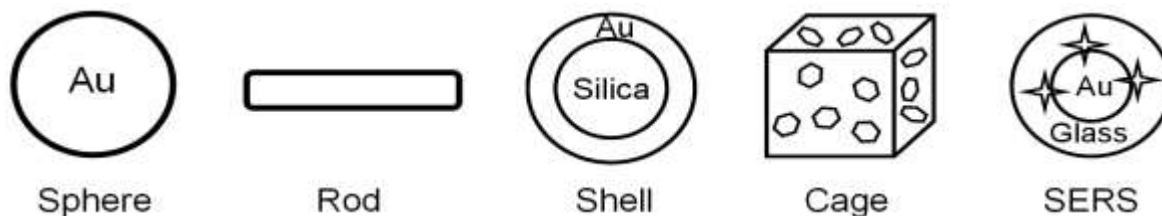
Polymeric shells are the structures in which nanoparticles or any drug is encapsulated by a polymer to deliver the therapeutic substance into the body. These polymers should be biodegradable in nature so that they can release the drug for the site of action.

Different nanoparticles are now a days used as antimicrobial substances as they show anti microbial effects on different bacterial species. No matter that the bacterial species are Gram negative or Gram positive.

#### **4. Structures of nanoparticles -**

When we talk about the structure of nanoparticles then nanospheres are of great interest for the researchers. Nanospheres can be manufactured by reducing a salt through a reducing agent. The size of the nanoparticles can also be controlled by increasing or decreasing the quantity of the reducing agent. As far as nanorods are concerned they can be manufactured with the help on nanoporous material.

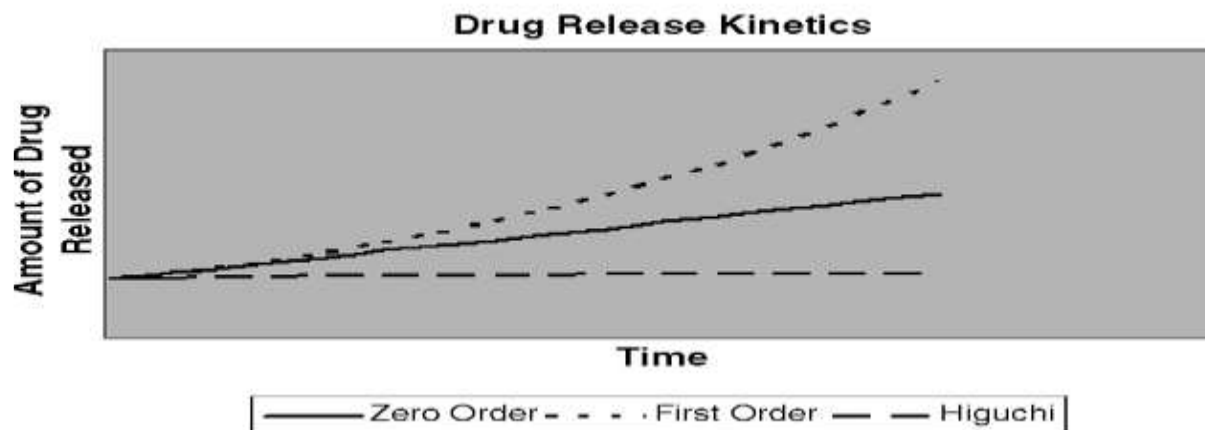
Nanocages can be manufactured by galvanic replacement reaction. This can be in between of nanoparticles and truncated nanocubes. So through this method we can prepare the structures which are generally known as nanocubes. Now a days nanocubes are of great importance in various research.



Different structures of nanoparticles.

**5. Drug release kinetics –**

When the drug is administered into the body then it usually follows a kinetics that is called drug release kinetics. When a drug is taken orally or it is given through injection then the kinetics which is followed is called the first order kinetics. Now a days transdermal drug delivery is of great interest. The kinetics which is followed in transdermal drug delivery is called Higuchi profile. But the aim of researchers now a days is to achieve a constant profile after release, to which we can say that it is near to zero order kinetics. The impact of drug onto the body is called its pharmacokinetic profile and reaction of body against drug is its pharmacodynamic profile.



Graphical representation of different kinetic profiles

**REFERENCES**

[1]. Ehdaie B. Application of nanotechnology in cancer research: Review of progress in the National Cancer Institute’s Alliance for Nanotechnology. Int J Biol Sci 2007; 3(2):108–110.

[2]. Park K. Nanotechnology: What can it do for drug delivery? J Control Release 2007; 120(1– 2):1–3.

[3]. Bergen JM. Nonviral approaches for neuronal delivery of nucleic acids. Pharm Res 2008; 25(5):983–995.



- [4]. Medicinenet. Medicinenet. Available at: <http://www.medicinenet.com/ablation> therapy for arrhythmias/page2.htm, 2008. Accessed October 2008.
- [5]. Solata O. Applications of nanoparticles in biology and medicine. *J Nanobiotechnol* 2004; 2(3):1–6.
- [6]. Gao X. Nonviral gene delivery: What we know and what is next. *AAPS J* 2007; 9(1): E92– E104.
- [7]. Moghimi SM, Hunter AC, Murray JC. Nanomedicine: Current status and future prospects. *FASEB J* 2005; 19:311–330.
- [8]. Nanomedicine Center, University of Nebraska Medical Center. Nanomedicine Group. Available at: [http://nanomedicine.unmc.edu/template\\_view.cfm?PageID=22](http://nanomedicine.unmc.edu/template_view.cfm?PageID=22), 2008.
- [9]. Pui D. Gene gun. Available at: [http://www.it.umn.edu/news/inventing/2000\\_Fall/nano\\_genegun.html](http://www.it.umn.edu/news/inventing/2000_Fall/nano_genegun.html), 2000. Accessed October 2008.
- [10]. Johnson-Saliba M, Jans DA. Gene therapy: Optimising DNAdelivery to the nucleus. *Curr Drug Targets* 2001; 2(4):371–399.
- [11]. Suri SS. Novel gene-silencing nanoparticles shown to inhibit Ewing's sarcoma. Available at: <http://www.physorg.com/news3800.html>, 2005.
- [12]. Hu S. Novel gene-silencing nanoparticles shown to inhibit Ewing's sarcoma. Available at: <http://www.physorg.com/news3800.html>, 2005. Accessed October 2008.
- [13]. Liu J, Zahedi P, Zeng F, et al. Nanosized assemblies of a PEG docetaxel conjugates as a formulation strategy for docetaxel. *J Pharm Sci* 2008; 97:3274–3290.
- [14]. Liu X, Howard KA, Dong M, et al. The influence of polymeric properties on chitosan/siRNA nanoparticle formulation and gene silencing. *Biomaterials* 2007; 28: 1280–1288.
- [15]. Chan P, Kurisawa M, Chung JE, et al. Synthesis and characterization of chitosan- poly(ethylene glycol)-folate as an on viral carrier for tumor targeted gene delivery. *Biomaterials* 2007; 28:540–549.

[16]. Feng M, Li P. Amine containing core shell nanoparticles as potential drug carriers for intracellular delivery. *J Biomed Mater Res* 2007; 80:184–193.

[17]. Fang JY, Fang CL, Liu CH, et al. Lipid nanoparticles as vehicles for topical psoralen delivery: Solid lipid nanoparticles (SLN) versus nanostructured lipid carriers (NLC). *Eur J Pharm Biopharm* 2008; 70:633–640.

[18]. Joshi M, Patravale V. Nanostructured lipid carrier (NLC) based gel of celecoxib. *Int J Pharm* 2007; 346:124–132.

