

## Role of Nanotechnology in Cancer Treatment

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### Abstract:

*The nanotechnology is the study and the use of arrangements between 1 nanometer and 100 nanometers. This technique is advanced and reformed technology for the present generation and more in use at various factors. Nanotechnology focuses on the coalescence and convergence of numerous scientific disciplines and other usual application of it. The present paper deals with the study of role of the nanotechnology in the cancer treatment where it is important to deliver the information regarding cancer and its occurrence in the body. The paper highlight on the Nano-particles that are rapidly developed and helpful in overcoming with various limitations of traditional drug delivery system and are helpful in dealing with different therapeutics for the treatment of cancer. This entire paper review on the ability of cell recognizing of Nano-particles by unique identifying characteristics and their changes from the anticancer therapies. The use of the recent development of the nanotechnology shows the transformation of the cancer therapeutics.*

**Keywords:** Nanotechnology, Convergence, Drug delivery System, Cancer therapeutics

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## Introduction

In today's time, cancer is considered as one of the most serious fatal disease with the outcome of killing of millions of people every year. Cancer is known to be the unrestricted multiplying of cells where the apoptosis is usually vanished and contain very intricate treatment procedure. The complexity reveals the phenotypic and genetic levels which shows the therapeutic resistance and clinical diversity. The cancer treatment includes the surgical removal, chemotherapy, radiation and hormone therapy. The chemotherapy is one of the common treatment for a cancer patient which delivers the anticancer drugs systematically, in order to quench the unrestricted multiplying of the cancer-causing cells. The significant role of cancer therapeutics depends on main challenge so as to distinguish the cancer-causing cells and the normal body cells. It depend upon the conventional chemotherapy fails to target the cells of cancer selectively without it being interacted with the normal body cells. Nanotechnology is defined as the science which deals with an array of size from a few nanometers to hundred nanometer which is dependent on their intended use.

It is really promising in the case of cancer diagnosis and cancer treatment so as to enter the tissue at molecular level. The term cancer nanotechnology deals with the enthusiastically implemented and estimated treatment cancer which shows the major advance in the detection, treatment, and diagnosis of the related diseases. Nanoparticles are basically designed so as to assist the therapeutic agent to go through the biological barriers to mediate the molecular interactions and other relevant molecular changes (Sutradhar and Amin, 2014)

## Role of Nano-technology in the treatment of Cancer

It is a well-known fact that the technology is known for the basic keywords in the people's time. A very significant sub-division of technology named as nanotechnology plays important role in the treatment of the cancer. With the involvement nanotechnology consisting more user devices and appropriate drugs for the disease and the better materials for the construction process. These Nanotechnological developments useful for the better diagnosis of cancer patient as nanotechnology uses competent drug delivery to the tumor cells and the other molecular targeted cancer treatment.

- Firstly, it can be used for the improved cancer diagnosis, as one of the major use of optical nanoparticle which permit the cancer treatment. The classical method use i.e. X-rays and tomography include mutagenic agents selectively on those cells who basically cause cancer. The X-ray in the cancer diagnosis itself causes the cancer once and hence it is important to eliminate the concern and optical nanoparticles in the relation of diagnosis for the technique that can be implemented. In the connection with the optical nanoparticles, ICG i.e. Indocyanine Green is also useful in the diagnosis of cancer. The molecules of ICG interact with the protein of plasma-like albumin, globulins, and lipoproteins which help the ICP to be there in the bloodstreams. It is also highlighted that the ICG molecules have amphiphilic property which help in the interaction with the hydrophilic and amphiphilic property. Hence with the use of this, tumor-free and tumors areas can easily be identified in the cancer treatment.
- Secondly, the aspects of nanotechnology is useful as the more effective drug delivery system for treating the tumors. It is reported that one of the major task of passive liposomal drug delivery is for the cancer cells. The molecules of liposome are very much helpful in the diffusion into the structures and their cells and cell membrane can network very well, while the process of acceptance of drug. The effect of EPR i.e. Enhanced Permeation and Retention in liposomes to remain in the bloodstream for a longer period and collected from the tumor cells. This effect permit up to ten times the quantity of drug which is delivered to tumor cells than that of the free drug process. The liposomal drug with that of the RES i.e. Reticular Endothelial System collectively break away the immune recognition and the drugs are able to present in the bloodstream.
- Thirdly, this nanotechnology is useful for the better cancer imaging and is considered one of the important usage of the cancer-imaging termed as tomography with contrast to agents. The CT i.e. Computer Tomography is known for the widespread method of imaging which measure in the process of imaging and analysis the ratio density of matter. This shows a significant effect on the health of an individual. In this, Nonionizing method for the differential

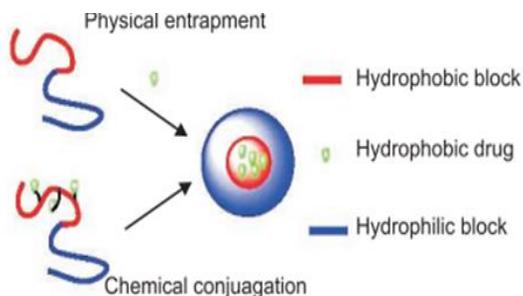
use on the scattering and absorption of light waves with that of the other types of tissue called as Optical Coherence Tomography. The tomography is not only responsible but also there is the involvement of Photoacoustic tomography which is utilized for the better cancer imaging. The technique is dependent on intrinsic light absorption divergence features of the biological tissues. It is important to use the PAT i.e. Photoacoustic tomography without nanocages as the signals of photoacoustics are usually lower when only blood is used (Aliosmanoglu and Basaran, 2012).

**Nanoparticles for Tumor Delivery and Targeting**

Nanoparticles are used and utilized for the anticancer drug transfer which is formed by the variety of materials consist of polymers, liposomes, dendrimers, carbon nanotubes, metals (gold and iron oxide).

• **Polymorphic Nanoparticles**

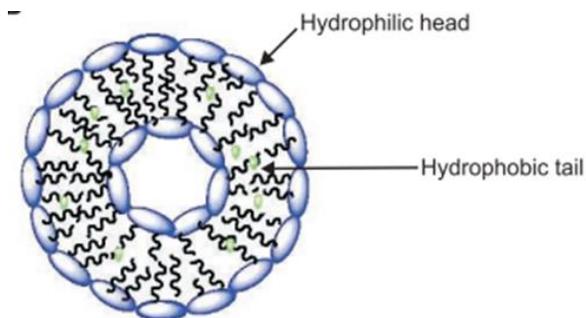
The polymers which are used for the preparation of Nano particles are follows under two main categories named natural and synthetic polymers. The formation of the polymorphic nanoparticles involve the two parts i.e. the hydrophobic core (aids as the container for anti-cancer agents) and other is hydrophilic shell (which stabilizes the nanoparticle). The drug is basically laden into polymeric nanoparticles by the two basic approaches, which are physical entrapment and chemical conjugation. The hydrophobic interaction with the core of the polymeric nanoparticles and drug molecule is entrapped in the nanoparticle core. It shows the drug molecule conjugated covalently onto polymer and the related chemical properties is the connection between drug and polymer which is critical. The intracellular level of the glutathione is greater in the extracellular level.



**Figure 1. Polymer-Based Nano-particles**

• **Liposomal Nanoparticles**

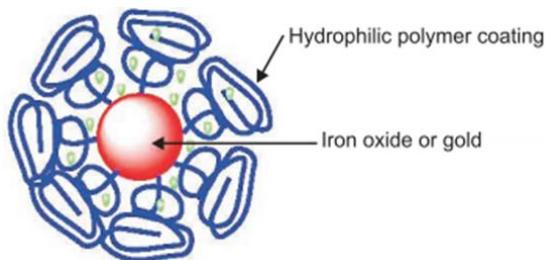
It is self-assembling circular units with membrane formed of phospholipid bilayers. It can range from 25 nm to 10 nm on the basic preparation process. The synthesis of the liposomal nanoparticles shows the drug delivery methods depending on unchanged liposomes by the short blood circulation time. The second generation of the polymer coated liposomes can escalate blood circulation times from several minutes up to 3 days.



**Figure 2. Liposome Based Nano-particles**

• **Gold and Iron Oxide Nano-particles**

The concepts of nanotechnology use to the development of new generation of anti-cancer drug delivery procedures. This Nano-particles can be manufactured through decrease of HAICI with narrow polydispersity. The important factor of gold nanoparticles is gold concentrations and are naturally less in animal bodies. Iron oxide nanoparticles have used imaging as clinical agents for MRI. The merit of nanoparticles system is that they deliver in targeted manner for desired region by using peripheral magnetic field.



**Figure 3. Iron oxide or gold Nano-particles**

### Advantage of Nanoparticles

- It is dose proportionality
- It shows decreased toxicity
- Nano-particles shows increased bioavailability
- Represent in small dosage form (Small tablet)
- It is used in amplified active agent surface area which conclusively shows quicker suspension of active agent in aqueous setting as human body.
- Even dosage form of drugs that are either unstable or unacceptably low bioavailability in non-particulate form.

### Review Literature

**Moghimi, Hunter, and Murray (2005)** discussed about the application of nanotechnology for the treatment, control and diagnosis and monitoring of the bio-logical systems which recently referred as Nano-medicine. This involve the identification of cells and receptors targets related with some specific clinical condition and the decision of correct Nanocarriers so as to attain the required response with the minimal side effects. They basically highlighted balanced methods in the surface engineering and designing of the Nano scale vehicles and the things for the site-specific drug transfer and the medical imaging after the parental administrations.

**Wang et al (2009)** cover the recent developments of nanotechnology which give opportunities to researchers for significantly transformation of the cancer therapeutics. The technology is helpful in the manipulation of physiochemical and biological properties of nanomaterial for the facilitation of more efficient drug targeting. The paper discussed about the multifunctional nanoparticles which is helpful in reduce nanoparticles for the detection and destruction of cancer cells at a same time. It is also conclusively stated that the clinical investigations is helpful in therapeutic nanoparticles which improve and reduce the side effects which compared with the conventional cancer therapeutic drug.

**Haque et al. (2010)** discussed about the nanotechnology as the use and the study of structures size between 1 nanometer and 100 nanometers. As it is well-known fact, that cancer leads to cause of death among numerous number of people with the

range variation of age as below 85 years. It is still under development that nanoparticle transport chemotherapy drugs directly to cancer cells. This paper, focused by summaries the recent status of the nanotechnology in the cancer treatment.

**Misra, Acharya, and Sahoo (2010)** stated about the application of nanotechnology for the use of cancer therapy which have received the substantial care in the recent years. Cancer nanotechnology is defined as an interdisciplinary area for the research in the field of medicine, engineering and science as an imminent field with extensive applications. This paper focuses on the target-specific drug therapy and methods for the primary analysis of the pathologies and the significant research areas with the nanotechnology, which plays a vital role. This paper represents the approaches of the cancer methodology as the progression of the cancer healing factor.

**Anajwala, Jani, and Swamy (2010)** deliver the information regarding Nano particulate technology with the use in the development of new generation of the more operative cancer therapies, which are capable of overcoming from the biophysical, biomedical, and biological hurdles that the body stages against the standard intrusion. The paper focuses on the describing structures of the cancer nanotechnology, which are implanted in the advance prospective for the development and design of the nanoparticle-based drugs. The growth of the several nanotechnology and nanomaterial which have enabled the cancer biomarkers recognition with the great precision and sensitivity. Hence it is noted that the discoveries of these technologies must be validated critically before the use in the clinical diagnosis.

**Patel, Mistri, and Prajapati (2012)** stated about the treatment of cancer with the use of nanoparticles as a point of view of drug delivery. It shows the incidence of death from cancer and death form the cardiovascular diseases in which cancer found to more complex. The paper detailed about the Nano medicines characteristics of nanotechnology consisting of drug delivery system and the new therapies of drug-related with cancer. The present paper use the features of Nano medicine so as to generate nano devices that are capable of functioning inside the body. The Nano devices are considered as the hybrid of the biological particles and other synthetic polymers that easily enter into the cells and organelles so as to interact directly with the DNA

and proteins. This paper focus on the key impact on the therapy of cancer.

**Sutradhar and Amin (2014)** mentioned the study of nanoparticles showing rapid development and straggled for the overcome various limitations of traditional drug delivery system which later come up with the different therapeutics for the treatment of cancer. The paper also discussed about the conventional chemotherapeutics which shows some of the serious side effects with the commotion in the immune system and other related tissues with the proliferation cells with the nonspecific targeting. This paper focus on the ability of recognition of cells of nanoparticles with numerous strategies containing exclusive recognizing properties from previous anticancer treatments. It also consider the drug transfer by nanoparticles inside the cells and also many researchers coined about the elimination of the adverse effects of conventional treatments with the implementation of cancer treatment.

**Sebastian (2017)** stated about the orthodox cancer treatments which are limited to surgeries, radiations and other chemotherapy treatments. These orthodox treatments significantly show the adverse effect and the current cancer treatment emphasis on specific drug transfer for cancer tissues and thus, decrease the contrary effect on the healthy cells. Nanotechnology is defined as the science and engineering of all the regulatory matter and to create devices with the original physical, chemical and biological properties.

The paper discusses about the cancer Nanomedicine which possesses the flexibility required for the most challenging impediments in the success of treatment of cancer with the use of conventional chemotherapeutic agents. The research is dependent on the identification of the appropriate Nanoparticles after the certain chemotherapeutic agents for drug cytotoxic effect or these effect on nanoparticles itself with the limited amount of electromagnetic energy.

### Conclusion

The cancer Nanomedicine shows the versatility use for the most challenging inhibitions for the treatment success with conventional or primitive chemotherapeutic agents. The Nanotechnological studies use in the drug molecules which is helpful in Nanoengineered structures. It prefers to use the better medicine opportunities with the diagnosis, effective drug distribution and the improved therapy and imaging for the cancer. The present study focus on the application of nanotechnology used in the cancer treatment which shows the exponential growth from the past years. The multidisciplinary field for the nanotechnology as its concept towards reality shows immense applications. The present study elucidate the complex biological process in tumor genesis and the innovation of the nanomaterial with against properties. It is important for the future implications so as to deliver the use of the advanced Nano-techniques in the cancer therapy.



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