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Research Article

Nanotechnology for Cancer Chemotherapy: Design of a Drug Delivery System, Characterization and Fabrication of Drug Delivery Carriers

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Abstract:

Non-selective anti-cancer drugs given systemically remain a problem because of their action on all cells in the body. These cytoxic drugs affect both the healthy and malignant cells of the body which cause side effects that are sometimes lethal. In the latest whims, novelties of cytotoxic drugs have provided mixtures having worst physiochemical characteristics, thus calling for other options than the invasive one for delivering the package to the diseased tissue. Problems with normal chemotherapy administration, drug transport, and formulation have been resolved by the use of nanoparticles in the delivery of chemotherapeutic medicines to cancer tissue or the tissue microenvironment. Nanoparticles, which are colloidal structures smaller than or equal to one micrometre, can penetrate the tumor's vascular walls, enter the tumor stroma, attach to the surface receptors on tumor cells, and control the release of anti-cancer medications locally. This implies that obtaining a desired copy of the target depends critically on the colloidal carrier's surface design. A long-circulating, targeted, and biocompatible drug delivery particle device. Several drug delivery systems which have proven their therapeutic potential are considered, and the need for the engineering of colloidal carriers which can be used in anticancer therapy is explained. Cancer is an ailment that has become rampant and elaborated in the lives of most individuals globally, and is always a potential cause of poor quality life. However, there is always a deficiency of sufficient cancer treatments, though effective formulations of strategies which helps to: Prevent these, reduce the fatalities, reduce the endurances of chronic pains, or enhance the over quality. Among the key stages towards effective cancer management some of the most significant are distinguishing cancer cells and the administration of drug which has very limited effects on surrounding tissues. Due to non-specificity and inability to elicit response from tumors by the conventional cancer diagnostic and therapeutic modalities; other methods like nanotechnology are employed for better diagnosis and to minimize the disease progression. Several immunotherapeutic agents derived from the nanotechnology aspect of treatment of several types of cancer using nanotherapeutic approaches with selective destruction of cancer cells with minimal invasion on the normal cells. Carbon nanotubes that is one of the main nanomaterials used in developing anticancer drugs have shown good pharmacokinetics and pharmacodynamics in the diagnosis and management of cancer. This review provides an overview of nanomaterial classes that are considered as the basic forms, being used extensively for the detection and treatment of cancer diseases.

Key words: Nanotechnology, Drug Delivery System, Design, Cancer Chemotherapy

Introduction:

Cancer stands second amongst the total causes of deaths both in United States and majority of the developed countries in the world. It can be concluded that from the perspective of genetic changes; cancer is a genetic disease in the sense that cells contain varieties of genetic characteristics like gene translocation point mutations and gene overexpression. The high risk patients benefited from the screening as had a more favorable patient outcome and survival. However, the diagnosis at an early stage of the disease remains important, but using most images may only provide poor image quality and needs costly apparatus. About 85% of cases of cancer of human organ is of the solid mass, and surgery may be the primary intervention against the disease. In the postoperative adjuvant treatment, radiation, chemotherapy, immunotherapy, gene therapy and heat are given to all cancer cells and tumor tissues. The only effective way found to treat cancer is through cytotoxic chemotherapy. The catch, though, with total cell kill is that it cannot be accomplished as soon as there is metastasis and spread of the cancer. The following have been forwarded as the causes of failure of therapy against cancer; First, any chemotherapeutic agent does not have high specificity for the cancerous tissue, second, what they call as multi-drug resistance, third, the newly formed blood vessel wall is compact and heterogeneous biologically, fourth, the low solubility at the physiological pH, and fifth, low levels of the host immune system. Current modes of treatment require a relatively high doses of the anti-cancer agent to be given systemically either as bolus dose or as infusion. The rate at which the cancer cells die rises in synergy with the number of milligrammes that can be given. Due to the fact that the dose that kills all the malignant cells is poisonous dose that results to patient death, its a pipe dream to talk of a dose can be given that would kill all malignant cells. A stunningly high percentage of anti-cancer drugs are in their state insoluble in water, and necessary for oganisms in the form of pharmaceutical solvents which are lethal. This is the other problem with chemotherapy. Further, side effects concerning the patient's health, time and the form of the drug are inconveniences to the patient. Thus, the diseases such as cancer reduce the quality of life and the period of life of the patient due to the systemic method of introducing chemotherapeutic agents used in the STST. Randomized controlled trials of anticancer drugs delivering high drug concentrations to the diseased tissue with low side effect impact on normal tissue remains an unsolved challenge for cancer therapy. For instance, it has been demonstrated that the encapsulation of the chemotherapy into nanometer-sized carriers enhances the cancer therapy. It has become evident that medication delivery systems in cancer, has been made possible through the incorporation of nanotechnology, use of varying numbers of colloidal carriers and nanoparticles.

If the colloidal particles have a size between 10 and 1000 nm, combined with a dispersed therapeutic agent inside or atop of the particles in a polymer carrier matrix as within a polymer shell by covalent chemical bonding, or within a structure such as liposomes, the delivery system is considered as nanoparticles. Drug delivery systems based upon nanotechnology include biodegradable nanoparticles, dendrimers, polymeric micelles, ferro fluids, liposomes, hollow microcapsulates, solid lipid nanoparticles, and solid core shell nanoparticles. Thus, the chemotherapeutic can be sheltered from the surrounding biological milieu, present a controlled fashion of release, and in some means overcome some obstacles posed by the tumour microenvironment when bound covalently to the aforementioned nanocarriers. There are general disadvantages that can be used prepare particle systems for each of the systematic methods. To start with several of them employ toxic chlorinated organic solvents and surfactants in manufacturing their products. Secondly, low EE, and the tendency to form aggregates, as well as uncontrolled and rapid burst-release at healthy tissues are deadly within-is the body. But when the nanoparticles have to be fabricated for drug delivery application for the cancer treatment, it

has toned down the problems associated with the conventional treatment of cancer and there is a chance to get excellent improvement in efficiency for the cancer patients where the efficacy can be raised drastically by delivering the drug at the targeted region with an effective timed release function while reducing the frequency of the often uncomfortable side effects.

In the diagnosis, the cancers can be easily and promptly identified using nanotechnology including biomarkers for the cancers. Since technology is advancing, then treatment such as nanoscale drug delivery can be made to have no side effects, and act only on the cancer tissues. Due to this character a feature of nanomaterials is the crossing of cell barriers. During the years of its implementation, nanomaterials have been used to destroy tumors using the active and passive targeting. However, many drugs are available for such cancers and are often sensitive to these daily used drugs, which consequently has poor outcome on the patients; not forgetting the side effects it causes on the body and hence affects the healthy cells. Hence different types of nanomaterials such as liposome, polymers, molecules, and antibodies and they found that the incorporation of all the above stearate in cancer drug design can maximize the yield and at the same time minimize the toxicity of the drug. However, because of toxicity in nanomaterials, there is a long way off to the creation of nano-therapies before the agents for the professional treatment of cancer. Because of the rise in application of nanotechnology in cancer treatment, this literature paper will focus on the use of nanotechnology in cancer diagnosis and treatment besides the strengths and limitations of its usage.

The creation of a medication delivery system:

The current research shows us how to actually ‘design’ a convincing drug delivery system for the treatment of cancer by reference to its carrier and pointing out the characteristic and utility feature/parameter that a carrier system must and needs to possess/boast for optimum work. The fabrication has to create a drug delivery structure that must be biodegradable, capable for injection, biocompatible, targeted and most of all, the chemotherapeutic must have the ability to release for a long time. Such functional qualities that can depend on characteristics of the medicine and the kind of cancer this medicine treats may be achieved when designing the drug delivery system. Functional properties are thus achieved through control of particle physicochemical characteristics, which include composition, particle size, surface properties and mechanical characteristics. The manufacturing process must also provide good drug recovery, in vivo stability and the storage stability that is desirable for a medicalCALEA facility. Potential advantages for linking the chemotherapeutic to the application of nanoparticles stem from two structurally adjustable factors: surface area and size. These parameters will be useful in avoiding proximity to the limited, cellular and physical confine that is attached to the colloidal carrier once it is introduced intravenously. A suitable delivery system of anti-cancer drugs using nanoparticles should have a size that mimics cell organelle. There is some upper limit as well as a lower limit in the size of the nanocarrier. They must be at the order of human red blood cells which are of about 6-8 nm in diameter to the maximization of the upper limit of the nanocarrier. The goals of the current distribution system explain this small size as follows. To harness gene therapy, the carrier must be locked safely within cellular nucleus which is possible to if the size of the carrier is 39nm or less. It is observed that if the size of colloidal carriers range from 8 to 39 nm upon intravenous injection, such carriers can go to compartments of the human body and to cell masses when their size in nanometer measure is between 10 and 1000 nm. Nanoparticles are not easily taken up by MPS while in circulation, hence intravascular injections avoid the innate immune system. They are also small in size; they have diameters of between 200 and 1000 nm that make them to be capable of passing through the narrowest channels in human vasculature, the capillaries. Furthermore, due to the highly curved shell of spherical nanoparticles, hydrophilic

polymers and targeting ligands, which are critical to a drug delivery system, interface optimally.

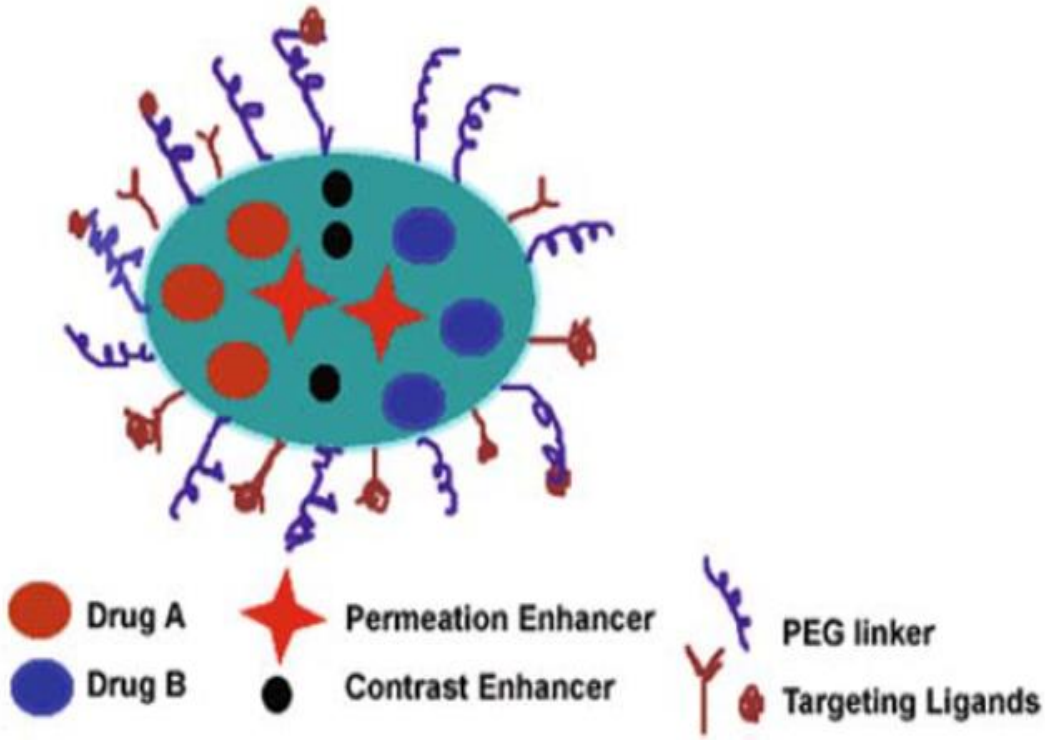

Figure 1. Diagram of a particulate drug delivery system carrier. The carrier matrix may include one or more therapeutic agents, contrast agents such as MRI the permeation enhancing agents. The surface of the carrier is functionalized with ligands for specific accumulation in the diseased regions and poly(ethylene glycol) (PEG) for nonthreatening encapsulation.

Tumor Growth and Angiogenesis:

Cancer can therefore be described as the disorder that occurs in normal regulation processes involved in cell growth. Scientists think that it is possible for any cell in the human body to become cancerous if certain genetic changes disable that cell's ability to control its growth in a normal fashion. A cancer cell dividing in what you would consider to be a normal tissue starts dividing faster and outstrip nutrition support. Following the formation of the small tumor mass, the nest healthy cells are displaced in the new future. The tumour vasculature basically originated from the host and hence the process involved in formation of new capillaries, called angiogenesis is similar but structure of vessels and capillary beds and blood flow rate is totally unlike normal healthy tissue. Further growth of tumour cells depends on the formation of new vessels, which in turn is known as angiogenesis and occurs in tumours with diameter of 2mm and above only. Pericytes also help to keep blood vessels' external structural shape, in normal, healthy tissue, endothelial cell layer is smooth without pericytes. They include; loss of endothelial cell barrier and poor adhesion of pericytes, fenestrations in tumor vessels, irregular caliber of vessels, high vessel tortuosity and stuturing, and adventitia containing random branching. Further, majority of tumors lack lymphatics and in those cases where such vessels were identified, the mean diameter of the lumen is greater and the mean interval between neighboring endothelial cells and layers of new sprouts are also greater.

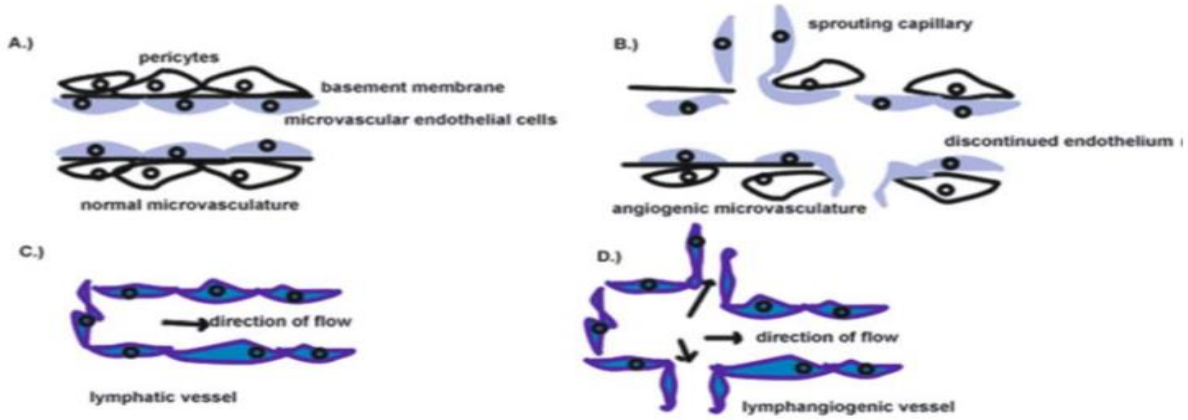

Figure 2. Structure of normal and tumor microvascular and lymphatic systems: Opinions differ with respect to the definition of angiogenesis as (a) presence of normal microvasculature with characteristically tight endothelium supported by a basement membrane and pericytes; (b) angiogenic microvasculature with characteristically discontinued endothelium, highly branched vasculature and fragmented basement membrane; (c) normal lymphatic vessel which does not present endothelial cell-to-cell junctions and ends blindly.

Real-time aimed delivery of Nano-carriers

While passive targeting has been described in array of in vitro and in vivo models such as anti-tumor activity by means of EPR effect, active or selective targeting may enhance the tumor deposition and intracellular deliverance. The principle for selective delivery of the drug is to target the differences between normal and cancer cell. The fact confirmed so far is that some of those surface receptors exist on the surface of cancer cells or can be overexpressed in comparison to healthy cells. One can make the particulate system undergoing delivery the body of cancer cells present in the antigen or receptor molecules. These molecules or ligands (antibodies, lectins, saccharides, hormones, small molecular weight compounds) bind with their cognate cellular epitopes in order to elicit the process of RME. This mode of internalization is the path through which the drugs convey; to exert their cytotoxicity, anti-cancer drugs must engage intracellular entities such as mitochondria, microtubules, nuclear products. This cycling of endosomes from the plasma membrane slows down the transport of the drug carrier to the required area in the cell; the cytoplasm. The methods of drug delivery rely on the carriers' ability to avoid such process and release the carrier into the cytoplasm. This policy has been applied with phosphatidylethanolamine, diverse types of amphipathic peptides, and polyethyleneimine cationic polymer. Apart from reducing total time of interaction with healthy body tissues and cells, active targeting mainly targets at enhancing the intra-cellular concentration of the chemotherapy drug in the sick site, thus minimizing the side effects in cancer patients.

Drug/DNA Delivery System Design and Synthesis

In the present day, dozens of studies demonstrate how chemotherapeutic medications can be delivered with precision thanks to associated nanocarrier agents like dendrimers, liposomes, polymeric micelles, biodegradable polymeric nanoparticles, and hollow microcapsules. These delivery strategies are either being employed or are being employed in the treatment of cancer. Although each delivery method has its unique problems and issues, biggest recent development has collectively clarified how each of these delivery mechanisms can be used at a therapeutic level using tissue culture or model organisms. This section here specifically deals with the main nanoparticles kindering to the nanoparticles that have made the most impact on drug delivery.

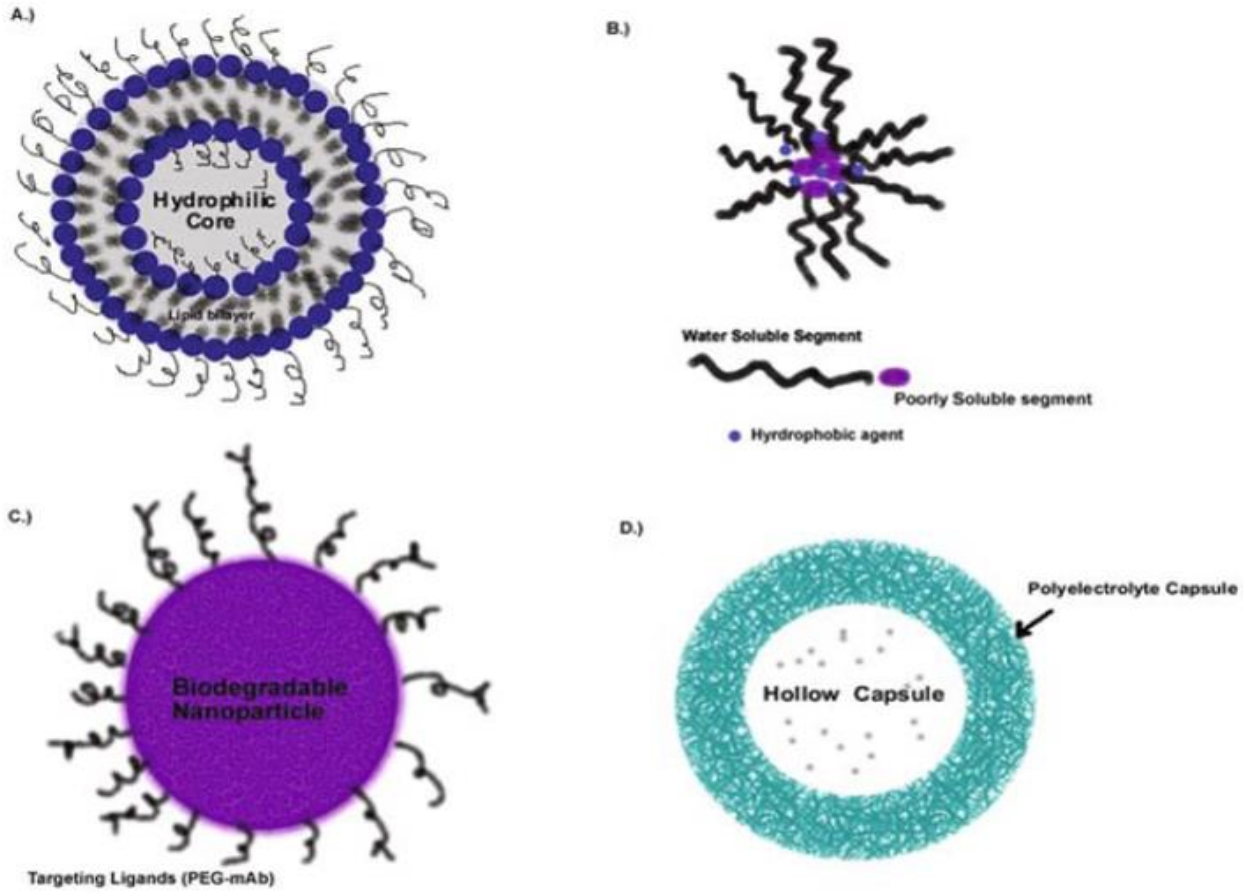

Figure 3. Current drug delivery nanoparticulate systems for anti-cancer therapy: A PILA based delivery system is as follows: (a) PEGylated liposome; (b) micelle; (c) biodegradable nanoparticles with targeted ligand at the terminal of PEG chains; (d) hollow microcapsule formed by the layer-by-layer self-assembly technique.

Characterization of Drug Carriers:

Some examples of such physicochemical characteristics include size and size distribution, surface and bulk morphology, surface and bulk chemistry also known as surface charge, drug encapsulation efficiency and the physical and chemical state of the so-called "payload" or the drug that is entrapped within the nanoparticle. The physicochemical characteristics of nanovectors are studied by employing different approaches. The physicochemical characteristics of nanovectors and their behavior in systemic circulation with blood components are categorized using these techniques.

Size and Size Distribution:

Particle size, and particularly particle size distribution in any colloidal suspension, is one of the most important design variables affecting any drug delivery system. A carrier in the nanometer size has a larger surface are to volume ratio favorable for the release of the drug and for altering the surface chemistry. The particles can neither be taken up by MPS nor be larger than 5 micron to penetrate the narrowest capillary of human vascular bed; they must also transport molecules across the open meshes in endothelia of pathological tissues. In the case of a controlled release of a drug at the disease site the monodisperse size distribution is highly desirable. Fluctuations in stability and agglomeration at nanoscale particle size may reignite the problems encountered in biological setting. Non-ionic stabilisers and surfactants are employed to prevent agglomeration of particles in the biological media. One key aspect of the stabilisation of the colloidal

carrier to form a superior drug delivery system is the restriction of aggregation. DLS instruments include ZetaSizer NanoS which may be used to quantify size and size dispersion. The polydispersity index (PI) of the nanoparticles is used to define their uniformity: PI<0.2 is characteristic of a monodisperse particulate system.

Bulk and Surface Morphology:

Out shape features or surface morphology characteristics using light microscopy, scanning electron microscopy (SEM) and or transmission electron microscopy (TEM) can be used to describe the physical appearance of the nanoparticle. It is also possible to estimate size and size distribution of the colloidal carrier with the help of these tools. Therefore for either of approaches one can get some information either of the bulk and/or surface of the material when the various settings and magnification for the two has been used . Sem is also based on the principle that when an incident electron beam collides with the sample surface and generates secondary electrons that have topographical information a SEM image is generated. There exists a good likelihood for achieving a high sample resolution depending on change in working distance as well as accelerating voltage. As such, when observing with a low WD because the particles are of a nanometer dimension, the surface relief details look more resolved. Lowering the rate of the electron impacts can also improve the resolution of the sample. This is applied to the sample surface at 5.0kV and the secondary electron scatter resolution gives a resolution of 3.5nm. At this lower limit it is possible to study the morphologies of the drug particles, surface roughness and at the nanometre scale. Overall, resolution and anti-stigmatism are very challenging at this lower magnification level (around 300k) due to the enormous effect of charging for the sample electrons. The charging element is however the major drawback of using SEM in an organization. However, by coating the sample with gold, restriction of resolution by the nanoparticles can be prevented after observing the particles under these sample processing conditions. These are generally below 1000A ˚, and the method objectively scans the thin sample sections using a high intensity electron beam with near atomic resolution. As reactive they are accelerated to several hundred kV, 200 kV consist electrons with wavelength of 0.025 A ˚ . Like most microscopes, the resolution of TEM is determined by aberrations in the electromagnetic lenses to 1-2A˚ range. TEM may be able to analyze the elemental contents, shape and surface profile of the sample using the collected electrons. As noted in the above discussion, it can be realized from the aforementioned conditions that one of the demands on TEM is that the sample should should be as thin as possible or electron permeable. Despite this, there is real possibility of a sample being damaged upon exposure to high energy electron beam. Scientists have also often used TEM to demonstrate the homogeneity and morphology of the thin polymeric films forming by electrostatic assembly.

Surface Make-Up:

The fundamental behaviour of a nanoparticle both in vitro and in vivo depends on the physical and chemical properties of the surface of the nanoparticle. A key design consideration of a medication delivery carrier is the lack of interaction with protein in addressing and avoiding parasite-type absorption by the immune system. For instance, it has been shown that certain processes such as emulsion-solvent evaporation yield particles with outer surfaces which determine protein adsorption. One method employing surface chemical analysis is to determine the concentration of an emulsifier or surfactant at the nanoparticle surface. XPS can be used to characterize surface chemistry since it investigates details of a material at a micro sample depth. The XPS uses the photoelectronic effect – a process when a beam of light comes into contact with a matter (surface), electrons are emitted. X-ray high energy photons are represented by h _ symbol and both sample and colloid have electrons at the surface where one of the photo-electron is ejected into vacuum with kinetic

energy, KE. Last of all the binding energy is calculated from the energy of the emitted photo electron and energy of the x-ray photon. This brings a survey scan of all the atoms that are available on the surface of the analyzed composition. The survey scan is an independent plot of counts per second (CPS) against atomic binding energy (BE). By means of the possible software program, all the obtained informations from the survey scan can be processed and atomic percents can be evaluated. Furthermore, both lower sample pass energies below 20eV and extended accumulation time provide target-scent NIS spectra and the kind of oxidation for constituent atoms at the surface. The information that can be derived from XPS cannot of course give any doubt while identifying certain functional groups and ligands adsorbed at nanoparticle interface. When it comes to surface chemical analysis, XPS offers four benefits: Thus, (1) the method is surface sensitive with a probe depth of 1-10 nm, (2) the distribution of functional groups at the interface and corresponding oxidation states of constitutive atoms can be identified, (3) all the existing elements can be identified with a fairly high probability of identifying the core state of atoms, (4) a quantitive method does not involve the use of standards. Although this method is surface sensitive, it does not analyse the gap between the particles of the drug and the solution. Also, before mass production the nanoparticles have to be dried; prior to introducing them into a high vacuum chamber (10–6 Pa). The structure of the aforementioned sample will require a change as a consequence of the high energy x-ray photon source. Nonetheless, this techniques unable to quantify hydrogen, the lateral resolution is more than 5 mm and may be a problem for getting sufficient amount of sample matter for analysis especially when working with powders.

Surface Charge:

They established that the surface charge density of the particle carrier favours the phagocytosis process of the phagocytic cells. A second definition of surface charge is so call measured zeta potential (-potential). The genuine surface potential is vastly harder to compute and is not equivalent to the potential. The _-potential based on the values of the ionic concentration, viscosity and pH of the solution or medium may define the amount of charges between the particles and determine aggregation. Moreover, the DLVO theory of colloidal thermodynamics supports the idea that a particulate system with a high charge density will generally be stable. Furthermore, under physiological conditions, _1–3 nm High surface charge density carriers are stable due to the repulsive force since Debye length can lead to coalescing.

Nanotechnology in the Diagnosis and Treatment of Cancer:

Application of nanotechnology in the diagnosis of cancer:

Some of the changes that occur due to the alteration of genes functions may lead to synthesis of some biomolecules form cell causing uncontrolled division and formation of tumors. There are two major classes of tumours; the benign tumours and the malignant tumours. Benign tumours do not metaformistically invade beyond and beyond of origin of Cancer whereas malignant tumours throw out cell that grows invading healthy tissue as well as any other organ of the body. They relate to cancer detection and prevention of the uncontrolled proliferation and spread of cancerous cells. That is why PET and MRI are the first diagnostic methods being used in cancer diagnosis followed by CT and ultrasound diagnostic methods. As beneficial as these imaging systems may be, they do not deliver adequate degrees of clinical data regarding neoplasms of different types and stages. Hence it becomes cumbersome when making a general evaluation of the disease state on which an ideal therapy can be recommended.

Nanotechnology helps in tumor imaging:

Over the last decade, nanoparticles have been considered in cancer diagnosis and monitoring processes and currently there are several different types of nanoparticles used for molecular imaging.

They have drawn much attention in the recent past in cancer research, diagnosis due to their advantages such as; small dimensions, biocompatibility and high atomic number respectively. Liposomes, polymeric micelles, and nanoparticles in cancer- like semiconductors and quantum dots and iron oxide nanocrystals have properties, optical, magnetic, and structural as compared to other molecules. When incorporated with nanoparticles, anti-tumor drugs and biomolecules such as peptides, antibodies or other substances can react with highly selective tumors to detect and diagnose cancer cells. The informativeness of using nanoparticles is due to the fact that cancer is diagnosed in tumour tissue in the early stages when using nanoparticles to image the tissues. Thus, by formation of superparamagnetic iron oxide nanoparticles (SPIONs), which may be used in MRI with the cancer cell lines of interest to act as the target for the SPIONs, metastases can be identified during diagnosis of lung cancer. As per the present studies, SPIONs exhibit high specificity and when incorporated as aerosol building blocks for lung cancer MRIs – they have not been reported to induce any undesirable reactions. Other related application that have been used on the tomographic imaging technology includes the magnetic powder imaging in which high resolution and receptiveness were obtained with cancer tissues. In the experiments with animals MNPs conjugated with the protein EGFR overexpressed in NSCLC have been used to nebulize the lungs. Besides, an in vitro Positron Emission Tomography (PET) using self-assembled amphiphilic dendritic molecules has been developed employs the nanosystem. Many PET reporting units are available at the surface of these dendritic molecules and the molecules have capability to form monodisperse supramolecular nanoparticles. Similarly, the dendritic nanometre system uses dendritic multivalent targeting and the enhanced permeability and retention effect for imaging different tumours with high sensitivity and specificity while sparing treatment toxicity.

Application of instruments of nanotechnology used in diagnosing cancer:

Today's nanotechnology can verify cancer imaging at the tissue, cellular and molecular levels in today's research. This is made possible by the ability of applications of nanotechnology in investigating the tumor micro milieu For instance the ability of fluorescent nanoprobes to respond to pH can be used in detecting fibroblast activated protein-a this is present on the cell surface of tumor –associated fibroblasts. Hereon we shall elucidate some spatial and temporal based nanotechnology instrumentation techniques that could be employed to monitor living cells including movement of cells in tumors.

Near Infrared (NIR) Quantum Dots:

Visible spectrum imaging is less useful since we cannot see objects at larger depths. In order to overcome this problem near infrared emitting quantum dots were developed with the capability to image lymphoma, pancreatic cancer, liver cancer and colorectal cancer. To complement the use of Tyr with cancer imaging, a second NIR window, NIR-ii (900–1700 nm) has been found. This window has better tissue penetration depth and spatial-temporal resolution when compared to the other windows. Further, it has been disclosed that a silver-rich Ag2Te QD incorporating a sulphur source can be developed for enhanced spatial resolutions in imaging over a broad range of infrared bands.

Colloidal Gold Nanoparticles:

AuNPs is quite ideal to be used as a contrast agent by virtue of its small size, Atomic number relative to biological tissues, and bio compatibility with animals. AuNPs has also been showed to be involved in both the active and the passive transport system that leads to increased cell targeting. The principle used in passive targeting is the form of an assembly of gold nanoparticles for imaging due to the permeability tension effect, also referred to as EPR. But active targeting only means that the AuNPs have to be conjugated with a tumor-specific targeted drug like EGFR monoclonal antibodies so that the AuNPs are automatically targeted towards tumor cells. In other words, when the energy is above 80 kev, the

gold material available for practical application offers higher mass attenuation than does iodine or other elements, suggesting both the gold as well as gold nanoparticles are eminently promising. The authors of this manuscript have conjugated AuNPs similar to the study by Rand et al Consequently, it has been found that Gold nanocomposite had significant intensity of cluster of liver cancer cells as compared to liver cancer cells alone and there was visible difference when observed using X-ray Imaging. There are critical implications of this paper for early diagnosis as using the method stated in this paper, even tumors that are only a few millurers in diameter can be observed in the body.

Nanotechnology in Biomarker Testing for Cancer:

The biomarkers in the cancer realm are cardinal features that denote a tumor or the state of a tumor. They are used to monitor cell processes, to monitor or mark changes in for example cancer cells; And these outcomes might someday help in developing a understanding of tumours. Biomarkers can be DNA, or fragments of proteins and also whole proteins From the above list of tumor biomarkers, the ones that can be used to confirm the existence of certain tumors include. In practice, the biomarkers should therefore have a sensitivity of greater than 75% and specificity of 99.6%. At the moment, biomarkers are screened using a patient's blood, urine, or saliva based on medical conditions. However, these biomarkers have not sold enough to support cancer screening. Consequently, several investigators have shifted their focus to determine extract patterns of those aberrantly expressed proteins, peptide fragments, glycans and autoantibodies in sera, urines, ascites or tumor tissues derived from cancer patients. As proteomic advances into the future, biomarkers of proteins for a number of cancers have been found. In any case, protein profiling tests would exclude the high molecular weight proteins from the samples: immunoglobulins and albumin. However, when such proteins are omitted from conjugation along with the low molecular weight protein biomarkers these biomarkers of interest are no longer measurable. To summarize the main statements of this paper, the given reasons are explained: Indeed, the population of low molecular weight proteins is significantly more abundant in biomarkers. Geho and Luchini have released two articles described a technique for concentrating low molecular weight protein using nanoparticles to identify biomarkers from body fluids. Because of their surface properties like electric charge or functional biomolecules that mesoporous silica particles, hydrogel nanoparticles, or carbon nanotubes now provide, nanoparticles overcome the carrier proteins. Another way of increasing the effectiveness of using nanocarriers in screening is to enhance sensitivity of the mass spectrum. Naturally occurring matrix ions are omitted by the analyte interaction with carbon nanotubes that improve the optical and thermal properties for the analyte's energy transfer as a benefit over absorption and ionisation. A third use is the fabrication of lab-on-a-chip microfluidic systems based on nanotecnology: used for immunosreening or for the selected characteristics of tumor cells. For instance, the high performance multiplexed protein detection technologies that are trending well are lab on a chip with quantum dots of cadmium selenide core conjugated with zinc sulfide shell linked to antibodies to carcinoembryonic antigen, cancer antigen 125 and Her-2/Neu. The other is that since cells growing in the surface of different sized nanometres which were identified by these nanometres across can distinguish the tumor cells. At the worst, there are still instances where screening of biomarkers through nanotechnology yields false positive and false negative results while improving sensitivity may be accomplished without the sacrifice of specificity.

Nanoparticles in the Treatment of Cancer:

Nanotechnology is therefore the course that is geared at the use of structure molecular and particles in delivery of drugs. Most used nano-carriers in cancer therapy include liposomes, micelles, dendritic macromolecules, quantum dots and carbon nanotubes. Liposomes are possibly

one of the most researched nanomaterials which are liposome: spherical structure comprising of nanoscale phospholipid bilayer membrane with water phase core. Due to the natural biphasic characteristic of phospholipids, liposomes are formed spontaneously and allows the hydrophilic drug to be retained into the monolayer liposome and the hydrophobic drug to be formed before a multilayer liposome. Liposomes were prepared in an acidic buffer; some of the drugs could be incorporated into the liposomes through an exchange of this solution to a neutral one. The neutral drug can also be encapsulated in liposomes but they have low preference for the acidic environment and as such do not readily diffuse out of the liposomes internal structure. Other route of administration is dissolving saturated drugs in a suitable organic solvent in order to form liposome. Due to the EPR effect, the avoid vesicle of size up to 4000kDa or 500 nm may be transported into the tumor through the interstices in the vessels. In the tumours they can get integrated with cells, can be engulfed through endocytosis and can unload the drugs in intracellular milieu. As the effect of the pH, redox potential, ultrasonic and electromagnetic field upon the liposome, the liposome could also be a passively or actively ligand-releasing drugs. In the vascular system, in the micro stage of the disease, and blood-borne disease, targeted therapy proves advantageous. This paper however establishes that the half life of a liposome depends on size. Liposomes of up to 100nm can readily penetrate the tumor and are retained in the tumor for a longer time, however liposomes greater than 100nm have a shorter half-life because they are rapidly recognized by the mononuclear phagocytic system. In the liposome, the format of the antibodies enables the liposome to attach to the tumor specific receptors hence having active targeting to the tumor after which the drug is transported to the site. Namely, many liposomal agents may be appropriate for clinical therapy based on a pharmacokinetic foundation. For instance, the later forms are adriamycin containing liposomes are an option in treating metastatic ovarian cancer, where patients received a decent clinical benefit..

Carbon Nanotubes:

CNTs can be divided into two types based on their structure and diameter: SWCNTs and MWCNTs For this purpose two types of CNTs are recognized which include, While the MWNTs have a structure of concentric graphene, the SWNTs are simply a monolithic circular graphene. Large scale biological application of carbon nanotubes includes their large surface area, high strength, metallic state, electrical conductivity and thermal conductivity. Another property of carbon nanotubes is their NIR (near infra-red) light absorption characteristic. This is called the thermal effect where the nanotubes get heated and can presumably home in on tumor cells. The raw types of carbon nanotubes promote non invasive penetration through biofilms which positions them as perfect carriers of almost any type of drug molecules into the living cells. Due to the properties associated with the carbon nanotubes, molecules such as paclitaxel are attached and administered both in culture and in whole organisms for treatment of cancer.

Polymeric Micelles

Polymeric nano particles are solid contained in a micelle for particle size of 10 to 1000 nm in size. The first kind of polymers that were used in drug delivery systems can be described as PNPs or polymer nanoparticles, nanospheres, nanocapsules or polymer micelles. PNPs are employed routinely in drug design and represent a potent drug delivery system for hydrophobic drugs. The mentioned hydrophobic effect in aquatic environment also makes it possible to self-assemble the PNPs created from the amphiphilic polymers containing both hydrophilic and hydrophobic parts. As a result of the covalent link or interaction through a hydrophobic hole the PNPs is also capable of absorbing the hydrophobic medications. As a result, these blocks are commuted for greater contacts in the core and complex neutral charge so as to transport the charged hydrophilic functional molecules including proteins, peptides and nucleic acids. PNPs are a suitable drug carrier with endothelial cell permeability and without kidney rejection due

to enhanced thermodynamic stability and volume reduction. For this reason, since hydrophobic macromolecules and medications can go towards the PNPs core, the suspension of PNPs in aqueous media following separation may induce the required therapeutic effect. Speaking of actuality in case the medications can get into the target cells by various ways when either orally or parenterally While providing different ways to reduce the toxicity to normal tissues as compared to the cancerous cells. The main challenges of using PNPs for cancer nanomedicine, however, are yet the question of how to deliver the medication to the site of action with minimal interference or toxicity. Recent trends in the use of PNPs for nanotechnology-based drug design for cancer therapy have been associated with their coinciding higher capacity to enhance patient care. For instance, when adriamycin conjugated nanomaterial was applied to some sorts of cancer treatment, the curative effect rather partially fulfilled the standard requirement. However, it was also associated with several side effects which are toxicity and some issues to do with the heart; this is why it is restricted. Such problems are balanced by Doxil (liposomal doxorubicin) which does not seem to have such a number of cardiotropic side effects in patients and could be viewed as a safer nanomaterial synthetic strategy for further investigations by the researchers..

Conclusions:

One can note that in the fight against cancer with the help of nanotechnology, the result has been achieved. The proposed use of nanocarriers in cancer therapy has following advantages over current treatment regimes: The cytotoxic drug molecules are encapsulated in the nanocarrier system that minimizes the toxic impact on the general body, the anti-cancer drugs are specific to the affected area and, the generalized use of nanocarriers increases the bioavailability of the drugs used. The major challenge however lies in the synthesis of nanoparticles that will have the appropriate surface chemistries for the development of a long circulation time and targeted drug delivery system. Challenges arise in synchronizing the surface chemistry of the material with the stability of particles. This increases site selectivity and an attendant reduced risk for side effects since the drug is deposited locally at the site of the CANCER lesion. To satisfy the different requirements to functionalize the surfaces of liposomes biodegradable nanoparticles and polymeric micelles, the ligands have been targeted at an overexpressed receptor on the surface of cancer cells. An integration of targeting methodologies of passive or active targeting techniques together with an external magnetic field could potentially indicate a new approach towards cancer therapy. The recognition of fresh aims that are specific to karyokinetically-active cells has meant that deposition methods that will allow the drug of-interest to be delivered to the target whilst circumventing gross architectural and functional barriers have become indispensably essential. Although some advancement is seen in cancer therapy based on nanoparticles, yet there is a demand that is unfulfilled. Strategies used in the creation of multi-functional surfaces could perhaps reduce the effectiveness of cancer drugs and create new therapies for patients. In the years after its invention nanotechnology has manifested a great deal of promise in the fight against cancer. Since nanomaterials are characterized by improved pharmacokinetics and pharmacodynamics, the diagnosis and treatment of cancer are improved. Besides their pecularities, nanotechnology offers significant advantages in terms of delivering the drugs to …-chair specifically without the toxic effect on the rest of the organism. However, it is like any other therapeutic molecule, particularly certain organ toxicities and a few problems with the use of nanotechnology becoming a hindrance to their practice in clinical medicine. Hence in order to conquer the challenges related to the application of nanotechnology much more has to be done to improve the drug delivery process; improve the efficiency of the administered drugs; and at the same time, minimize the inconveniences as much as possible. Thus, the dependencies of the physicochemical characteristics of the used nanomaterials may be optimized and the derivates

providing an increase in safety and efficiency in the treatment and diagnostics of cancer diseases will be revealed. In aggregate with this, our departure was endeavoured beneath efforts to emphasize on the correspondence of the major beneficial factors of nanotechnology with the shortcoming in regard to the implementation of the application to the clinical requisite for cancer. Besides that, the therapeutic uses of nanotechnology and future enhancement to be utilized would have therapeutic capacity to be applied in other disease diseases. Such examples may call for minor or major patho-pharmaceutical interventions including ischemic stroke, rheumatoid arthritis, diabetes mellitus that require the use of an appropriate pharmacologic agent at the site of pathological alterations.

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