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Review

Smart Drug Delivery Solution: Review on Targeted Drug Delivery

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Abstract:

Smart drug delivery system is an advanced method of drug targeted (dt) delivery. To enhance their therapeutic effects and reduce the related side effects, active drug molecules should selectively accumulate in the disease area for a prolonged period with high controllability. Targeted delivery requires special carrier systems. A tdd carrier is a special molecule, particle, composite, or system that has the ability to hold the drug in or on them, either by encapsulation and / or by means of a separator. Nano-carrier-based tdds have advantages such as higher surface-to-volume ratio, higher and more reactive activity centers, stronger adsorption capacity, and other properties such as morphological preferences. In this various type of targeted drug delivery system. Application of targeted drug delivery is used in diabetic patient, cancer therapy & tissue engineering.

The selection and design of a polymer are challenging tasks because of the inherent diversity of structures and require a thorough understanding of the surface and bulk properties of the polymer that can give the desired chemical, interfacial, mechanical, and biological functions. Natural polymers, e.g., gelatin, collagen, and lecithin, have been widely used in pharmaceuticals for many years. Synthetic polymers have gained a significant attention in recent years due to their wide range of varieties that offer added flexibility in terms of their application in ddss. These are available in a wide variety of composition with readily adjustable properties. Smart drug delivery system various manufacturing method, evaluation parameter can be monitored. In recent advances various marketed example used in targeted drug.

Keywords: Targeted drug delivery, cancer therapy, tissue engineering, Synthetic polymers

1. Introduction

A smart drug delivery system (sdds) is an advanced method of drug targeted (dt) delivery. To enhance their therapeutic effects and reduce the related side effects, active drug molecules should selectively accumulate in the disease area for a prolonged period with high controllability. Drug delivery refers to the approaches, formulations, technologies, and systems for transporting therapeutics in the body as needed to safely and efficiently achieve their desired therapeutic effects the smart drug delivered by this system fulfills the criteria: of increase the doses of the delivered drug to the targeted body part of interest (tissue/cells/organs), not be degraded by any of the body fluids, diminish side effects by improving the efficacy of drug treatment, absorption of the delivered drug must cross a biological membrane, and the drug is released in appropriate dosages to the body part of interest[(1)]. Ehrlich first introduced the concept of target drug delivery system based on the term "magic bullet" in 1906. The main idea of a targeted drug delivery system was based on three basic factors: namely finding the particular target for the disease, finding the drug which will effectively treat the disease, and selecting appropriate target vehicles to carry the drug in stable form while preventing other interactions and damage to the healthy tissues. Targeted drug delivery is an intelligent drug delivery system in which a specific amount of a therapeutic substance is delivered to a target area in the patient's body over a long period of time. Cancers autoimmune diseases, neurological disorders, pulmonary diseases, cardiovascular diseases and most other conditions require effective, safe, specific targeting of drugs to certain receptors or

direct delivery into the organ and tdd is expected to serve to these needs. Ideally, tdd systems should have the following features: tdd should have controllable and predictable rate of drug release and drug action should not depend on the release kinetics. It should have therapeutic amount of drug release and minimal drug leakage during transit. Carriers used should be bio-degradable or readily eliminated from the body without any problem. The preparation of the delivery system should be easy or reasonably simple, reproductive and cost effective.

Targeted delivery requires special carrier systems. A tdd carrier is a special molecule, particle, composite, or system that has the ability to hold the drug in or on them, either by encapsulation and / or by means of a separator. Nano-carrier-based tads have advantages such as higher surface-to-volume ratio, higher and more reactive activity centers, stronger adsorption capacity, and other properties such as morphological preferences. The mode of control and secretion of drugs by these carriers at the target sites is relatively unique and special, in that initially an outbreak occurs and eventually leads to continuous release for a long time. Therefore, nanocarriers significantly increase the efficacy of drugs in limited concentrations and also reduce the side effects of drugs and reduce the 135 suffering of patients from various diseases [(2)]. Targeted drug delivery, means insert the proper medication to specific body parts. Drug delivery vehicles must meet several requirements: they must be able to pass through hard-to-reach 115 places, such as the blood-brain barrier, which can be easily identified by target cells, and in the case of tumor chemotherapy, tumor vessels. The drug ligand complex must be stable in biological fluids, plasma, interstitial and other materials. It must be specifically and selectively identified by target cells and must retain the character of title of manuscript surface ligands. Once detected, the carrier system must release the drug into target organs, tissues, or cells. 120 the drug vehicle used must be non-toxic and non-immunogenic. High loading / encapsulation amount of the drug, zero premature release of drug molecules, cell type or tissue specificity and site directing ability, and proper controlled release rate of drug molecules to achieve an effective local concentration are other features of drug carriers. 125 at present, nanotechnology-based drug delivery systems have been studied due to the development and fabrication of various nanostructures. These particles or structures can easily penetrate tissues (absorption of nanoparticles is about 15-250 times higher than that of microparticles) and be absorbed by cells. They also protect drugs from being destroyed by various gastrointestinal enzymes, so they can transport the drug to the target as safely as possible. 130 nano-carrier-based tads have advantages such as higher surface-to-volume ratio, higher and more reactive activity centers, stronger adsorption capacity, and other properties such as morphological preferences. The mode of control and secretion of drugs by these carriers at the target sites is relatively unique and special, in that initially an outbreak occurs and eventually leads to continuous release for a long time. Therefore, nanocarriers significantly increase the efficacy of drugs in limited concentrations and also reduce the side effects of drugs and reduce the 135 suffering of patients from various diseases [(3)].

2. Types

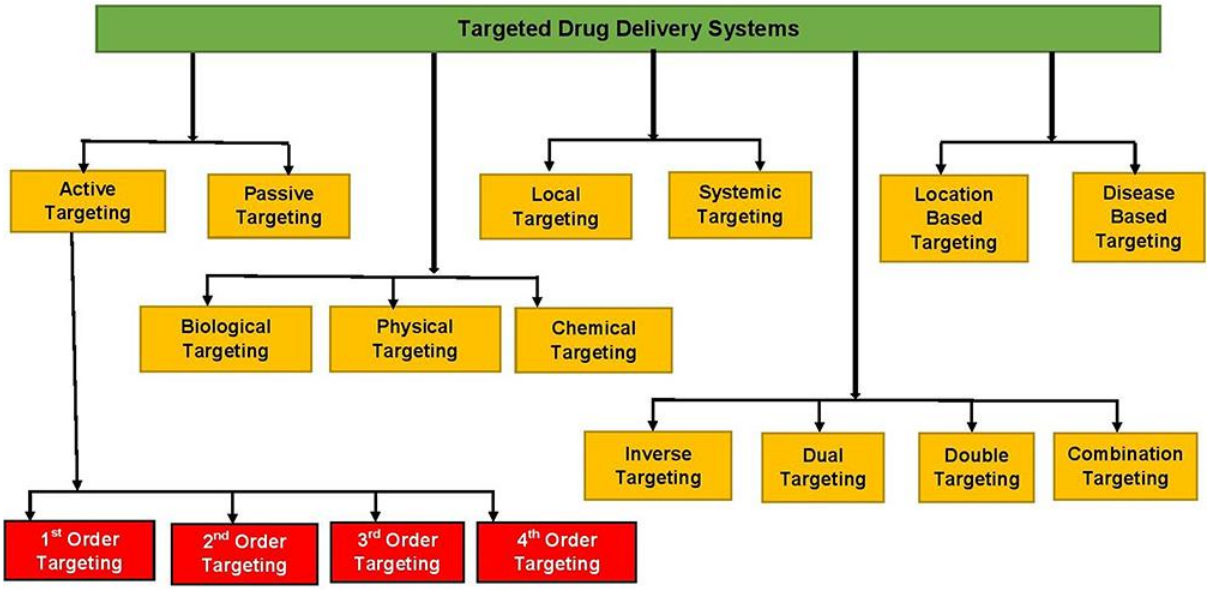

Figure-1: Targeted drug delivery system

2.1 Inverse targeting: reverse targeting of drugs means preventing inactive absorption of colloidal carriers by the reticulo 145 endothelial systems (res). This can be achieved by suppressing the regular function of res by injecting large amounts of empty colloidal carriers or macromolecules such as dextran sulfate. This method facilitates res saturation and suppresses the defense mechanism. This type is usually used as an effective way to target the drug (s) to non-res organs in the body.

2.2 physical targeting: 150 this approach can be achieved by changing some characteristics of environmental conditional changes such as ph, system temperature, light intensity, magnetic field, electric field or ionic strength and other small and even specific stimuli such as glucose concentration or gas concentration to localize the drug carrier at a predetermined location. This method is used to target nanoparticles for tumors as well as in the cytosolic delivery of entrapped drug or genetic materials.

2.3 dual targeting: in this system, the carrier molecule has therapeutic activity and therefore increases the therapeutic effect and activity of the drug. For instance, the net synergistic effect of drug conjugate or the composite can be seen when a carrier molecule with antibacterial or antifungal activity is loaded with an antibacterial or antifungal drug (e.g., loading antibacterial drugs on porous zno nanoparticles).

2.4. Double targeting: the combination of temporal and spatial methodologies to target a carrier system is called dual targeting. Here, it is possible to control the rate of drug delivery to the desired location by spatial placement targets drugs to specific organs, tissues, cells or even subcellular containers and temporal delivery.

2.5. Active targeting: 165 active targeting is the specific interaction between the drug / drug carrier and target cells through specific ligand-receptor interactions for intracellular localization that occurs only after blood circulation and extravasations. In this method, special modified nanosystems are used to identify and interact with specific cells. Vitamins, carbohydrates, lipids, peptides and surface proteins, antibodies and nucleic acids are among the various targeting agents that are used in active targeting. The main reason for active targeting is the selectively 170 increases in the amount and size of drug delivery to target tumor cells due to the avid and specific interaction between nanocarriers and target cells. This approach can be classified into three different levels of targeting.

1) first order targeting, refers to the distribution of the drug in the capillaries of general target sites such as compartmental targeting in lymphatics, peritoneal cavity, plural cavity, cerebral ventricles and eyes, joints.

2) second order targeting, selective drug delivery to specific cell types, such as tumor cells, rather than to normal 175 cells, for example, selective drug delivery to kupffer cells in the liver.

3) third order targeting is a specific type of drug delivery in which the drug is targeted intracellularly through endocytosis or through receptor-based ligand interactions at the site.

2.6. Passive targeting: 180 passive targeting is one of the natural phenomena that exists in the human body. Hormones, neurotransmitters, growth factors, etc. Have a natural tendency to target receptors at their site of action, such as insulin and insulin receptors. This concept also applies to drugs. Some tissues in disease conditions physiologically offer opportunities that can be exploited by passively targeting nanocarriers. This is called the enhanced permeability and retention (epr) effect, in which nanocarriers accumulate in diseased tissues due to loosen fenestrations and / 185 or poorly formed lymphatic drainage accrual of drugs / drug-carrier systems at the site of operation leads to targeted drug secretion over a period of time. Due to the clearance of nanocarriers by the reticular-endothelial system (res) consisting of macrophages and mononuclear phagocytes, it can be used to passively target macrophages and even the lymph nodes and spleen to treat infections that affect res (e.g., leishmaniasis and malaria). In order to create 190 features such as long-circulating, res avoidance, and granting them time to accumulate at target sites in high amounts (long-circulating nanocarriers), modifications (e.g., binding of polyethylene glycol; peg) are often performed on nanocarriers [(4)].

3. Application

3.1 Glucose sensors:

one of the most popular applications of ph-sensitive polymers is the fabrication of insulin delivery systems for the treatment of diabetic patients. Delivering insulin is different from delivering other drugs since insulin has to be delivered in an exact amount at the exact time of need. Many devices have been developed for this purpose and all of them have a glucose sensor built into the system. In a glucose-rich environment, such as the bloodstream after a meal, the oxidation of glucose to gluconic acid catalyzed by glucose oxidase can lower the

ph to approximately 5.8. This enzyme is probably the most widely used in glucose sensing and makes it possible to apply different types of ph-sensitive hydrogels for modulated insulin delivery.

3.2 Cancer therapy:

nanoparticles used in smart drug delivery systems have a high surface area to volume ratio. This allows many functional groups to be attached to a nanoparticle, which can seek out and bind to certain tumor cells. In photodynamic therapy, a particle is placed within the body and is illuminated with light from the outside. The light gets absorbed by the particle and if the particle is metal (e.g. Nanoshells), energy from the light will heat the particle and surrounding tissue. Light may also be used to produce high-energy oxygen molecules that will chemically react with and destroy most organic molecules that are next to them (like tumors). This therapy is appealing for many reasons. It does not leave a "toxic trail" of reactive molecules throughout the body (chemotherapy) because it is directed where only the light is shined and the particles exist.

3.3 Tissue engineering:

nanotechnology can be used as part of tissue engineering to help reproduce or repair or reshape damaged tissue using suitable nano material-based scaffolds and growth factors. Nanoparticles such as graphene, carbon nanotubes, molybdenum disulfide, and tungsten disulfide are being used as reinforcing agents to fabricate mechanically strong biodegradable polymeric nanocomposites for bone tissue engineering applications. The addition of these nanoparticles in the polymer matrix at low concentrations (~0.2 weight %) leads to significant improvements. In the compressive and flexural mechanical properties of polymeric nanocomposite. Potentially, these nanocomposites may be used as a novel, mechanically strong, lightweight composite as bone implants. For example, a flesh welder was demonstrated to fuse two pieces of chicken meat into a single piece using a suspension of gold-coated Nanoshells activated by an infrared laser. This could be used to weld arteries during surgery [(5)].

4. Drug selection criteria:

The selection and design of a polymer are challenging tasks because of the inherent diversity of structures and require a thorough understanding of the surface and bulk properties of the polymer that can give the desired chemical, interfacial, mechanical, and biological functions. The choice of polymer, in addition to its physicochemical properties, is dependent on the need for extensive biochemical characterization and specific preclinical tests to prove its safety. There are also many polymers that have been investigated and have applications in different routes of drug delivery system. Surface properties such as hydrophilicity, lubricity, smoothness, and surface energy govern the biocompatibility with tissues and blood, in addition to influencing physical properties such as durability, permeability, and degradability.

4.1 Natural polymers:

Natural polymers, e.g., gelatin, collagen, and lecithin, have been widely used in pharmaceuticals for many years. These offer various advantages due to their biodegradable nature, excellent biocompatibility, non-toxic, wide applicability as such or after modification, well-known structural and physiological properties, and less immunological properties.[34] the natural polymers are basically of four types, e.g., protein based such as collagen and gelatin, polysaccharides based such as lecithin, chitosan polyethylene oxide (peo) and polyoxypropylene (pop), and some carbohydrate blends, e.g., cellulose/poly(ethylene glycol) (peg) blend.

4.2 synthetic polymers:

Synthetic polymers have gained a significant attention in recent years due to their wide range of varieties that offer added flexibility in terms of their application in ddss. These are available in a wide variety of composition with readily adjustable properties. Bulk preparation of synthetic polymers is easy, which also eliminates the additional step of purification in the case of natural polymers. In contrast to natural polymers, these are considered less prone to bacterial contamination. However, synthetic polymers also suffer from some disadvantages, including the following:

Toxicity of the chromium compounds.

(i) potential hazards as water pollutants.

(ii) fairly high temperatures (55–70°c) of operation.

(iii) a system can produce similar etching of plastic articles made from synthetic polymer resins. The synthetic polymers are basically of two types:

(iv) biodegradable such as polyester, poly amide, etc. 2. Non-biodegradable such as cellulose derivatives, acrylic polymer, etc. [(6)]

5. Composition

5.1 Target: target means specific organ or a cell or group of cells, which in chronic or acute condition need treatment.

5.2 Carrier or marker: carrier is one of the special molecule or system essentially required for effective transportation of loaded drug up to the pre-selected sites. They are engineered vectors, which retain drug inside or onto them either via encapsulation and/ or via spacer moiety and transport or deliver it into vicinity of target cell. [7]

6. Manufacturing

6.1 Salting out method

This technique has the benefit of lowering the stress on the protein involved in the synthesis of encapsulants, and it produced high efficiency and was simple to scale up. The extraction of water miscible solvent from such an aqueous solution is what causes the salting-out phenomenon. The first phase involves dissolving the drug as well as the polymer in a vehicle, which would be subsequently emulsified into such an aqueous gel with salting out reagent and a colloidal stabiliser. Colloidal stabilisers and salting out agents, including electrolytes and non-electrolytes, have indeed been employed. By using this method, an oil/water emulsion is created, that is then diluted with additional water to improve solvent diffusion inside the aqueous phase and facilitate the production of nano-spheres. The manufacture of ethyl cellulose, pla, and poly-methacrylic acids nanospheres uses the salting out method.

6.2 Solvent evaporation method

this method depends on both how soluble the polymer is and how hydrophobic the organic solvent is. Ibuprofen's better skin absorption and betulinic acid nanoparticles as an alternate treatment for visceral leishmaniasis are two examples. The first step is the emulsification of a polymer solution in an aqueous phase, which is proceeded by the evaporation of the solvent of the polymer, which causes the polymer to precipitate as nano-spheres. The drug polymer mixture is emulsified inside an aqueous solution that includes a surfactant or emulsifying agent to create oil in water (o/w) emulsion. Once a stable emulsion has been established, the organic solvent then is evaporated either by constant stirring or by lowering the pressure. To create tiny particle sizes, ultrasonication or highspeed homogenization may well be utilised. Nanoparticles are gathered by ultracentrifugation, and then any free drugs or stabiliser residue is removed by washing them in distilled water. For preservation, nanoparticles are even further lyophilized.

6.3 Emulsions–diffusion method:

excellent encapsulation efficiency, the absence of homogenization, high batch-to-batch repeatability, ease of scaling up, ease, and limited size range are just a few advantages of this method. This method was utilised to create poly lactic acid and make plga nanoparticles that were loaded with estrogen. The encapsulating polymeric is saturated with water after being mixed in a solvent that is partially water-miscible. Next, based on the oil-to-polymer proportion, the polymer-water saturated solvent phase is emulsion in an aqueous solution that contains a stabilizer, resulting in solvent diffusion to the outer phase as well as the creation of nano-spheres or nano-capsules. Based on the solvent's boiling point, the solvent is eliminated in the final phase either through evaporation or filtration.

6.4 Double emulsion and evaporation method:

Examples of drug nano-formulations created using the double emulsion approach includes oleuropein with increased stability and rose bengal for the treatment of breast carcinoma. The double emulsion method is used to load the lipophobic medication. Drug solutions are added to an organic solution that contains the polymer while being stirred constantly to create a w/o emulsion. The second aqueous phase then gradually incorporates the created emulsion. Continue spinning until the w/o/w emulsion forms. After the solvent has evaporated, high-speed centrifugation may be used to separate the nanoparticles.

6.5 Coacervation or ionic gelation method:

two distinct aqueous phases have been prepared, one for the polymer and the other for the polyanion sodium tripolyphosphate, and it varies depending on the strong electrostatic attraction between both the positively charged amino group of chitosan and the negatively charged tripolyphosphate to shape coacervates with a magnitude in the nano-meter range.

6.6 Polymerization method:

Diffusion in the polymerization medium or adsorption onto to the nanoparticles after completion polymerization is the two ways that drugs are introduced during the polymerization an isotonic medium devoid of surfactants can be utilized to re-disperse the nanoparticle suspension after ultracentrifugation to remove the various stabilizers and surfactants that were employed throughout polymerization.

6.7 Nano spray drying:

A quick, easy, repeatable, and expandable drying method known as spray drying provides for moderate ambient temperature that are ideal for heat-sensitive biopharmaceutical molecules. In contrast to certain other drying techniques, spray drying is a continual process that turns various liquids into solid particles while providing for alterations in dimension, distribution, structure, porosity, density, and chemical properties. Four steps are involved in spray drying: heating the drying gas, producing droplets, drying the droplets, and collecting the particles.

6.8 Supercritical fluid technology:

although suitable for large-scale production and is ecologically beneficial, it requires specialized, expensive gear. Supercritical fluids are fluids that, even at temperatures higher than their critical temperature, maintain their homogeneity. Due to its moderately critical conditions, non-flammability, high cost, and safety, supercritical co2 (sc-co2) is the supercritical fluid that receives the most applications [(8)].

7. EVALUATION

Ph-ph fluctuations in various organs and tissues of the body, such as the stomach (ph≈ 2) and intestines (ph≈ 7), ph is one of the most widely used stimuli in smart dds. Also, due to the significant ph difference found at the cellular level between the cytosol (7.4), the golgi apparatus (6.40), the endosome (5.5-6.0) and the lysosome (4.5-5.5), they are especially suitable for design intracellular-specific 235 delivery. In addition, there is a difference between the extracellular ph of blood and healthy tissues (7.4) and damaged tissues such as tumor tissues (6.5-7.0) and inflammatory tissues (ph drop to 6.5). Also, healing progress index, is another application of ph-changes.

7.1 Redox conditions: In nature, molecules containing sulfur (ii) such as cysteine and cysteine-derived compounds (e.g., glutathione, gsh, etc.) Are known as defense compounds. Gsh – glutathione disulfide is the most important redox pair in animal cells. Reduction of gsh by nadph and glutathione reductase is a known redox system in cancer cells. 250 also, since gsh is an intracellular substance present in different parts of the body and its amount in tumor tissues is higher than healthy tissues (4 to 7 times more), therefore the role of gsh as a stimulus to stimulate drug release in tumor cells strengthens.

7.2 Temperature: temperature is one of the easiest and most effective stimulants to control drug secretion. In general, thermo-sensitive nanocarriers are designed to store their payloads at a physiological temperature of 37° c and when the temperature rises above 40-45 ° c, release the cargo quickly. Typically, pathophysiological conditions such as inflammation, infarction or tumor, as well as infections caused by microorganisms cause a local increase 275 in temperature in the affected tissues.

7.3 light- one way to stimulate drug release at the target by external light illumination are light-responsive systems. 280 stimulation of formulations placed on the skin or that circulate through blood vessels close to the body surface (e.g., eye structures) by ultraviolet (uv) rays and visible light causes the drug to be released. In photo sensitive carriers, excitation by one-time or repeatable light irradiation is accompanied by the opening or closing of the nanostructure, resulting in the release of the drug.

7.4 Electrical field- electrically sensitive networks can be created using polyelectrolytes with a high density in ionizable groups. Injectable drug-loaded microparticles or implants for subcutaneous insertion can be used to prescribe these 290 networks. In this way, by placing an electro-conducting patch on the skin through the implantation site and turning on the battery, the protons move towards the cathode and by changing the ph near the electrodes, it causes the network to shrink, thus the drug is released by squeezing.

7.5 Magnetic field -magnetite- and Magmite-based nanoparticles are the most commonly used magnetic nanoparticles as contrast agents for magnetic resonance imaging (mri). Using magnetic stimuli, a non-invasive approach is possible to temporally and spatially control of the Carriers to the targets and release of the drug is performed under programmable exposure of external magnetic field.

7.6 Ultrasound -305 because ultrasound has high immunity and the ability to penetrate body tissues with low frequency and very low scattering, it is widely used in clinics for diagnosis and treatment. Ultrasound can be applied to the body using common physiotherapy equipment by adjusting the frequency, duty cycles and time of exposure to capture drug carriers and trigger drug release. As a result, it can be used as a unique technique in the development of intelligent nanocarriers (ultrasonic sensitive nanocarriers) [(9)].

8 Result & discussion-

Researcher/year	**title of work**	**Work summary & findings**
Buzu elema et al., (2020)	Smart drug delivery system: a review archives of clinical case reports	In this review article suggested that the smart drug delivery system on targeted drug delivery system, their formulation, side effects & technology develop in targeted drug delivery system.
Saeideh hosseini (2021	Smart drug delivery systems: concepts and clinical applications	Targeted drug delivery (tdd) is being developed as one of the most advanced medical science techniques in the diagnosis and treatment of diseases. As the name implies, it means that the drug is delivered to the target cells and tissues. This results in a lower dose as well as a significant reduction in side effects with maximum bioavailability and high efficacy of the drugs.
Mahajan.et.al (2007)	Targeted drug delivery system,	The objectives of drug targeting are to achieve a desired pharmacological response at a selected site without undesirable interactions at other sites. This is especially important in cancer chemotherapy and enzyme replacement therapy. Drug targeting is achieved by two approaches. The first approach involves chemical modification of a parent compound to a derivative which is activated only at the target site.
Sarvan et al., (2024)	Target drug delivery system: an advance approach of pharmaceuticals,	The application of nanotechnology to medicine, particularly more particularly to the administration of drugs, is expected to grow quickly. Pharmaceutical sciences have used nanoparticles to lessen the toxicity and adverse effects of drugs for many years. It wasn't known until recent that the carrier systems itself could present dangers to the patient. Further than the typical risks given by compounds in delivery matrix, new risks are added by the use of nanoparticles for medication administration.in order to advance this topic, strong cooperation between individuals involved in particle toxicology and drug delivery is required for the exchange of ideas, techniques, and knowledge

9. MARKETED EXAMPLES

Some of the formulations using targeted therapy for cancer are already available within the market, for instance, myocyte (liposomal doxorubicin) daunoxome (liposomal daunorubicin). Doxil (liposomal doxorubicin), depocyt (liposomal cytarabine), and abraxane (albuminbound paclitaxel particles). Some of the samples of antibodies directed toward cancer therapy include rituxan (rituximab), herceptin (trastuzumab), and campath (alemtuzumab) [(10)].

Drug/marketed formulation	Strength/dosage form	Application
1) adalimumab 2) Humira 3) cetuximab 4) Erbitux 5)daunorubicin 6) daunoxome 7) cytarabine 8) depocyt 9) paclitaxel 10) abraxane	40 mg i Njection 100 mg/50 ml Iv infusion 2 mg/ml concentrate for solution for infusion 50 mg intrathecal injection 100 mg Lyophilized powder for injectable suspension	Tumor necrosis factor (tnf) blocker Anticancer targeted therapy hiv-related kaposi's sarcoma Intrathecal treatment of lymphomatous meningitis Metastatic breast cancer

10. RECENT ADVANCES

10.1 Insulin pump:

The ultimate goal for diabetes mellitus is to control the blood glucose level by insulin delivery and minimized the long-term diabetic complications. Currently main therapy is to administered insulin through subcutaneous injection for diabetes patients. Two or three injections are required a day to maintain the normal blood glucose level. Because this method is burdensome and invasive to living organisms, the patient's situation would not be good regarding the quality of life. Therefore, an electrical and mechanical controlled insulin pump that injects insulin automatically into the bloodstream has been developed. An insulin pump constructed with polymer materials has been studied. Many researchers working on deliver insulin by smart device.

10.2 gluco watch

A GlucoWatch™ biographer is non-invasive, watch like device that measures glucose. A plastic part of gluco watch that snaps into the biographer and sticks to the skin. Auto- matic reading every 10 min up to 13 hrs is taken by it. Gluco watch presently takes the lead among user-friendly techniques aimed at glucose monitoring. This system is based upon the principle of reverse iontophoresis.

Stimuli-responsive drug-delivery systems in clinical trials: –

a. Auroshell: thermosensitive gold nano shell is prepared by nano spectra biosciences for intracranial tumor –

B. Opaxio: enzyme-activated polymeric np is prepared by cell therapeutics, inc. For treatment of ovarian cancer.

c. Thermodox: thermosensitive liposomal doxorubicin is prepared by cession corporation are useful in breast cancer and primary liver cancer.

d. Nonother: magnetic sensitive iron oxide nps are prepared by magforce nanotechnologies ag for glioblastoma, prostate cancer, esophageal cancer and pancreatic cancer. [(11)]

11. CONCLUSION

The administration of therapeutic compounds using conventional methods for treatment or prevention of disease affects both diseased and normal cells of the body and associated with a severe side effect. To enhance the efficiency and reduce adverse side effects of therapeutic agents other safe and suitable drug delivery systems such as smart drug delivery system has been designed [(12)]. Delivery of drug molecule to reach its specific site is itself a difficult task in the complex cellular network of an organism. Finally, targeted drug delivery is coming forward as one of the brightest advanced techniquein the medical sciences in the diagnosis and treatment of couple of lethal diseases. It has crossed the infancy period and now touching height of growths in research and development in clinical and pharmaceutical fields. Several such preparations have entered the phases of clinical testing or trials have now been marketed. However, such strategies should be subjected to continuous evaluation in the light of advances in the understanding of the numerous processes occurring in response to administration of the carriers or vehicles with drugs of interest with site specificity. New strategies under investigation should periodically undergo evaluation, taking advantage of the 'bench to bed-side' experience available today. [(13)]

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