Drug Delivering Technique Using Ferromagnetic Nano Particles Under the Impact of Magneto-Reception

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Abstract–

We have two problems that we want to solve, the first problem is that the drug may be take a lot of time to reach the target area and this will lead us to another problem which is, the medication is distributed throughout the body through the systemic blood circulation Targeted drug delivery seeks to concentrate the medication in the tissues of interest while reducing the relative concentration of the medication in the remaining tissues. Targeted delivery is believed to improve efficacy while reducing side-effects such as in chemotherapy where roughly 99% of the drugs administered do not reach the tumor site. The second problem is there are some drugs can't reach the specific area like the protein as the proteins can be digested before reaching the target. So solving these two problems by the ferromagnetic nano cobalt ferrite in the drug which will attract to the magnetic receptors found on the cell that we want to treat. As Magnetoreception is present in bacteria, arthropods, molluscs, and members of all major taxonomic groups of vertebrates.

I. Introduction

We have two main problems that we seek to solve it and we tried to find a solution for it. The first problem is that the drug may be take a lot of time to reach the target area. Having two main problems that we seek to solve it and we tried to find a solution for it. For most therapeutic agents, only a small portion of the medication reaches the organ to be affected. The second problem that there are some drugs can't reach the specific area like the protein as the proteins can be digested before reaching the target. Humans are not thought to have a magnetic sense, but there is a protein (a cryptochrome) in the eye which could serve this function. Under normal conditions, birds are sensitive to only a narrow band of magnetic field strengths around the geomagnetic field strength but can orient at higher or lower magnetic field strengths given accommodation time. The structure of cryptochrome from a plant (Arabidopsis thaliana) is available, and the cryptochromes of plants and birds are structurally very similar. Recent experiments by Ahmad et al. (Ahmad, Galland, Ritz, Wiltschko and Wiltschko. Magnetic intensity affects cryptochrome- dependent responses in Arabidopsis thaliana. Planta 225, 615-624 (2007)) have shown that Arabidopsis seedlings exhibit a magnetic field effect. Processes involved with cryptochrome signaling (such as hypocotyl growth inhibition) are enhanced under a magnetic field of 5.

II. Background Research

A. Nanotechnology is a relatively novel interdisciplinary area of comprehensive research that combines the basic sciences, like biology and chemistry, with engineering and medicine. Nanotechnology involves creating and utilizing the constructs of variable chemistry and architecture with dimensions at the nanoscale level comparable to those of biomolecules or biological vesicles in the human body. According to Mustafa El Sayed research for making a bio marker for the cancerous cell he used the gold to mark these cells. When gold or silver nanoparticles are conjugated to cancer antibodies or other cancer targeting molecules, the cancer cells selectively labelled with those nanoparticles and can be easily detected under a simple microscope due to their strongly enhanced light scattering properties then used the laser to heat up these cells.

B. Magnetoreception is a sense which allows an organism to detect a magnetic field to perceive direction, altitude, or location. This sensory modality is used by a range of animals for orientation and navigation, and as a method for animals to develop regional maps. For the purpose of navigation, magnetoreception deals with the detection of the Earth's magnetic field. Magnetoreception is present in bacteria, arthropods, molluscs, and members of all major taxonomic groups of vertebrates. Humans are not thought to have a magnetic sense, but there is a protein (a cryptochrome) in the eye which could serve this function.

C. Fish appear to steer with magnets. Scientists have zeroed in on the likely source of some animals' sense of direction. Cryptochrome isn't unique to birds – it's an ancient protein with versions in all branches of life. In most cases, these proteins control daily rhythms. Humans, for example, have two cryptochromes – CRY1 and CRY2 – which help to control our body clocks. But Lauren Foley from the University of Massachusetts Medical School has found that CRY2 can double as a magnetic sensor.

D. In traditional drug delivery systems such as oral ingestion or intravascular injection, the medication is distributed throughout the body through the systemic blood circulation Targeted drug delivery seeks to concentrate the medication in the tissues of interest while reducing the relative concentration

of the medication in the remaining tissues. For example, by avoiding the host's defense mechanisms and inhibiting non-specific distribution in the liver and spleen, a system can reach the intended site of action in higher concentrations. Targeted delivery is believed to improve efficacy while reducing side-effects such as in chemotherapy where roughly 99% of the drugs administered do not reach the tumor site.

There's also been evidence in recent years that, in birds, the cryptochromes in their eyes are responsible for their ability to orient themselves by detecting magnetic fields, a sense called magnetoreception. According to researchers at the Theoretical and Computational Biophysics group at the University of Illinois at Urbana-Champaign, whose researcher Klaus Schulten first predicted magneto receptive cryptochromes in 1978, they could provide a magnetic field "filter" over the bird's field of view.

III. Materials & Methods

Materials

There are three types of magnetic materials, and they are Paramagnetic materials, Diamagnetic materials and Ferromagnetic materials. And we will work on the Ferromagnetic materials which are materials that have magnetic properties like those of iron. They can become permanently magnetized. Examples of ferromagnetic materials are nickel, cobalt, and alnico, an aluminum- nickel-cobalt alloy. Magnetic fields are produced by currents. If you have a strong enough magnetic field all matter is magnetic.

•Nano Cobalt: Our cobalt nanoparticles can be used for Contrast agents in magnetic resonance imaging; Electromagnetic-wave absorption. The magnetic properties of nano- materials have been believed to be highly dependent on the sample shape, crystallinity, magnetization direction, and so on. Nanoparticles have common features of superparamagnetic behavior at room temperature. Cobalt is a ferromagnetic metal with a specific gravity of 8.9. The Curie temperature is 1,115 °C (2,039 °F) and the magnetic moment is 1.6–1.7 Bohr magnetrons per atom. Cobalt has a relative permeability two-thirds that of iron.

•Cryptochromes (from the Greek "hidden color") are a class of flavoproteins that are sensitive to blue light. They are found in plants and animals. Cryptochromes are involved in the circadian rhythms of plants and animals, and possibly also in the sensing of magnetic fields in several species.

•Nano Magnetic receptors bind to the cells to attract the drug with the nano cobalt which is a magnetic material.

Methods

We will dedicate the specific area with a biomarker to put on the Magnetic receptors then put a cryptochrome protein on the cells we want to treat. As cytochrome affected by magnetic field Then prepare the cobalt ferrite (CoFe2O4) nanoparticles were obtained through self-combustion and wet fertilization methods using aqueous extracts of Hibiscus rosa-sinensis flower and leaf. X-ray diffraction, scanning electron microscopy, Fourier transform infrared spectroscopy, and magnetic measurements were used for the characterization of the obtained oxide powders. we will put the Nano cobalt ferrite with the protein to combine with the drug and this will make the drug attract to the cell with the magnetic receptor. Particle sizes 24 nm and 26 nm. The X- ray diffraction patterns confirmed the formation of single phase CoFe2O4 ferrites. Reagents. The iron nitrate (Fe (NO3)3· 9H2O), the cobalt nitrate (Co (NO3)2· 6H2O), and silver nitrate (AgNO3) were of reagent quality (Merck). Hibiscus f lowers/leaves were from local market. Preparation of Hibiscus Flower Extract. 5g of dried flowers was placed in 100 mL distilled water under stirring. The mixture was boiled for 15min.The bright red extract (pH =2) was then cooled at room temperature and filtered. Preparation of Hibiscus Leaf Extract. 5g of fresh leaves was cut and was placed in 100mL distilled water under continuous stirring. The mixture was boiled for45min.until the color of the aqueous solution became yellow green (pH=6). The extract was cooled at room temperature and filtered. Synthesis of Cobalt Ferrites. The Self-Combustion Process. The metal nitrates (2Fe3+: 1Co2+) were added slowly under stirring to the aqueous extract of Hibiscus Rosa-sinensis flower.

The obtained solution was concentrated until a gel was formed. This gel was placed onaheaterat250–300 ∘C. Initially, the gel melted and then, decomposed spontaneously by self-ignition, leaving behind voluminous foam (H1). This self-combustion reaction is a redox process in which the polyphenols from the hibiscus flower extract act as reducing agent. The magnetic foam was annealedat800∘C/1htoimprovethe degree of crystallization of cobalt ferrite(H1-800). The Wet Ferritization Reaction. The metal nitrates (2Fe3+:1Co2+) were added under stirring to the aqueous extract of Hibiscus rosa-sinensis leaf and the pH was raised to 10 by adding NH4OH 25%. A dark brown precipitate was separated. The suspension was maintained at 80∘C/4h. After four hours, the precipitate became magnetic. It was filtered and dried(H6) on phosphorous pentoxide. A thermal treatment at 800∘C for 1h led to a well crystallized cobalt ferrite(H6-800). Synthesis of Ag-CoFe2O4 Nanoparticles through Self Combustion Method. Silver-cobalt ferrites have been obtained by the same procedure as for the CoFe2O4, described above, using metal nitrates in a 2Fe3+:0.8Co2+: 0.2Ag + ratio and hibiscus flower/leaf extract(H10/H11).

To improve the degree of crystallization, a thermal treatment at 800∘C/1hwasrequired(H10-800/H11-800).

Characterization Techniques. A quantitative reversed phase high-performance liquid chromatographic (RP-HPLC) method with DAD detection has been developed for the separation and the quantification of the flavonoids and phenolic acids in hibiscus flower/leaf extracts. The next step that we will inject the body with the drug will have been combined with Nano cobalt ferrite and the protein. Then the magnetic receptor will

attract the drug with the magnetic material and the protein. And the disease will be treated faster and specifically.

IV. CRYPTOCHROME & TARGETED DELIVERY

Cryptochromes are photolyase-like blue light receptors originally discovered in Arabidopsis but later found in other plants, microbes, and animals. Arabidopsis has two cryptochromes, CRY1 and CRY2, which mediate primarily blue light inhibition of hypocotyl elongation and photoperiodic control of floral initiation, respectively. In addition, cryptochromes also regulate over a dozen other light responses, including circadian rhythms, tropic growth, stomata opening, guard cell development, root development, bacterial and viral pathogen responses, abiotic stress responses, cell cycles, programmed cell death, apical dominance, fruit and ovule development, seed dormancy, and magnetoreception. Cryptochromes have two domains, the N- terminal PHR (Photolyase-Homologous Region) domain that bind the chromophore FAD (flavin adenine dinucleotide), and the CCE (CRY C-terminal Extension) domain that appears intrinsically unstructured but critical to the function and regulation of cryptochromes. Most cryptochromes accumulate in the nucleus, and they undergo blue light-dependent phosphorylation or ubiquitination. It is hypothesized that photons excite electrons of the flavin molecule, resulting in redox reaction or circular electron shuttle and conformational changes of the photoreceptors. The photoexcited cryptochrome are phosphorylated to adopt an open conformation, which interacts with signaling partner proteins to alter gene expression at both transcriptional and posttranslational levels and consequently the metabolic and developmental programs of plants.

Nanotechnology notably contributes to improving the quality of drug delivery, diagnosis and treatment surmounting various problems associated with traditional drugs including low solubility of hydrophobic drugs, non-specific or o ff-target delivery. Thanks to modern intensive research on advanced delivery systems, the non-selective drug distribution between diseased and intact tissues are expected to be a trail of the past, therefore, manipulating the therapeutic or diagnostic agent for fitting targeting purposes has become the need of the hour.

Targeting strategies prompted manifold benefits over traditional drug delivery systems including evading side effects associated with indiscriminate drug distribution to almost all body organs as seen mostly with chemotherapeutic agents used to treat cancer. These chemotherapeutic agents have the highest share of serious adverse effects as they affect normal cells especially those having common features with cancer cells like extensively proliferative cells of bone marrow, hair follicles, and alimentary tract. Normal cells that are not described as extensively proliferative also do not subsist cytotoxicity as seen with the cardiotoxic effect of doxorubicin anticancer. These adverse effects do not only affect patients' quality of life, their compliance or even life expectancy, but they also can be as lethal as bone marrow suppression, reduced immunity and cardiovascular toxicity. While other nanotechnology-based drugs offer the ability to target the site of action actively via ligand-mediated endocytosis or passively depending on enhanced permeability and retention.

V. ACKNOWLEDGMENT

New developments are currently being under investigations regarding synthesis of ionps e.g., supercritical fluid extraction is a new method for preparation of ionps and considered as a green, nontoxic process. This method depends only on water at plasma state obtained under certain heat and pressure values producing high solubilization efficiency of water as solvent. Reducing the harmful chemicals needed, costly and high energy requiring traditional methods of magnetic nanoparticles synthesis through using novel, green and environmentally friendly synthesis methods based on plants and/or organic materials e.g., (Urtica leaf extract, caffeine, pomegranate peel extract, egg white, etc. Studies also are performed on improving the efficiency of biomedical application as for monitoring dynamical magnetic response aiming to reduce the dramatic heat loss of ionps occurring after cell internalization allowing efficient performance of the magnetic nanoparticles during hyperthermia process, studying their newly prompted biomedical applications as 3D cell culture, toxicity reduction via utilizing safe and biocompatible material and solvents. Although magnetic nano particles used for hyperthermia are under clinical trials especially form an aging serious cancers like glioma, metastatic bone cancer, prostate cancer, etc., the targeting-based models still require excessive efforts and complete understanding of their pharmacokinetic and pharmacodynamics manner for moving them out of the pipeline into market.

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