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Nano-electrocrystals in pharmaceutical drug delivery

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Abstract
In this review that explained applications of nano-electrocrystals as a drug delivery., Nanocrystals that are used to deliver medicinal drugs have gained importance in recent decades as a result of the development in nanomedicine where the resulting vesicle, which has a watery core surrounded by a hydrophobic membrane, can be loaded with a variety of hydrophobic or hydrophilic molecules for therapeutic purposes. Liposomes are usually synthesized with naturally occurring phospholipids, mainly phosphatidylcholine. Cholesterol is often included in the preparation to adjust film stiffness and increase its stability. The molecular load is induced by formation of liposomes in aqueous solution, solvent exchange mechanisms, or pH gradient methods. Different molecules can also be chemically coupled to the surface of the liposome to alter the recognition properties. One typical modification is the coupling of polyethylene glycol (PEG) to the vesicle surface. The hydrophilic polymer prevents identification by macrophages and reduces filtration. Size, surface charge, and bilayer fluidity also alter the conduction kinetics of liposomes. The liposomes diffuse from the bloodstream into the interstitial space near the target site. Since the cell membrane itself is composed of phospholipids, liposomes can fuse directly with the membrane and release the charge into the cytosol, or they may enter the cell through phagocytosis or other active transport pathways.

Keywords: nano crystal, drug delivery, nano medical, nano polymer, review, drug carrier

Introduction
The delivery of body fat has various advantages. Liposomes increase the solubility, stability and adsorption of drug molecules. Peptides, polymers, and other molecules can be drained onto the surface of the liposome for targeted delivery. Coupling of different ligands can facilitate binding to target cells based on the interaction of ligand-receptors. Changing vesicle size and surface chemistry can also be adjusted to increase circulation time [1, 2]. Several lipotropic drugs approved by the Food and Drug Administration (FDA) are in clinical use in the United States. The anthracycline doxorubicin is delivered with phospholipids and cholesterol to treat AIDS-associated Kaposi's sarcoma and multiple myeloma with high efficacy and low toxicity. Many others are undergoing clinical trials, and lipid drug delivery remains an active area of research today, with potential applications including DNA therapy, brain targeting, and oncology [3]. Emerging drug delivery methods incorporating nanotechnology methods could be beneficial by optimizing heightened somatic response, specific targeting, and efficacy, with a non-toxic metabolism. Several nanotechnology methods and materials can be employed for drug delivery. Ideal Materials uses a controlled nanomaterial to transport a drug charge into the body. Mesoporous silica nanoparticles (MSN) are increasingly popular for research due to their large surface area and flexibility to many individual modifications while demonstrating high-resolution performance under imaging techniques. Activation methods vary greatly across nanoscale drug delivery molecules [4-7]. but the most common activation method uses specific wavelengths of light to release the payload. Nanovalve-controlled cargo release uses low-intensity illumination and plasmonic heating to release the payload in a variety of MSN containing gold particles. A two-photon phototransducer (2-NPT) uses wavelengths close to the IR to induce disulfide bond breaking to release the load. Recently, nanodiamonds have shown potential in drug delivery due to their non-toxicity, spontaneous absorption across the skin, and ability to enter the blood barrier [8-11].

Mechanism of drug transport through nanocrystals
An ideal drug delivery system should have effective targeting and controlled release. Two main targeting strategies are passive targeting and active targeting. Passive targeting is based on the fact that tumors have blood vessels of abnormal structure that favor the accumulation of relatively large particles and nanoparticles. This so-called enhanced permeability and retention effect (EPR) allows the drug carrier to be transported specifically to cancer cells. Active targeting, as the name implies, is more specific and is achieved by taking advantage of ligand-receptor interactions on the surface of the cell membrane. Controlled drug release systems can be

achieved in several ways. Programmed drug delivery systems are tuned to the rate at which active agents diffuse across the membrane. Another mechanism of delivery and release is activation modulated drug delivery, in which release is triggered by environmental stimuli. Stimuli can be external, such as the introduction of chemical stimuli or activation by light or electromagnetic fields, or biological - such as pH, temperature and osmotic pressure which can vary widely throughout the body. For polymeric nanoparticles, the induction of stimuli response is highly dependent on known polymers that possess an inherent stimuli response. Some polymers that can undergo reversible phase transitions due to changes in temperature or pH have aroused interest [12-14]. Arguably the most widely used polymer for activation-modified delivery is the heat-responsive poly(N-isopropylacrylamide) polymer. It is readily soluble in water at room temperature but precipitates reversibly from when the temperature rises above the low critical solution temperature (LCST), changing from forming an extended chain to a collapsed chain. This feature presents a method for changing the hydrophilicity of the polymer via temperature. Efforts are also focused on dual stimuli-responsive drug delivery systems, which can be harnessed to control encapsulated drug release. For example, the tri-block polymer poly (ethylene glycol)-b-poly (3-aminopropyl-methacrylamide)-b-poly (N-isopropylacrylamide) (PEG-b-PAPMA-b-PNIPAm) can be self-assembled to form micelles, which It possesses a core–shell–corona structure above the lower critical solution temperature. It is also responsive to acidic or basic medium. Therefore, drug release can be adjusted by changing the temperature or pH conditions. Drug delivery strategies for inorganic nanoparticles depend on the properties of the materials. Active targeting of inorganic nanoparticle carriers is often achieved by surface activation with specific ligands of nanoparticles. For example, the multifunctional inorganic nanocomposite (5-FU/Fe3O4/αZrP@CHI-FA-R6G) is able to accomplish simultaneous imaging and tumor optical therapy. It can be directed to the site of tumor cells with continuous analytic behavior. Studies have also been performed on the responses of gold nanoparticles to near-infrared (NIR) light as a drug-release catalyst. In one study, gold nanoparticles with double-stranded DNA encapsulated with drug particles were irradiated using NIR light. The particles generated heat and denatured the double-stranded DNA, causing the drugs to be released at the target site. Studies also indicate that the porous structure is useful for achieving sustained or pulsed firing. Porous inorganic materials exhibit high mechanical and chemical stability under a range of physiological conditions. Well-defined surface properties, such as large pore size, narrow pore diameter distribution, and high surface area allow trapping of drugs, proteins and other biogenic molecules with predictable and reproducible release patterns [15-17].

Disadvantages of Nanocrystals

Some of the same properties that make nanoparticles effective drug carriers also contribute to their toxicity. For example, gold nanoparticles are known to interact with proteins through surface adsorption, which can be used for cargo loading and immune protection. However, this property of protein adsorption can also disrupt the normal protein function necessary for homeostasis, especially when the protein contains exposed sulfur groups. The photo thermal effect, which can be stimulated to kill cancer cells, may also create reactive oxygen species that impose oxidative stress on surrounding healthy cells. Gold nanoparticles with sizes less than 4-5 nm fit into DNA grooves which can interfere with transcription, gene regulation, replication and other processes that depend on DNA protein binding. The lack of biodegradability of some nanoparticle chemicals can cause them to accumulate in certain tissues, thus interfering with a wide range of biological processes. Currently, there is no regulatory framework in the United States for testing nanoparticles for their overall health and environmental impact. Nanoparticles present potential risks, both medically and environmentally. Most are due to the high surface-to-volume ratio [18-20], which makes the particles highly reactive or catalyst. They are also able to pass through cell membranes in living organisms, and their interactions with biological systems are relatively unknown. However, particles are not likely to enter the cell nucleus, Golgi complex, endoplasmic reticulum or other internal cellular components due to particle size and intercellular clumping. A recent study looking at the effects of ZnO nanoparticles on human immune cells found varying levels of susceptibility to cytotoxic infection. There are concerns that pharmaceutical companies, seeking regulatory approval for the nano-formulations of existing drugs, are relying on safety data produced during clinical studies of the previous reformulated version of the drug. This may lead to regulatory agencies, such as the Food and Drug Administration, missing out on the new side effects of nano-reformulation. However, significant research has shown that zinc nanoparticles are not absorbed into the bloodstream *in vivo*. Concerns have also been raised about the health effects of breathable nanoparticles from certain combustion processes. Preclinical investigations have shown that some inhaled or injected noble metal nanostructures avoid persistence in living organisms. As of 2013 the US Environmental Protection Agency was researching the safety of the following nanoparticles [21-24]:

Carbon Nanotubes

Carbon materials have a wide range of uses, ranging from composite materials for use in vehicles and sports equipment to integrated circuits for electronic components. Interactions between nanomaterials such as carbon nanotubes and natural organic materials strongly influence both their accretion and deposition, strongly affecting their transport, transformation and exposure in aqueous environments. In previous research, carbon nanotubes have demonstrated some toxicological effects that will be evaluated in different environmental settings in current

EPA chemical safety research. EPA research will provide data, models, test methods, and best practices for discovering the acute health effects of carbon nanotubes and identifying ways to predict them.

Cerium Oxide

Nano-cerium oxide is used in electronics, biomedical supplies, power, and fuel additives. Many applications of engineered cerium oxide nanoparticles disperse naturally in the environment, increasing the risk of exposure. There is ongoing exposure to new diesel emissions using fuel additives containing CeO2 nanoparticles, and the environmental and health implications of this new technology are unknown. EPA Chemical Safety Research assesses the environmental, environmental, and health impacts of diesel fuel additives that support nanotechnology.

Titanium dioxide

Nano titanium dioxide is currently used in many products. Depending on the type of particles, they can be found in sunscreens, cosmetics, paints, and coatings. It is also being tested for use in removing contaminants from drinking water.

Nano Silver

Nano silver is incorporated into textiles, clothing, food packaging and other materials to eliminate bacteria. The Environmental Protection Agency and the US Consumer Product Safety Commission are studying certain products to see if they transmit nano-sized silver particles in real-world scenarios. The Environmental Protection Agency is researching this topic in order to better understand the extent to which children come into contact with nano-silver in their environments. Iron: While nanoscale iron has many uses being investigated, including as "smart fluids" for uses such as polishing optics and as a better absorbent iron supplement, one of its most notable current uses is the decontamination of groundwater [25, 26]. This use, with support from Environmental Protection Agency research, is being piloted at a number of sites across the United States. Figures (1 -7).

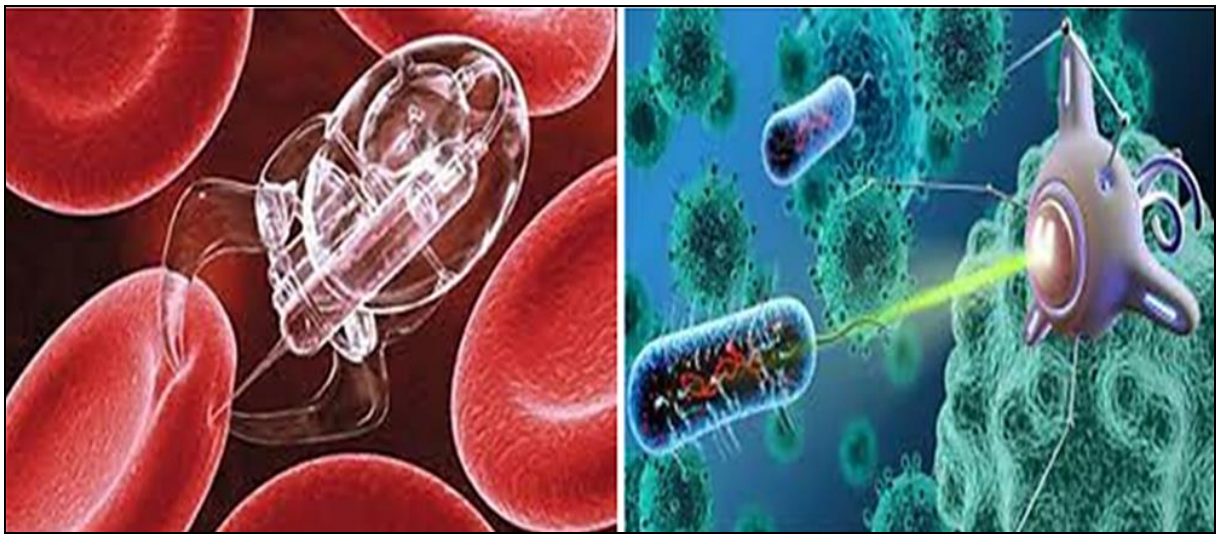

Fig 1: Nano-Robots for biological and surgical treatment

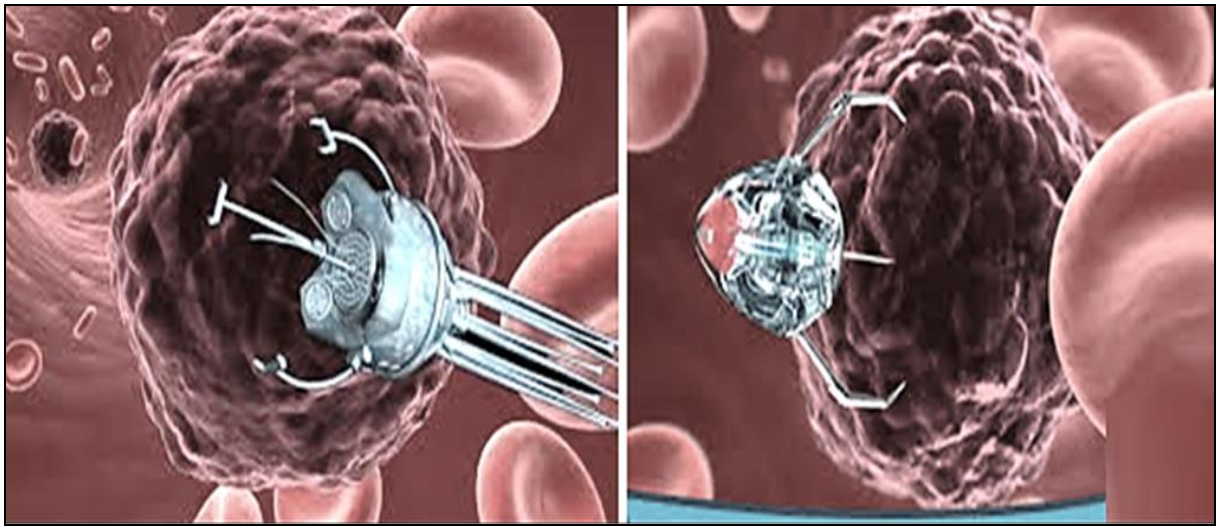

Fig 2: Nano-Robots for treatment of Cancer Cells

Fig 3: Nano-Robots for as herbal medicine holder

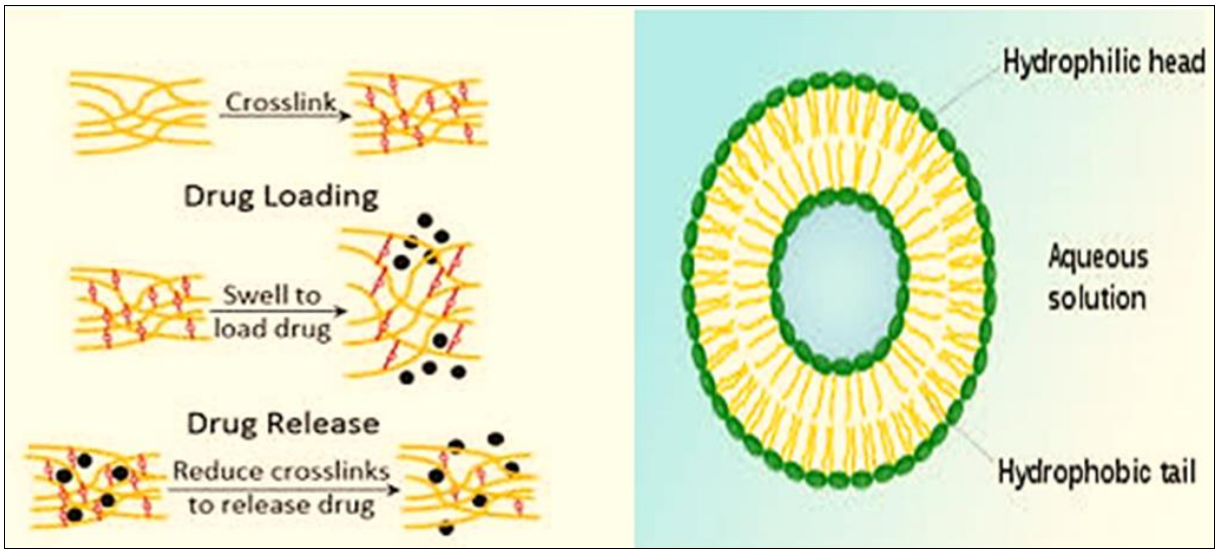

Fig 4: Crystal-Nano as a drug Loading to Brain

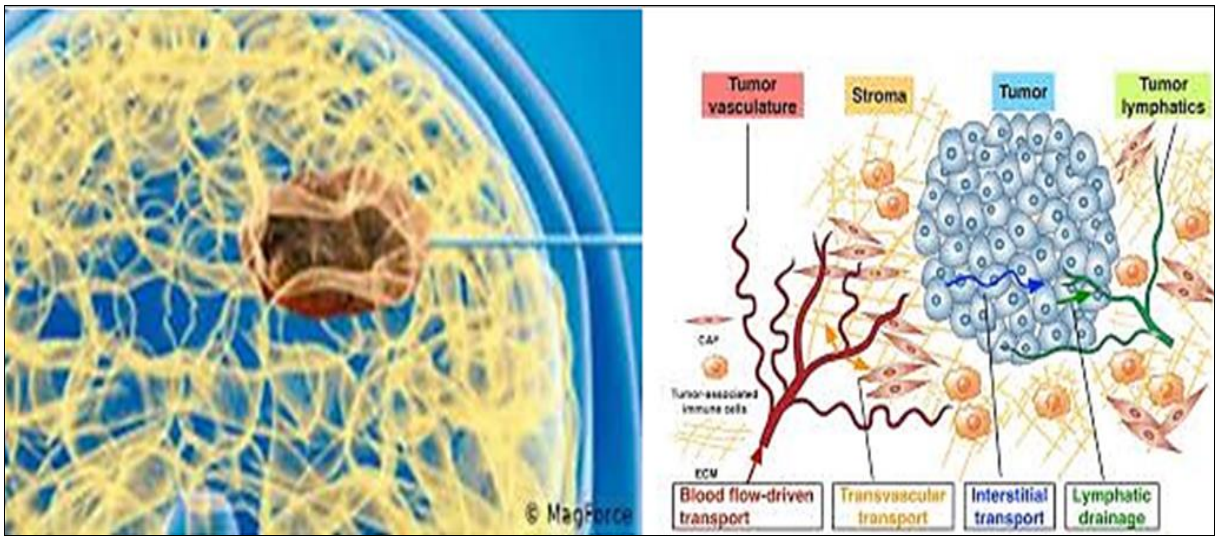

Fig 5: Crystal-Nano for Detection Tumors of Brain

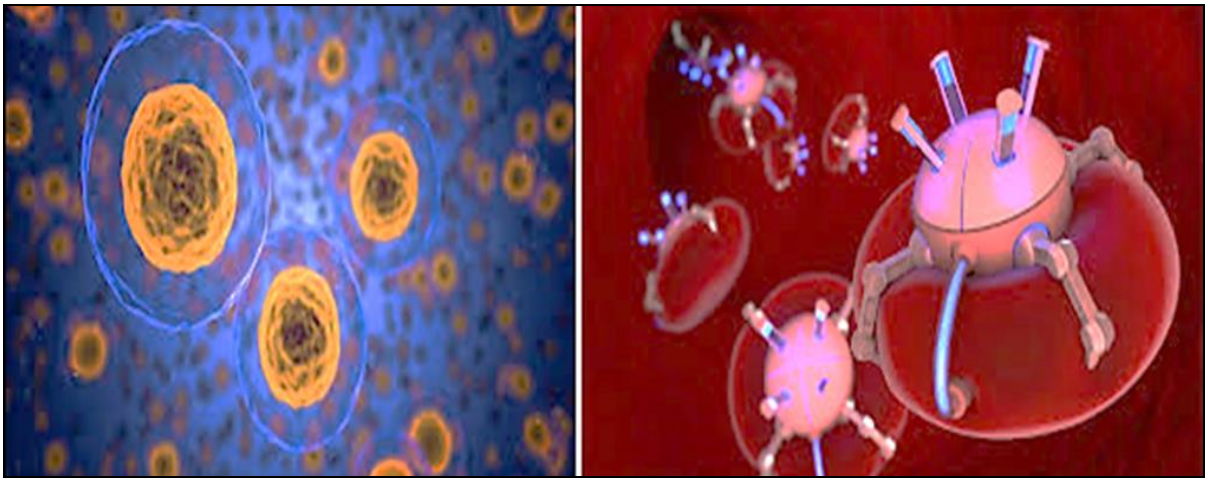

Fig 6: Nano-robots that penetrate cells

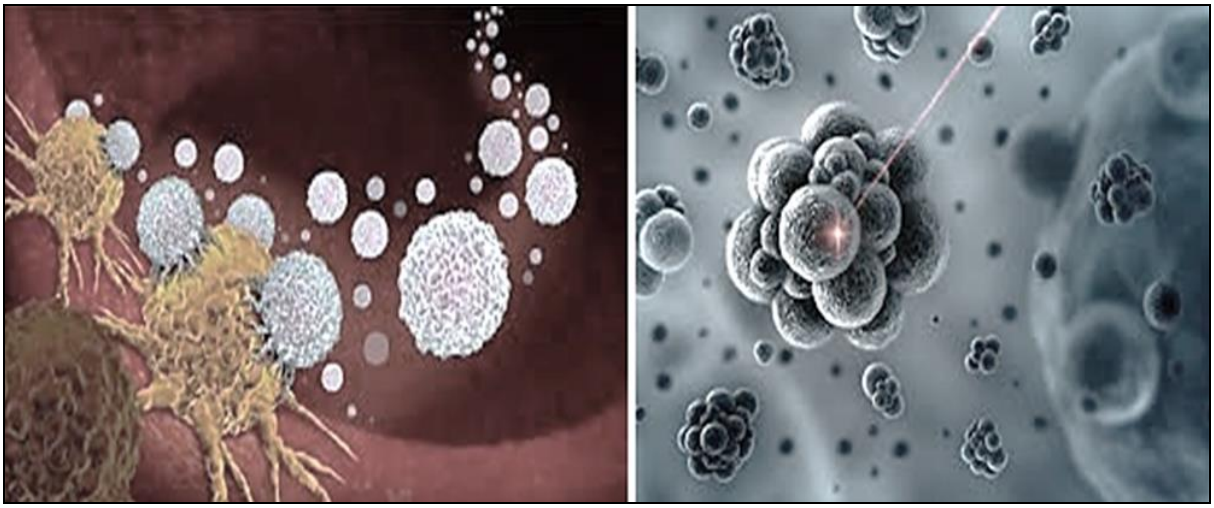

Fig 7: Crystal-Nano as sensors to detection of disease

Conclusion

The technology uses nanoparticles bound to the protein albumin. Albumin as a carrier of hydrophobic chemotherapy drugs through non-covalent bonding. Since albumin is already a natural carrier of hydrophobic molecules and is capable of transporting cell-bound molecules to itself, albumin nanoparticles have become an effective strategy for treating many diseases in clinical research, Biodegradable polymers offer great potential for drug delivery and control (such as adhesives, sutures, and surgical meshes), as well as orthopedic devices (nails and rods), as well as in dental and tissue engineering applications.

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