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Review Article

Review on Evaluation of Portable Nano-Chemical Drugs in The Chemical Treatment of Cancerous Tumors

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Abstract

This Review deals with Cancerous tumors and the abnormal growth of some cells and not others were and still are a major cause of many deaths among people in various countries of the world. And the spread of this disease in general and wide has made it a terrifying matter for the countries of the world, especially countries that include in their diet hybrid foods, which prompted scientists to think and search for treatment methods targeting this disease. Among the most common techniques in the treatment of cancer are surgical resections, followed by chemotherapy and radiotherapy or a combination of both together, and it is not hidden from everyone the side effects of these treatments, as the sufficient focus of the treatment does not reach the tumors and thus the occurrence of many complications during treatment, including resistance Medicines that appear in cancer patients and are called multidrug resistance.

Key words: cancer; nano; tumor; cancerous cells; treatment; anticancer; drugs; nano delivery

Introduction

Newly developed chemical drugs in nanotechnologies in medical systems to deliver drugs to nanoparticles such as industrial polymers, microcapsules, liposomes and many other systems. The aim was to increase the biological effectiveness of the drug and its accumulation in the target cell, and this is important for anti-cancer drugs, as the drug reaches the appropriate amount to the cancer cell without affecting normal tissues. The drug loaded on the nanoparticles decomposes slowly, and this leads to the delivery of the necessary amount of drug to the affected cell at a controlled rate. In it, all these factors contributed significantly to the clinical acceptance of drug delivery via nanotechnology for the treatment of cancerous tumors. Hence the need to use accurate therapeutic and diagnostic techniques to be a tool in the hands of scientists to fight cancer. This is why nanotechnology was developed, which relies on the use of tiny particles whose sizes range between 1-100 nanometers and which have the ability to bind to any substance such as antibodies, anti-cancer drugs and many others. The size of the nanoparticles is almost imperceptible, as the nanoparticles are very small, ranging between 100-1000 times that of cancer cells, and therefore they can be transported easily through blood vessels, which in turn interact with the cell protein on the cell surface and inside, and thus these particles act as the vehicle that It works to transfer the treatment to the cancer cell accurately, and this is what scientists consider as the new weapon treatment to fight this disease.

Treatment of Cancerous Tumors with Nanoparticles:

The difficulty in treating cancer diseases lies in the high toxicity and lack of chemotherapy or biological treatment, which means that it often kills healthy cells in addition to cancer cells, so we have noticed that patients who take it suffer from debilitating and serious health problems. Therefore, researchers focused on finding mechanisms for drugs that target cancer cells only and leave healthy cells behind, and serious attempts include using specialized immune bodies that target one of the receptors or enzymes important in the spread and growth of cancer, or stimulating immunity, as the system fights cancer cells, and this approach helps to improve The effectiveness of the treatment, especially for some blood and colon cancers, where patients live longer and have specific side effects.

And although it works well, it still needs a lot of development to be successful. It affects other types of cancer. As for the technology we are talking about, it is probably an alternative or synonymous with the use of immune genes, it is the use of nanotechnology to deliver anti-cancer chemical drugs, and the technology summarizes the use of very small spheres "billionths of a meter", these balls have thousands of holes, the size of 20-60 nanometers, so chemicals can be placed in these areas. Nanoparticles are also used in dyes for medical radiology so that they reach and bind to the places required to be accurately diagnosed, which makes the issue of diagnostic imaging more clear. Science believes that nanotechnology will be of great benefit in the treatment of tumors, especially with regard to imaging, due to the small size of nanoparticles, as it can be used in conjunction with magnetic resonance imaging to obtain exceptional images of the locations of the cancerous tumor. Nanoparticles such as quantum dots are much brighter. Of organic dyes, and need one light source for stimulation, in the case of using fluorescent quantum dots, images with higher contrast can be obtained at a lower cost if we compare them using organic dyes that are used as contrast media. The multiple functional groups are attached to the nanoparticle because the nanoparticles have a high ratio of surface area to volume, and therefore they can bind to specific cancer cells, where the nanoparticles accumulate at the tumor site differentially, where work is underway to create multifunctional nanoparticles that have the ability to detect and image the tumor and then treat it. When surgeons operate on cancer patients, they do their best to remove all the diseased cells, because any that are left may regrow into a new tumor or spread to another part of the body. Oncologists usually follow surgery with radiation therapy or chemotherapy, to increase the chances of killing any remaining tumor cells. However, this traditional approach to fighting cancer is not foolproof. In recent years, doctors and scientists have researched nanotechnology to aid in treatment. Groups of gold atoms, known as nanoparticles, could be an effective weapon in fighting cancer cells.

Solid carcinomas usually have permeable blood vessels. As a result, when gold particles are injected into the bloodstream, they seep through openings in blood vessels and collect around a tumor. These cells also swallow nanoparticles to clean the surrounding areas. Once inside cells, these molecules act as Trojan horses. When the researchers shined infrared laser light on the gold particles, it penetrated centimeters of tissue and heated the particles, which in turn killed the cancer cells. That some gold particles are located inside and around normal cells, so healthy tissues can be damaged when the laser targets cancer cells, and the second is that the lasers that are usually used to heat the particles release continuous beams of infrared light, so the heat spreads beyond the cells carcinomas, to normal tissues. In cases where the growth of tumors is in and around vital tissues, such as nerves or arterial walls, any secondary damage to healthy tissues can weaken them or render them in a serious condition."

The gold particles were provided with antibodies that bind to the receptors on the surface of the squamous cells. They also supplied the gold particles with antibodies (immune proteins) that bind to receptors on the surface of squamous cells. And so the molecules aggregate into clusters of dozens, in and around cancer cells. Instead of firing continuous laser beams, the researchers fired only ultrashort infrared pulses.

Treatment or repair of cellular damage: It can also be used in the treatment of cancer, as nanoparticles reach and concentrate in cancer cells, then they are heated by certain radio frequency waves, which kills cancer cells without harming neighboring normal cells. In the future, it will obviate the need for chemotherapy or radiation, which has many side effects.

Skin applications: the use of some types of nanoparticles in addition to lasers to build and restore skin tissue. Nanotechnology was also used to diagnose some microbial diseases so that nanoparticles stick to antibodies that unite with microbes inside the body, and then signals from nanoparticles can be captured to diagnose infection with this virus. microbe or other. It can also be used to solder blood vessels after they have been cut without the need for the usual sutures. There are also potential applications of nanotechnology in tissue engineering to stimulate proliferation or repair of certain patient tissues, which may replace organ transplantation in the future.

Nanotechnology in Medical Fields:

Nanotechnology has surpassed expectations by its development over its counterparts in technologies, especially in the field of medical care, and dentistry is no exception. There are recent innovations included in the necessary materials in the field of dental diagnosis and treatment. It has been suggested that the use of biotechnology, nanomaterials, and nanorobots in dentistry will increase the likelihood of maintaining oral health as close to ideal as other technologies and the combination of this technology, ethics, and safety to be able to provide high-quality dental care. Conventional chemotherapy kills both cancerous and non-cancerous cells. And the use of nanotechnology in the manufacture of accurate vectors that carry drug doses, and these vectors are designed in a way that the immune cells in the body do not recognize. Where these submarines perform two operations when they reach the tumor area: It closes the capillaries that feed the cancerous tumor., It releases its chemical or radioactive components that only kill cancer cells. This technology was implemented on a group of mice at the American "Memorian-Kettering" cancer center, where the mice with cancer were able to live after 300 days of this treatment, while the mice that did not receive treatment did not live more than 43 days. "nano-rbot" as it is the most exciting possibility in its ability, if realized, to change the world of medicine from its current form, as this "nano-rbot" will then be able to explore the depths of the body, to discover places in order to repair them or attack invading microbes and parasites. Where doctors dream that the realization of nano-rbots one day extends to include: the treatment of bacterial poisoning, respiratory failure, physical injury, in addition to inherited diseases by replacing and replacing defective chromosomes.

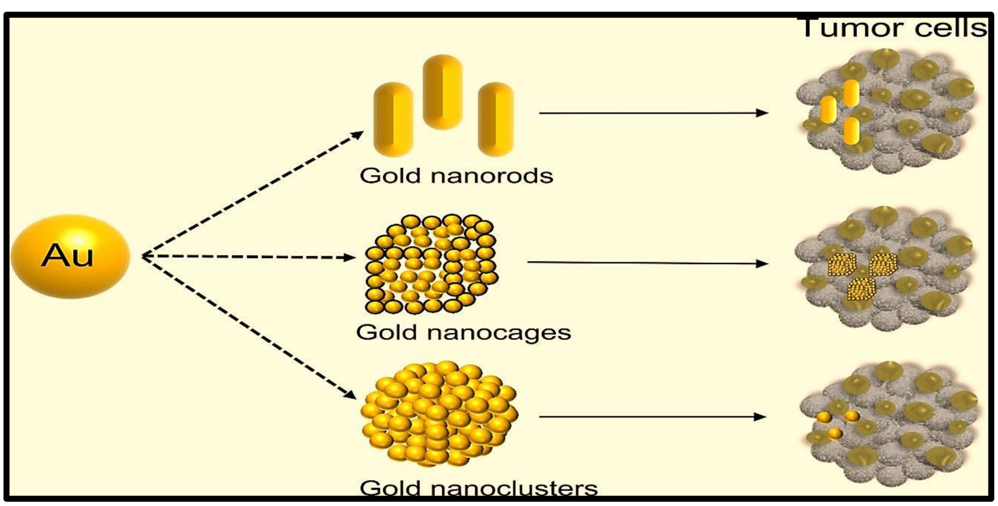

Figure 1: Nano- chemical Element as a drug in Treatment of Cancer cells

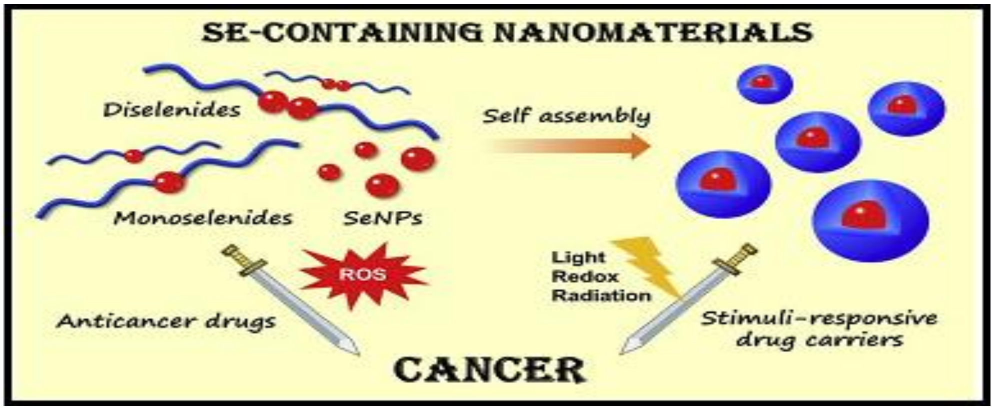

Figure 2: Selenium-Containing Nanomaterials for Cancer Treatment - ScienceDirect

Injection of Nanoparticles into the sites of Cancer Cells:

The method of injecting nanoparticles loaded with drugs can be concentrated in the kidneys at the site of cancerous tumors and cause them to shrink severely. Nanoparticles were also found to leave the cancer site after unloading the anticancer drug payload and were excreted via urine and feces within four days of injection, with no noticeable side effects. The researchers are now working to improve the precision with which the nanoparticles reach cancer cells by attaching certain genetic signals to these objects, and to test the approach on different types of cancer. The question is: When will this technology be used to treat human cancer? Of course, this would require studying its toxicity in laboratory animals, then testing it in specific cancer patients, and then having the FDA evaluate these results and the feasibility of the technology. The year witnessed many preliminary results of this promising technology, for example, but not limited to, the National Academy of Sciences published an article from the University of Cambridge in the United Kingdom earlier this month, in which it was discovered, by analyzing samples taken from the breast, in laboratory studies of cancer cells Lung and uterus, by loading the drug into nanoparticles made of platinum, cisplatin was less toxic to the kidneys and also showed good efficacy against these different types of cancer.

One of the most important successes in this field was the discovery by scientists at the University of California at Los Angeles in collaboration with the California Institute of Nanotechnology "founded in 2000", using silica nanoparticles "created by Japanese scientists", discovered in 1990, and used for purposes other than Medical, and contains thousands of small holes. The anti-cancer drug, which cannot be administered directly "because of its high toxicity", is loaded with nanoparticles and administered to cancer-containing breast implants of humans with cancer.

Medical Applications as Chemical drug Carriers

The recent development in nanotechnologies has helped to change the medical rules used in preventing, diagnosing and treating diseases, and we are now living in the era of nanomedical technology, where nanotechnology offers, for example, new ways of drug carriers inside the human body (called nanocarriers with sizes up to the nanoscale) be able to target different cells in the body.

Through this technique, the cells of the body can be easily photographed as if we were taking a normal picture of them, as well as those cells can be controlled and shaped in different shapes.

Many types of nanoparticles are used in medical applications as drug carriers or imaging tools inside the body. Currently, various types of manufactured liposome nanoparticles are used as delivery systems for anti-cancer drugs and vaccines. Gold nanoparticles are also used in home test devices to detect pregnancy. In addition, drug delivery systems as well as polymeric or lipid-lipid nanoparticles may be designed to improve the pharmacokinetic and therapeutic properties of drugs. The strength of drug delivery systems is their ability to alter the pharmacokinetics and biodistribution of a drug within organs. Nanoparticles also have a range of unconventional properties that are used to improve drug delivery. While the larger particles are being purified from the body, the cells have the ability to carry these nanoparticles due to their sizes. Drug delivery mechanisms have also been developed, including the ability to get the drug through cell membranes as well as within the cell cytoplasm. Efficiency is important as many diseases depend on processes within the cell and can only be inhibited by drugs that make their way into the cell. The elicited response is one-way for the drug molecules to be used more effectively. Medications are placed inside the body and activated in response to a specific signal. For example, a drug with poor solubility in solution is replaced with a drug delivery system in which both hydrophilic and hydrophobic environments are present, which improves the solubility of the drug. In addition to the fact that the drug may cause tissue damage, with a drug delivery system, a controlled release and diffusion process may eliminate this problem. If the body is cleared of drugs very quickly, this patient may be forced to use higher doses of those drugs, but with the drug purification process based on drug delivery systems, those drug doses that one takes can be reduced

Nanowires are used as nanoscale biosensors due to their high sensitivity and nanosize, where these nanowires are coated with manufactured antibodies so that they stick only to biomolecules (DNA), proteins, or other biological particles present inside the body, and not to other molecules. These proteins or others coated with nanowires will change their conductivity, and thus this nanobiological probe can be used to detect a large number of diseases in their initial stages, by introducing large numbers of nanowires into the body that are coated with different antibodies, representing different probes.

Gold-plated nano vessels are also used to destroy cancer cells, and the length of these nanoveils is about 120 nanometers, which is 170 times smaller than the size of a cancer cell. Red, which heats gold and raises its temperature, which leads to the combustion and death of these cells. This method is characterized by accuracy and locality due to the smallness of the nanospheres in relation to cells and their concentration in diseased cells only, which makes healthy cells away from the risks of side effects.

Bio-nano generators are nano-electrochemical devices that generate electrical power from blood glucose in the body and then use this power to operate other nano-devices implanted inside the human body, such as pacemakers or nano-sugar injection robots.

Among the promising medical applications of nanotechnology is the use of polymer nanofibers to perform prosthetic surgeries for blood vessels. Recently, prosthetic devices made of protein nanofibers have been implanted in the human central nervous system. Polymer nanofibers are also used in the treatment of burns and wounds and are used in the cosmetics industry.

When cadmium selenide nanoparticles (quantum dots) are injected into the body, they selectively collect inside cancer cells. If the target area is exposed to ultraviolet light, the particles light up, which helps in locating malignant cells and removing them accurately.

Nanotechnology is now considering the manufacture of nano-devices with mechanical and electrical properties that replace red blood cells and carry out all their functions, and nanotechnology now offers an alternative to human spare parts with efficiency that is close to the original, as research is now being conducted to replace some organs that perform movement functions, such as bones and muscles. And joints with nanoorganisms do the same job., Rare earth element nanoparticles are used to remove phosphate from the blood of patients with hyperphosphatemia.

Surgical tools have now become a target for development and improvement using nanotechnology, as it was possible to design a surgical scalpel based on a nano-diamond material that cuts with extreme precision through the eyeball. In the near future, it is expected that nanotechnology will provide successful solutions to correct the damage caused in the audio-visual and sensory organs in humans by cultivating accurate nano-devices inside the body. For example, researchers are now working on cultivating a nano-membrane in the retina of the blind to improve his vision.

Surgical Removal of Tumors:

In cases where most of the cancerous tissue could be removed, all animals (100%) survived, thanks to no surviving cancer cells. In cases where the option of partial surgical removal of the tumor is the only one available, the survival rate of animals doubled from what it was before the application of this technique. Colon cancer research has also made great strides, as about 10 years ago it was not possible to identify more than one mutation in these tumors. of mutations, thus determining a more accurate and appropriate treatment for each patient.

Gold Nanoparticles as Treatment

Thousands of years ago, humans intended to use nanoscales without knowing this term. They were used in the manufacture of steel, rubber, and vulcanization, all of which were based on the random properties of the atomic sizes of those materials. It is not possible to specify a specific era or era for the use of this technique. It was mentioned that glass makers in the Middle Ages were using colloidal gold nanoparticles to color the glass, and this is supported by the cup of the Roman king Lycurgus, which has been in the British Museum since the fourth century AD, and which contains particles of gold and silver. Nano-sized, where the color of the cup changes from green to dark red when exposed to a light source. In 1959, the famous American physicist Richard Feynman spoke in a lecture he delivered before the American Physical Society under the title "There is a wide space at the bottom" during which he explained that matter at the infinitesimal levels (now nano), with a few atoms, behaves differently from its state when be of the perceived size, and he also indicated the possibility of finding ways to independently move the atoms and molecules of matter in order to reach the required size. In 1986, the American mathematician Eric Drexler, the actual founder of this science, wrote a book called Genesis Engines, in which he outlined the basic ideas of nanoscience. In 1991, a new physical phenomenon was discovered for the first time, which is the nanotube at the NEC Electronic Industries Company in Japan, by the scientist Sumio Legima, when he was studying the ashes resulting from the electrical discharge process between two electrodes of carbon using a high-efficiency electron microscope, and the result was that he found that carbon particles They take up a tube-like arrangement inside one another

The most optimistic about technology in the modern era did not imagine that an ultra-small unit of measurement known as the “nano” would be invented to the extent that it was described as “one millionth of a millimeter” (one billionth of a meter), and then its entry into multiple fields that known technologies cannot reach. Among them are advanced technological techniques, and they have also become an indispensable part in the treatment of incurable diseases, through which malignant cells are reached and destroyed without affecting healthy cells, which were damaged until recently by traditional treatment methods that do not differentiate between cells and target everything that reaches them. In addition to the serious side effects that patients suffer from, perhaps for months, during treatment periods, doctors using nanotechnology were able to effectively treat incurable diseases by directing treatment to cancer cells with extreme precision and eliminating them, which represented a major medical revolution that developed methods of treatment with this technology. Effective and interesting to many, and progress through this technology has reached the implantation of “nano” sensors in the brain to help paralyzed people walk, in addition to many other successes that have contributed to the eradication of many diseases after accurately diagnosing them and targeting them with modern treatments.

Conclusion

Nanotechnology plays a major role in improving living tissue engineering and cell therapy, which includes the use of live cells or natural or synthetic compounds that are grown inside the living body.

Some researchers are now making experimental attempts to use silicone nano-capsules that stop the body's immune system from recognizing foreign cells, as these capsules block antibodies produced by the body's immune system while a sufficient amount of insulin is released by the nano-capsules into the blood.

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