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Short Communication**Nanoparticles and Nanotechnology: Properties and Applications****Rajesh S**

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ABSTRACT

In the field of science, nanoparticles are immensely being used now days. Nanoparticles are particularly used in drug delivery, in drug discovery, diagnostics and innovation in medical science. Nanotechnology is the branch of science which deals with the matter at the atomic and molecular level. The field of medicine has made use of this field and has created methods to treat different diseases, methods of drug delivery and has found ways to kill microorganisms.

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In the field of health science, nanoparticles are immensely being used now days. Nanoparticles are particularly used in drug delivery, in drug discovery, diagnostics and innovation in medical science. To deliver the drug to tiny area within the body, nanoparticles are being used. Nanoparticles can be used to increase the solubility of drug at a specific and required target sites within the body. This increases the capacity of drugs which are poorly soluble and thus makes them suitable for specific treatment in spite of their poor solubility by directly targeting the tiny area where the drug action is required. This is also known as drug bioavailability. Many of the anticancer drugs are successfully made or formulated using such nanomaterials. In this list well know drugs used for anticancer are dexamethasone, doxorubicin 5-fluorouracil, paclitaxel etc. Drug like dexamethasone are anti-proliferative as well as antiinflammatory effects. These drugs binds to specified receptors known as cytoplasmic receptors and the subsequent complex of drug and receptor is transported to cell nucleus. This results in certain genes expression which is controlling proliferation of cell and thus acts as anticancer drug in a more effective way with the help of nanotechnology and their nanoparticles. In the field of medicine, effective drug distribution and drug toxicity is an issue, but the

introduction of nanoparticles with certain surface properties for targeted drug delivery reduces or almost eliminates drug toxicity and makes drug distribution more effective. Small biomolecules such as peptides, proteins, amino acids and nucleotides loaded nanoparticles are capable of escaping the immune system and thus are more efficient in targeting particular tissue or particular diseases. Nanotechnology has been a revolution in the field of diagnosis of diseases and their timely treatment. Gold nanoparticles are used as ultra sensitive fluorescent probes and thus these probes are used to detect easily cancer biomarkers in the blood. This method is so sensitive that it can be employed to detect directly even the microscopic bacterial DNA and also viruses. Nanoparticles are able to carry killer genes which suppress growth of ovarian tumor and thus can be used to treat ovarian cancer. At present this is being tried on mice and the results are outstanding. This will be promising technology in treatment of cancers in human being with the use of nanoparticles. Nanoparticles are effectively used in the treatment of diphtheria. The toxin which is killing the cell of bacteria which result in diphtheria diseases is made available with the help of nanoparticles to the patients. Nanoparticle can deliver genes which are resulting in the production of diphtheria toxin. Apart from the above uses, there are so many applications of nanoparticles. Nanoparticles are used as effective tools in improvement of stem cell

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therapy. More specifically, with the use of nanoparticles in stem cell therapy, muscle degeneration is reduced, increase regeneration of vascular tissues which are already damaged, stimulate formation of new blood vessels which are implanted into living organisms and results in keeping the tissue alive for long time. Nanoparticles can also be used in the manufacturing of vaccines of deadly diseases like anthrax. In this, with the size of only 200 nanometers, the immune system is stimulated as it is specifically triggered and also this avoids pathogenicity. Immunity stimulation is important but at the same time, pathogenicity should be controlled for any vaccine and its effective application.

Nanotechnology is the branch of science which deals with the study of matter at the atomic and molecular level. Nanotechnology has diversity of applications for example it is used in the device physics as well as medicine. Medicine is one field which has made use of nanotechnology in its various applications. Though some of the techniques of nanotechnology in medicine are only just in the minds of the scientists, some techniques are under the development process and some are in the market successfully being used. Some researchers refer nanotechnology as nanomedicine because nanoparticles are under development for medical purposes and some researchers use the term nanomedicine to make such nanorobots which can repair the damaged cells in the human body. But it is a fact that nanomedicine is playing an important role in detecting the diseases in the human body and is developing cures for them.

Nanotechnology and Drug Delivery: One of the most important applications of nanotechnology in medicine is the drug delivery. This application is still under development. It will help the doctors to inject the drug in the patient's body in the form of nanoparticles. The nanoparticles would also be used to heat or light the diseased cells such as cancer cells. The benefit of these particles is that they can target only those cells which are damaged and this way these cells can be treated without creating damage to the healthy human cells. Nanoparticles also make the earlier detection of the disease and doctors can find cure against the disease efficiently and rapidly.

Chemotherapy is the technique used to kill cancerous cells from the body. Now nanoparticles will deliver the drug of chemotherapy. Such drugs are under development and will be in the market soon. People who hate injections, there is a good news for them that now the drug will be encapsulated in the nanoparticles. This way the drug will easily pass from stomach into the bloodstream because of its smaller size. The techniques are being developed which will make drugs using nanoparticles and those drugs would be taken orally.

Nanotechnology and Diagnostic and Imaging Techniques: There is one more positive point about nanotechnology is that the quantum dots are now being used to detect tumors of cancers in the human body and are helpful in diagnosis tests. Though this technique is still in the experimental stages but it will be an efficient approach to treat cancer. Other nanoparticles like iron oxide are being used to do MRI of the cancer patients. The mechanism of treatment is that iron oxide is bound with a peptide. When they are released in the body, they bind to the cancer cells. Iron oxide contains the magnetic property and when it binds to the tumor, it shows images from the Magnetic Resonance Imaging Scan. There are other applications of nanoparticles also that they can bind to the proteins or other molecules and help in the detection if the disease. But this method is still at the experimental level and will definitely provide efficient means of treating the diseases.

Nanotechnology and therapy techniques: Therapy techniques are also applying nanotechnology to improve their mechanisms. Buckyballs are the nanosubstances which help to reduce the inflammation produced during an allergic reaction and have the ability to trap the free radicals which are produced during any allergic reactions. Similarly nanoshells are the substances which help destroy the cancerous cells from the body when the cells are

heated by infrared light. They also avoid the damage to the surrounding healthy cells. One other use of nanoparticles is that they can be used to produce electrons which destroy the cancerous cells from the body and there are very less chances that the healthy cells will be affected. Nanoparticles can be applied in place of radiation therapy avoiding destruction of healthy cells. The use of aluminosilicate nanoparticles in the trauma patients is very helpful because they have the ability to reduce bleeding by absorbing water. It results in the quick clot of blood because when the water will be absorbed from the blood, the blood will become dry.

Nanotechnology and Antimicrobial technique:

Nanotechnology is also helpful in killing the microbes. Nanocrystalline silver is a nanoparticle which kills the microbes from the wound. Some nanoparticles are used to treat infections as they kill bacteria because of the presence of nitric oxide gas in them. When the cream is applied on the infection, nanoparticles release nitric oxide gas which kills the bacteria.
