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Synthesis of Silver Nanoparticles and its Application

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Abstract. Silver nanoparticles are well known powerful antimicrobial agents. Despite significant advances in clarifying the antimicrobial mechanism of silver nanoparticles, the exact mechanism of action is not yet fully known. Previous reviews for Of silver nanoparticles Advances in research on antimicrobial mechanisms and recent original contributions are included in this overview. Topics discussed include antibacterial and anti-silver ion interactions against silver nanoparticles. At the center of the overlay is a summary of current knowledge about Antibacterial activity of silver nanoparticles. The possibility of pathogenic microorganisms developing resistance to silver nanoparticles is also discussed. Silver nanoparticles (Ag-NPs) change rapidly in the environment, changing their properties and changing their transport, fate and toxicity. Such changes should be considered when assessing the potential environmental impact of Ag-NPs. This review looks at different aquatic environments Discusses the important transformation processes of Ag-NPs, Especially organic ligaments and physical and chemical stability and Changes in metal Ag cores caused by the effects of such changes in toxicity. Predict what the shapes of oxidized silver are Thermodynamic arguments are used will look like under different environmental conditions.
Keywords: Silver nanoparticles, Synthesis, Toxicity, Cancer.

Introduction

Silver nanoparticles are nanoparticles of silver measuring 1 nm and 100 nm Although often referred to as 'silver', A large percentage is formed in some silver oxides surface and total silver atoms. The The released Ag + ions are recommended to interact with the respiratory chain proteins in the membrane, Inhibits O2 depletion within cells and promotes the production of reactive oxygen species (ROS) Stimulates, thus causing cellular oxidative stress and death. microorganisms. Silver nanoparticles were found in the organic matrix of bacteria. The bacteria that make up lactic acid are used to produce silver nanoparticles. In addition to arrhythmias and arthritis, exposure to soluble silver compounds can cause liver and kidney damage, irritation to the eyes, skin, respiratory and intestinal tract, and other toxic effects, including changes in blood cells. Metal silver poses minimal risk to health. Silver NPs Can be integrated using different radiation methods. Laser radiation well-defined form of aqueous solution of silver salt and surfactant And can produce silver NPs with size distribution. Drugs can be attached to gold nanoparticles surfaces by ion or covalent binding and body absorption, and they can deliver them by biological stimuli or light activation and control their release. Silver nanoparticles (Sliver nanoparticles) medicine, food, health, consumer And are widely used in various fields including are antibacterial agents, industrial, Home and Health Products, Consumer Goods, Medical Device Coatings, Optical Sensors Used in many applications in the field of cosmetics and medicine. The food industry has improved the diagnostic, orthopaedic, drug delivery, effects of anti-cancer drugs. In general, conventional physics and chemistry methods seem to be the most expensive and dangerous. Interestingly, biologically produced Sliver nanoparticles show higher yields, solubility and higher stability. Among the many synthetics for Sliver nanoparticles, Under optimal conditions for translation research they can create a well-defined size and image structure. In conclusion, the green chemistry approach to the integration of Sliver nanoparticles is highly promising. The physical and chemical properties of a particle in their biological properties After set, precise particle characterization is essential because it can have a significant impact. To solve the security problem of healthcare, it is necessary to classify the nanoparticles prepared before use.

Silver Nanoparticles

[1] Nanoparticles are now considered a viable alternative to antibiotics, and bacteria Have the ability to solve the problem of multitruck resistance. In particular, silver nanoparticles have attracted much attention in the field of science. Friday is always different Used against diseases; It is gram-positive and due to low cytotoxicity in the past Used as a disinfectant and antimicrobial against Gram-negative bacteria. Recent Over the years sliver nanoparticles have become more attractive for the production of a new type of antibiotic. This opens up a whole new way to fight off a wide range of bacterial pathogens. The high antibacterial effect of sliver nanoparticles is widespread Although described, the mechanism of their action is not yet fully understood. In fact, different in morphology and metabolism Powerful antibacterial and broad-spectrum activity against microorganisms, Nanoparticles seem to be associated with a multifunctional mechanism that interacts with microorganisms.

In addition, their specific structure and Different methods of interaction with bacteria can provide A unique and well-studied antibacterial mechanism for exploitation. A structural In perspective, sliver nanoparticles have dimensions ranging from at least 1 to 100 nm, most Importantly, when the particle size decreases. The area-to-volume ratio increases greatly. As a result, physical, chemical and biological properties vary considerably aggregate. [2] Organisms are exposed to bacteria, viruses and fungi. Silver nanoparticles, their uniqueness Thanks to the properties, they are at the forefront of the fight against pathogenic microbial activity. Friday has a strong effect on slowing down their activity. The reason for their behavior in this case is that the area of the silver nanoparticles is increased compared to the solid form of silver. It is best with microbes Makes contact and has antimicrobial activity, which is very effective Will be. Silver nanoparticles against a broad spectrum of Gram-negative and Gram-positive bacteria Are active, including some antibiotic-resistant strains. In the group of Gram-negative bacteria, The antimicrobial activity of silver nanoparticles has been confirmed, including: Escherichia, Pseudomonas and Salmonella. Chromosome The effective action of silver nanoparticles against bacteria has also been reported: Bacillus, enterococcus, Listeria, Staphylococcus and Streptococcus. In combination with some antibiotics Use of silver nanoparticles. Recent studies show that it produces a cohesive effect. By blocking silver nanoparticles from their reflection, anti-viral Research shows that it can be a useful weapon in combat. Their activity against HIV-1 and influenza virus has also been confirmed.

[3] Biological function of nanoscale metal particles And their use as molecular studies are areas of research of growing interest. Due to their large area and high reactivity, Nanoparticles compared to the total number of metal particles Exhibit significant physical, chemical and biological properties. In particular, the optical properties of silver nanoparticle depend on their size and shape and vary According to their chemical context, they have been seriously studied. In addition, due to the unusual antimicrobial properties of silver there is growing interest in the use of nano-Ags as specialized antimicrobial agents. For example, nanocrystalline lysate silver plastics to suppress microbial infection of burns currently used in medical practice. There are many silver alloys that have nano-Ag as the active antimicrobial ingredient. The amount of nano-Ag produced by different synthetic mechanisms and the relationship between the associated antibacterial activities has been previously studied. Differences in the antibacterial activity of nano-Ag at different stages can be explained chemically by the levels of Ag + ions. If the particles are small, the surface area will be larger than the mass ratio, Therefore the relative concentration of the Ag + chemical is higher. When two levels of nano-AG exhibit equivalent antibacterial activity, The theoretical positions of the Ag atom displayed on the particle surface are approximately equal in the same order of magnitude. In quantities that bind to nano-AG bacteria the amount of differences may explain the antibacterial activity. In this regard, previous studies have shown that nano-AG, which presents a direct link with bacteria, Shows approximately 1-10 nm in diameter. [4] Chemical reduction using gallic acid. Classified using TEM, DLS, X-ray diffraction and UV-Vis absorption spectrum. The antibacterial activity of silver nanoparticles was analyzed And found that it can be modified with the size of silver nanoparticles. It decreases as the particle size increases [5].

Silver nanoparticles in consumer products are widely used for their antimicrobial properties. This increased use raises environmental concerns due to the release of sliver nanoparticles into the environment. Once released, zero silver can be oxidized to Ag + and the cation can be released or it can be stretched into sliver nanoparticles. The chemical shape of Ag has implications for its toxicity, so it is important to classify their stability to predict the environmental toxicological potential of sliver nanoparticles. Situation sequencing of nanoparticles in sliver offers significant advantages over laboratory studies, capturing the natural variation of the aquatic environment over time and is therefore taken as representative of environmental processes. [6] Silver nanoparticles capable of inhibiting a prototype arena virus at non-toxic concentrations and before and after initial viral exposure to the virus Arena effectively blocks virus duplication when managed. The process of virus neutralization by silver nanoparticles is the beginning of virus replication Occurs in phases. Silver nanoparticles have received considerable attention in biological applications, and more Concentrated and harmless nanosylated silver particles are readily available. produced. And have recently been demonstrated to have antimicrobial properties. [7] Single-nanoparticle sensitivity sites offer additional benefits, Because they are implemented immediately in multiplex detection programs. By controlling the size, shape and chemical changes of individual nanoparticles, multiple sensitivity sites can be created, each of which can be differentiated by the spectral location of its LSPR max. These unique nanoparticles are integrated into one device, Allows rapid and simultaneous detection of thousands of different chemical or biological species without labelling. For example, if each nanoparticle is in the range of 2 to 3 times that of the adjacent nanoparticle, The 50 × 50 µm2 arrays can be used to screen 2500 different analyzers simultaneously.

Synthesis

[8] Determination of optimal conditions for assembly of silver nanoparticles Described in the following sections. The easiest and most convenient method is to use bench-based dilute aqueous solutions. Also requires simple equipment such as the Spectronic-20 spectrophotometer and magnetic stirrer plate. Chemical reaction is the reduction of sodium borohydride to silver nitrate:

$$AgNO_3 + NaBH_4 \rightarrow Ag + 1/2\ H_2 + 1/2\ B_2H_6 + NaNO_3$$

[9] Sliver nanoparticles can be prepared by micromellation. The synthesis of Sliver nanoparticles in two-phase aqueous organic systems consists of two unmixed phases (metal precursor and reducing agent) based on the initial spatial division of the reaction. The ratio of the series contacts Interface between two liquids between metal precursor and reducing agent and

intermediate transport between water and organic phases Controlled by intensity; It is mediated by the quaternary alkylmonium salt. Metal clusters formed at the interface Are stabilized, their surface coated with stabilizing molecules occurring in polar aqueous medium, organic by an intermediate transporter Converts to media. This method allows the production of homogeneous and size-controlled nanoparticles. However, more harmful organic solvents are used in this method. Large amount of surfactant thus added to the system and the organic solvent must be separated and removed from the final product. As a result, the production cost of silver nanoparticles increased by this method. Dodecan was used as an oil grid, It is a less harmful and non-toxic solvent. The silver solution thus prepared does not need to be separated from the reaction solution and can be used directly for antibacterial action. [10] Rational design and control of nanostructures is important in achieving the appropriate properties required for many high-performance and biomedical applications. The size and structure of silver nanoparticles and their associated physical, chemical and biological properties are strongly dependent. Production method by radiation using gamma rays, ultraviolet-visible rays, microwave and ultrasound. The mechanism by which nanoparticles are formed from solution is clarified. Metal colloids are formed from their ions by the nucleus. The growth process requires more activating energy as the ion is controlled and less activating energy is required. It has been reported that the size and distribution of metal colloids depend mainly on the relative ratios of these two processes. Concentration of reactions, reducing agent energy, pH and Different reaction such as reaction temperature Development processes can be controlled by parameters [11].

In general, the assembly of nanoparticles is Is Using three different approaches, including physics, chemistry and biology Is carried out. In physics, nanoparticles tube at atmospheric pressure Are formed by evaporation-compression using a furnace. Sliver nanoparticles attach, spark emission and pyrolysis Conventional physics methods are used including. The advantages of physical methods are speed, no radiation and hazardous chemicals Not used as reducing agents, But the disadvantages are low yield and high energy consumption, solvent contamination and lack of uniform distribution. [12] Chemical methods use water or organic solvents to form silver nanoparticles. There are generally three main components to this process Uses, i.e. Metal precursors, reducing agents and stabilizing / closing agents. Basically, Friday The reduction of salts involves two stages (1) nuclear; And (2) subsequent growth. In general, the silver nano Particles can be obtained by two methods, which are classified as "top-down" and "bottom-up". "More-down" Method, machine grinding using bulk metals continuous stabilizing agents using continuous stabilizing agents. "Bottom-up" methods include chemical reduction, electrochemical methods, and sono-decomposition. Unlike low yield physics methods, the main The advantage of chemical methods is higher yield. The methods described above are very expensive. In addition, Sliver nanoparticles used in combination with citrate, borohydride, thio-glycerol and 2-mercaptophanol The materials are toxic and dangerous. In addition to these shortcomings, the particles produced are expected Do not have cleanliness because their surfaces have been found to be contaminated with chemicals. Sliver nanoparticles with well-defined sizes are very difficult to produce and require one more step to prevent particle accumulation. In addition During the packaging process, many toxic and hazardous by-products are removed. Chemical methods Cry chemical synthesis, laser removal, lithography, electrochemical reduction, laser radiation, sono-decomposition, Use of techniques such as Thermal decomposition and chemical reduction. The advantages of the chemical composition of nanoparticles are simplicity of production, low Price and high yield; However, the use of chemical reducing agents can be harmful to organisms. [13]The Tollens suite provided Sliver nanoparticles with a limited amount of one-step operation. The basic toluene reaction aldehyde reduces the toluene reagent Ag (NH3) 2 + (aq).

$$Ag\ (NH_3)\ {+2}\ (aq) + RCHO\ (aq) \rightarrow Ag\ (s) + RCOOH\ (aq)$$

In the modified tolerance practice, the Ag + ions are reduced by the presence of ammonia by the sugars, with particle sizes of the AgNP films and particles in the range of 20–50 nm and various forms of AgNP ranging from 50 to 200 nm. Ag (NH3) 2+ is a stable complex ion formed as a result of the strong interaction of ammonia with Ag +, so the nature of the ammonia concentration and the reductant must play an important role in regulating AgNP levels. To better understand, let us consider this example of the compilation process. Research on the saccharide reduction of Ag + ions by the modified tolerance process revealed that small particles are formed at low ammonia concentrations.

Toxicity

[14] A study on mice using intravenous administration Includes a 28-day systemic toxicity effect of 20–100 nm Sliver nanoparticles. Sliver nanoparticles showed a sharp Spleen size increase with increased population of D and B cells. Histopathological examination of the affected tissues in the spleen Is done, which shows the accumulation of sliver nanoparticles in the liver, lymph nodes and other organs. Clinical Chemistry Increased phosphatase, alanine Revealed transaminase and aspartate transaminase, all of which indicate liver damage. Ingestion of Sliver Nano Particles Can enter the body through and are absorbed from the gastrointestinal tract. The portal enters the vein. Then, it enters the liver. causing a toxic effect on the liver cells. Attempts were made on liver cells to detect details of direct damage Detection of toxic effects of nanoparticles. Significantly, they observed Abnormal conditions of mitochondria in exposed liver tissue. First, They are characterized by irregular cell shape and their division due to the action of nanoparticles Noticed. The liver is an organ with high metabolic function. Therefore, like other drugs, Sliver nanoparticles can cause damage to liver tissue after excessive accumulation. Also, absorbed Nutrients are usually processed and stored in the liver distributed to other parts of the body when needed. Thus, toxicology The risk of liver damage is higher in studies. This also applies to the kidneys because it is one of the most metabolized organs.

One of the current problems with agNP-based nanotechnology is the sliver nano at the nanometer scale Is the nanotoxicity of particles and the environmental impact. To predict the potential cytotoxic effect sliver nanoparticles by sliver nanoparticles traveling in the intracellular environment It is necessary to study the chemical reactions that occur. The use of silver nanoparticles for their chemical cytotoxic properties Powerful anti-cancer Or Has received much attention as antibacterial agents. Mechanisms of bactericides, various hypotheses Nevertheless, the properties of silver nanoparticles have not yet been clearly established. Of current literature Basically, the proposed cytotoxic mechanisms can be summarized as follows: i) Membrane microenvironment Increasing; ii) Inside the cells of sliver nanoparticles iii) Reactive oxygen species (ROS) and free AgNP-induced cellular toxicity induced by the formation of radicals; Including DNA, protein and lipids Damage to microorganisms and biological molecules; And iv) towards apoptosis Modulation of cell signal transmission paths. Sliver nano with all important parameters such as ion release, surface area, surface charge, concentration and pulp level May affect the cytotoxic properties of particles. [17] The chemical composition of sliver nanoparticles is widespread Even if used, the toxicity and pollution caused by chemicals should be highlighted and more To be focused on. Compared to physics and chemistry, the biological system demonstrates the economic and environmental approach to sliver nanoparticles. In the middle [15]. Bacteria of organisms, fungi and algae, Plant parts, bark, peel, leaves, flowers, fruits, stems, seeds and rhizomes widely distributed in biological collections. Are used. Organics such as enzymes, alkaloids, phenolic compounds and terpenoids The ingredients are rich in antimicrobial and antimicrobial plant extracts. silver salts. Also, some of these organic substances act as stabilizing and sealing agents Can be used. In different ways, the mentioned combinations may affect the subsequent clinical applications of sliver nanoparticles. [18] There is ample evidence Silver ions are important in the antimicrobial activity of silver nanoparticles. Antimicrobial toxicity of silver nanoparticles to nanoparticles Area is important. High concentrations of released silver ions were observed at very high surfaces of silver nanoparticles. The lowest concentration of silver ions is silver Nanoparticles have a very small surface area and as a result have weak antimicrobial properties. Some authors of bactericidal activity The mechanism releases silver ions into silver nanoparticles, whereas the particle-specific function of silver nanoparticles is much higher. Low. Toxicity of 20-80 nm silver nanoparticles has been reported for the release of silver ions. The result is that 20-80 nm 10 nm longer than silver nanoparticles shows that silver nanoparticles are more efficient cell-particle interactions, which led to life within more Silver cells. Mechanism of toxicity of silver nanoparticles to non-cancer cells That is, nanoparticles enter the cell and release significant amounts of toxic ions.

Cancer

[19] Diagnosis of the use of sliver nanoparticles for cancer And is divided into therapeutic purposes. Many labs are developing therapeutic use of Sliver nanoparticles as Nanocorrectors for Target Distribution Chemotherapy agents and developers for radiation and phototherapy. Using Sliver nanoparticles in cancer cell lines or animal specimens Here we compile possible treatment approaches for cancer. For example, plasmonic magnetic nanoparticles were integrated with silver monolayer-gold-plated of different nanoparticles on the same platform Magnetic nanoparticles to enhance MRI variation of many components. 12.8 W / cm at 808 nm SKBr3 coated material within 3 minutes at relatively low exposure This shows that it kills cells very efficiently. High absorption capacity of Au-Ag nanorods to counteract the effectiveness of phototherapy Optomer that integrates and exhibits excellent hyperthermia performance and selectivity Designs based nano framework. Composition of Sliver Nano Particles with lichens is toxic in cells and strongly affects cellular absorption. [20] In this direction, nanotechnology is present It is one of the new technologies that has the potential to improve the diagnosis and treatment of cancer. New Imaging Agents, with Multifunctional Target Devices, Can provide treatment agents directly to the biological target for cancer, bypassing biological barriers, nano biosensors can predict disease, reduce the growth of cancer cells, and reduce treatment costs. Metal nanoparticles appear to be important agents in this area because they are used in many biochemical applications such as high sensitivity detection and biosensors, heat and radiation treatment improvement, as well as relatively low toxicity drug and gene distribution. Sliver nanoparticles interact with macromolecules in cells and proteins and DNA-like cells and proteins and DNA-like cells, Showing apoptotic bodies and necrotic cell death due to cytotoxicity of cell Sliver nanoparticles, However all of these possibilities are still under study. Many factors, such as particle size, time, and size, affect the toxicity of Sliver nanoparticles. Against MCF-7 cell culture, it is toxic And cellular damage to the human epithelial larynx (H-2) cell line by ROS formation. Biologically synthesized Sliver nanoparticles from Suaeda monoica leaf in HP-2 cells revealed quantitative toxicity at the studied concentration.

Applications

Due to the unique properties of AgNP, Sliver nanoparticles are used in household utensils, hygiene and food storage. Widely used in environmental and biomedical applications. Antibacterial, antifungal, antiviral, anti-inflammatory, anti-cancer and angiogenic Sliver nano in various biological and biological medical applications of We are interested in emphasizing the use . Silver nanoparticles used in electronics application are usually made by chemical reduction methods. Using these methods, spherical, cube, wire and triangular shapes made of silver nanoparticles. However, the scattering of silver nanoparticles is a barrier to their use in ECAs due to their accumulation. Silver nanoparticles cannot be used effectively improving the conductivity of ECAs. Used as conductive fillers in electronic conductive adhesives (ECAs) Silver nanoparticles are beneficial for electronic use [23]. Silver nanoparticles (Sliver nanoparticles) Nano structures for genetic and enhanced biomedical applications, Including their attractive physicochemical properties and the biological functions associated with their size, Thanks to their high antimicrobial capacity and non-toxicity. AgNP based nano systems and nano products pharmaceutical distribution, wound breaking, Suitable alternatives to tissue scaffolding and protective coating applications. Various physical chemistry parameters such as size, shape, concentration, surface charge and pulp level Associated with intrinsic antimicrobial effects expressed by Sliver nanoparticles. Furthermore, Impressive surface of nanosilver Allows to combine multiple ligands, thus activating the enormous potential of the Sliver nanoparticles depending on the surface function [24]. Sliver nanoparticles have for biological medical applications Intrinsic therapeutic properties. Photosensitizers / radiosensitizers, antiviral and anticonvulsant agents Sliver nanoparticles are used in emerging applications. Treatment for various types of cancer Documented with Sliver nanoparticles. Basic anti-cancer mechanisms of gNPs (1) Degeneration of cell membranes, (2) The reaction is damage to oxygen species and Ag +, protein or DNA. The photosynthesis mechanism of Sliver nanoparticles is based on non-radioactive decomposition, which converts photovoltaic energy into thermal energy [25]. of particles. Here, we are conclude with the latest updates specifically referring to previously published seminal papers. Of various applications of Sliver nanoparticles **[22].** The project diagram is given in Figure 1

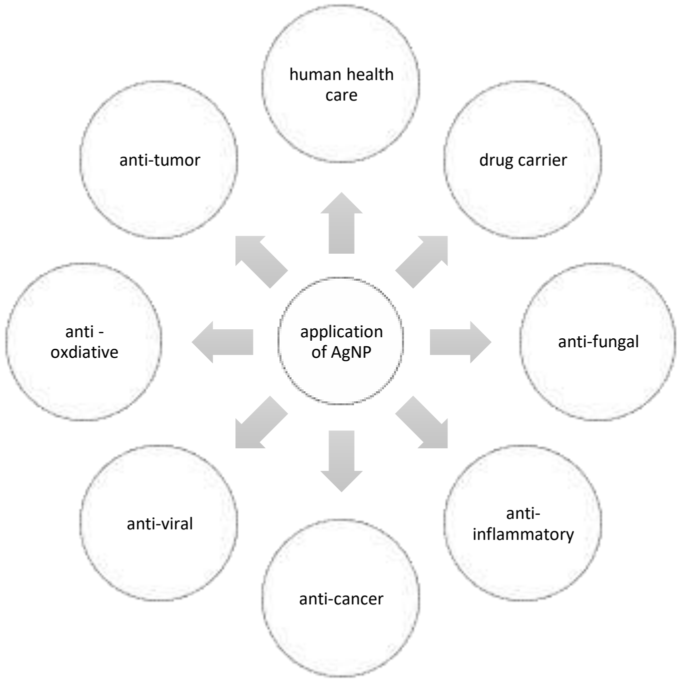

FIGURE 1. Shows the Application of AgNp

Figure 1. Shows the Application of AgNp Due to the exceptional properties of ultralo interfacial tension, large interface area, thermodynamic stability and dissolution of contaminated liquids, the microbial emulsion The technique has various applications in the field of chemistry and biology. Microemulsion system Particle such as geometry, morphology, integrity and area Guarantees size control, which is one of the most flexible manufacturing techniques that allows to control particle properties. Nanoparticles and non-particles New applications for particles are growing rapidly in various aspects due to their size, distribution and morphology. Green Nano Technology is expanding its horizons in the world of science and technology, at the same time as they call it. "miracle of science"[26]. The development of biologically inspired experimental processes for the synthesis of nanoparticles is emerging as a key branch of nanotechnology. Biologically integrated silver nanoparticles can have many applications, and the spectrum for absorbing solar energy can be an intermediate material for selective coatings, electrical batteries, optical receptors, bio-labeling and antimicrobials. Reliable for integration of nanoscale materials such as research, providing eco-friendly processes, biological processes and "green" chemistry in nanotechnology. Nature's inspiration comes from magnetic bacteria; It synthesizes magnetite nanoparticles, silicic substances synthesize diatoms, gypsum and calcium carbonate-forming S-layer bacteria. Silver nanoparticles (Sliver nanoparticles), similar to their total counterparts; Proven to be effective antibiotics Against various pathogenic microorganisms. Although various chemical and biochemical methods have been explored for the production of Sliver nanoparticles, Microbes are very effective in this process. New enzyme approaches that use bacteria and fungi in the synthesis of nanoparticles are Is expected to play a key role in many conventional and emerging technologies. Nano Particles of particles have been found to be present within cells in many cases, But complicates the work of the downstream process [27].

Conclusion

Compared to other antibiotics, Silver is also used to fight infections From the earliest days to prevent spoilage Widely researched and used. High concentrations of silver nanoparticles are toxic and are recommended to trigger various environmental problems that can cause various health Problems if published in context. Various applications of silver nanoparticles for textiles Dry clothes, coatings for medical devices, textiles enriched with silver nanoparticles. Due to the uncontrolled release of silver ions, the devices can be coated on the outer and inner sides, reducing its antimicrobial effectiveness. However, there are some issues with the exact mechanism of contact of silver nanoparticles with bacterial cells, such as how the surface of the nanoparticles affects its killer function, animal samples and clinical studies. Understand the antimicrobial properties of silver clothing, the toxicity of silver clothing, if any, etc. Therefore, one must be careful in using this miracle in a good, effective and efficient way, understanding its shortcomings and being careful. It does not cause any harm to an individual and the environment. Overall, silver nanoparticles with unique properties such as silver and nano size are used to generate safety data in the pharmaceutical, biomedical and related fields, which demonstrate their safety and at the same time rule out their toxicity.

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