OPINION

Creation and use of silver nanoparticles

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ABSTRACT

In addition to being readily available and having a recognised microbicidal function, silver has no unfavourable effects on the human body. The main cause of the microbicidal impact is silver ions, which have a broad antibacterial spectrum. Furthermore, it is less likely that germs may become resistant to multiple drugs, as with antibiotics. When employed directly, silver ions' microbicidal action is reduced because they precipitate after binding to halide ions like chloride. Silver Nanoparticles (Ag NPs), which are often utilised as microbicidal agents and release silver ions from particle surfaces, have recently been created as a solution to this problem. Silver ions are efficiently discharged from nanoparticles based on their unique surface areas.goods that nanotechnology offers, it has becoming more popular across a variety of industries. Nanomedicine is the use of nanotechnology in healthcare and medicine, and it has been utilised to treat some of the most widespread illnesses, such as cancer and cardiovascular conditions.

Key Words: *Nanomedicine; Cancer*

INTRODUCTION

Because of its metallic qualities, such as conductivity, and because it has an antibacterial effect, silver is frequently utilised in industrial applications. Even at low doses, silver has antibacterial activity against a number of different organisms. Silver ions, which are released from a substance containing silver and interact with the thiol groups of enzymes and proteins that support bacterial life, are primarily responsible for silver's antibacterial activity. This interaction prevents bacterial cells from respiring properly, which kills the bacteria. Silver ions bond to halide ions, such as chloride, in the environment and precipitate, losing their water solubility and antibacterial properties. As a result, when employed alone, free silver ions have a very limited antibacterial effect.

A metallic particle must be between 1 nm and 100 nm in size to qualify as "nano." Metallic nanoparticles have particular characteristics, like surface plasmon resonance. Due of their distinctive, vibrant colours, such as the red from gold nanoparticles and the yellow from silver nanoparticles, these particles have been employed for glass decorating. Additionally, nanoparticles have a small mass of metal and a big specific surface area. Common methods for creating metal nanoparticles include heating or vaporising a metal in an inert gas or vacuum to create metal atom aggregates, or reducing metal salts in a solution. New environmentally friendly synthesis strategies are also used to create size-controlled Ag NPs.

Microbicidal properties of Ag NPs

Ag NPs' microbicidal action is only recently discovered to be mediated by processes. The accumulation of nanoparticles in "pits" that form in the cell wall causes the release of free radicals, which damages the cell and kills the bacteria. Additionally, one of the elements that harm bacteria is the redox reaction in which which the silver ions are liberated from Ag NPs. Silver ions are released from the surface of small (less than 10 nm) Ag NPs, indicating substantially stronger antibacterial activity than would result from direct bacterial contact with that surface. Only lately have studies on the toxicity of Ag NPs to the human body been published. Recent in vitro studies show that Ag NPs are hazardous to HaCaT (Human Keratinocyte Cell Line) cells. Toxicity data regarding cell viability showed a dose-dependent safe profile at low concentrations (10 m), however higher concentrations were linked to a high rate of cell mortality. Other human biological models, such as lung fibroblasts, glioblastoma cells, and mesenchymal stem cells, have also been used to test.

The cytotoxicity of Ag NPs. Proteins are undoubtedly harmed by oxidative stress and severe lipid peroxidation, which have been seen. At least in part, the generation of reactive oxygen species has been hypothesised as the mechanism by which Ag NPs cause cytotoxicity (ROS). Overproduction of ROS impairs DNA, lipids, and proteins, which ultimately results in cell death and slows down an organism's ageing process. Additionally, depending on the Ag NPs' surface charge intensity, cells can absorb them. Once within the cells, their buildup is likely to cause oxidative stress, which in turn destroys DNA. Additionally, the induction of cell apoptosis is taken into account. As a result, understanding of Ag NP toxicity to various human cells has continued to grow. However, relevant research is infrequently disclosed and mostly focused on in vitro and animal investigations. As an illustration, intraperitoneal delivery of a substance did not affect

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vivo acute/subacute toxicity data. While there were less mast cells found at the skin level compared to the control, histological views of internal organs and the biochemical parameters examined along with the other biological findings revealed a low toxicity level. Therefore, more research on human safety is anticipated in the future.

The surface structure of the chitin nanofiber sheet (CNFS) used in our study is nanoscale fiber-like, increasing the amount of surface area that can be used to adsorb silver nanoparticles. Additionally, chitin/chitosan-based materials have benefits in terms of biochemical activities, such as anti-infectious activity, promotion of angiogenesis/wound repair, and stabilization/activation of growth factors. Recent research suggests that CNFS may be used as a component of skin-protective formulations since it improved the epithelium granular layer and increased granular density when applied to skin. The skin, which covers the majority of the human body, is vulnerable to a variety of stressors and wounds. Depending on how severe the physical or chemical injury was, the wound could be fatal or cause significant long-term pain. Preventing the wound from drying up and taking precautions against bacterial infection are vital when caring for a wound. In order to keep the area around the wound moist, wound dressings are employed. Antibiotic therapy and cleanliness are precautions against infection. Numerous investigations have been done on the creation of wound dressings incorporating materials with antibacterial activity in response to the widespread worry about resistant bacteria brought on by the frequent use of antibiotics.