

A historical review on silver nanoparticles (AgNPs) synthesis for different leaf, vegetative and plant extracts

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ABSTRACT

Silver nanoparticles are nanoparticles of silver of between 1 nm and 100 nm in size. While frequently described as being 'silver' some are composed of a large percentage of silver oxide due to their large ratio of surface to bulk silver atoms. It was found that the bacterium *Lactobacillus fermentum* created the smallest silver nanoparticles with an average size of 11.2 nm. It was also found that this bacterium produced the nanoparticles with the smallest size distribution and the nanoparticles were found mostly on the outside of the cells. Silver has a long history of its usage in different forms and for different purposes. Nanoparticles have unique properties due to their small size. The surface area to volume ratio is 0.00000008, a factor of 7,500,000 less than 10 nm nanoparticles. While high surface area to volume ratios is important for applications such as catalysis, the actual properties of silver are different at the nanoscale.

Keywords: Silver nanoparticles (AgNPs), Green synthesis, UV-Visible spectroscopy, Electron microscopy, Leaf extract, Plant extract, Power activity, Antibacterial activity.

I. Introduction

To overcome this issue, silver nanoparticles (Ag NPs) have been recently synthesized and frequently used as microbicidal agents that release silver ions from particle surface. Depending on the specific surface area of the nanoparticles, silver ions are released with high efficiency from different vegetative and leaf extracts. Silver has a long history of its usage in different forms and for different purposes. The synthesis of silver nanoparticles by sodium borohydride (NaBH_4) reduction occurs by the following reaction: $\text{Ag}^+ + \text{BH}_4^- + 3 \text{H}_2\text{O} \rightarrow \text{Ag}^0 + \text{B}(\text{OH})_3 + 3.5 \text{H}$. The reduced metal atoms will form nanoparticle nuclei. Overall, this process is similar to the above reduction method using citrate. Silver nanoparticles (AgNPs) are increasingly used in various fields, including medical, food, health care, consumer, and industrial purposes, due to their unique physical and chemical properties. These include optical, electrical, and thermal, high electrical conductivity, and biological properties.

II. Methods and Materials:

A. Synthesized silver nanoparticles

The most important physical methods for the synthesis of the silver nanoparticles are evaporation-condensation, laser ablation, electrical irradiation, gamma irradiation, and lithography.

B. Tollens method

A simple one-step process, Tollens method, has been used for synthesis of silver NPs with a controlled size. This green synthesis technique involves reduction of $\text{Ag}(\text{NH}_3)_2^+$ (as Tollens reagent) by an aldehyde.

C. Harmful of silver nanoparticles

The toxicity of silver, including nanoparticles of silver, to humans is generally low. Skin contact with textiles containing silver is one of the main ways people are exposed to silver nanoparticles. In general, consumer products release only small amounts of silver, not resulting in significant health effects

D. Use of Silver nanoparticles

An increasingly common application is the use of silver nanoparticles for antimicrobial coatings, and many textiles, keyboards, wound dressings, and biomedical devices now contain silver nanoparticles that continuously release a low level of silver ions to provide protection against bacteria.

E. Dangerous of Nano Silver

Endocrine disruptors are not the only worrying chemicals that ordinary consumers are exposed to in everyday life. Also nanoparticles of silver, found in dietary supplements, cosmetics and food packaging, now worry scientists. A new study shows that nano-silver can penetrate our cells and cause damage.

F. Side effect of Nano Silver

As a compound, the silver found in the environment is thought to be quite safe. However, the environmental and health risks of silver nanoparticles are not well understood, and ingesting colloidal silver is considered unsafe.

G. Silver toxic to humans

Silver exhibits low toxicity in the human body, and minimal risk is expected due to clinical exposure by inhalation, ingestion, dermal application or through the urological or haematogenous route.

H. Approval of FDA for Nano Silver

Because colloidal silver products are sold as dietary supplements, they are regulated by the FDA as food instead of medicine. That means they don't have to meet the same measures of safety and effectiveness as medicines do before they go on the market.

I. Nano Silver safe in toothpaste

Coral Nano Silver is free of sodium lauryl sulfate (SLS), glycerin, parabens, and fluoride. It is all-natural, safe to swallow, kid friendly, and best of all, it tastes great with essential oil flavorings. Products include toothpaste and mouthwash, and they even offer a toothbrush.

J. How many ppm colloidal silver is safe?

Silver Wings offers products in 50,150,250, and 500 PPM. IS COLLOIDAL SILVER SAFE? Yes, due to the unparalleled silver particle size, Silver Wings Colloidal Silver can be safe for the whole family. Properly prepared pharmaceutical grade colloidal silver is safe to use in higher PPM strengths and concentrations. A dosing reference chart created by the EPA suggests that your daily silver exposure - topical, oral, or environmental - shouldn't exceed 5 micrograms per every kilogram you weigh. Colloidal silver's most common commercial form is as a liquid tincture. Most health food stores carry it.

K. Quantity of silver is in a human body

Trace amounts of silver are in the bodies of all humans and animals. We normally take in between 70 and 88 micrograms of silver a day, half of that amount from our diet. Humans have evolved with efficient methods of dealing with that intake, however. Over 99 percent is readily excreted from the body.

L. Can silver be absorbed through the skin?

Conclusion: Our results suggest that silver nanoparticles are able to penetrate intact human skin in vivo beyond the stratum corneum and can be found as deep as the reticular dermis.

M. Silver as a drug

Colloidal silver is a mineral. Despite promoters' claims, silver has no known function in the body and is not an essential mineral supplement. Colloidal silver products were once available as over-the-counter drug products.

N. Silver as a heavy metal

Gold and silver are both classified as heavy metals but are by no means toxic. Some of the most common toxic metals are lead, mercury, cadmium, arsenic and chromium. Other heavier metals that have noted levels of toxicity are zinc, iron and copper.

III. Separation of silver nanoparticles

Silver nanoparticles of 10nm or larger are centrifugally pelleted at 12-15,000rpm over 1 h-90mins, leaving **silver** nitrate in solution. Wash the pellet several times. For larger silver nanoparticles, try a slower speed. Ideally a soft pellet will be easier to resuspend in solution. The production of nanoparticles using plant extract is alternative the conventional methods. The photosynthesis is a green and eco-friendly technology used for production of large scale nanoparticles. Plant extracts may act both as reducing agents and stabilizing agents in the synthesis of nanoparticles.

IV. Conclusion

Green synthesis is an emerging area in the field of bionanotechnology and provides economic and environmental benefits as an alternative to chemical and physical methods. In this method, nontoxic safe reagents which are eco-friendly and biosafe are used.

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