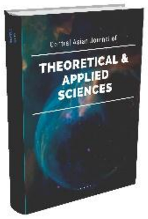

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 05 Issue: 01 | Jan 2024 ISSN: 2660-5317
https://cajotas.centralasianstudies.org

Preparation Sliver Nano Particles (AgN) Via Laser Ablation And Bacteria Effect

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Received 28th Nov 2023, Accepted 9th Dec 2023, Online 6th Jan 2024

Abstruct. *In this research, Nano silver(AgN) was prepared by pulse laser ablation liquid technique(PLAL) with different laser energies (550,650,700) mJ and different pulses (300,600,900) pulse. The properties of Nano silver were studied for tested likes X-ray diffraction(XRD), and it was found sliver Nano particles has a face center cubic. It was also found from examination scanning electromagnetic (SEM) that it has a spherical shape with nanometer sizes reaching less than 20 nanometers, when the test of Zeta potential(Z-potential) proved sliver Nano particles were stability. From the biological side, Nano silver has proven its ability to inhibit bacteria from diffusion.*

1-INTRODUCTION:

Silver, which has the atomic number 47 and the symbol Ag, is a gleaming, highly ductile, and malleable element that is marginally "harder than gold. It is among the fundamental substances that comprise our world. It can be found in nature as a native element, a mineral (like argentite and chlorargyrite), and an alloy that combines with other metals (like gold). According to [1], silver can exist in four distinct oxidation states: Ag^0, Ag^{1+}, Ag^{2+}, and Ag^{3+}. Although it is a chemically inert element, it can react" to form soluble silver salts when combined with hot, concentrated sulfuric acid or nitric acid. Additionally, it has excellent heat and electricity conductivity, but because of its higher cost, its applications in the electrical industry have been severely limited [2]. The metallic form of silver is water insoluble, but its metallic salts, like "silver chloride (AgCl) and silver nitrate (AgNO3), are soluble in water. Metallic silver has been used extensively in coinage, fungicides, surgical prostheses and splints over the past few decades [3]. On the other hand, its metallic salts have also been used to treat a number of illnesses and conditions, such as gastroenteritis, gonorrhea, and epilepsy". Soluble silver compounds have the potential to have negative health effects when consumed through food because of their high absorptivity. However, Schluesener and Chen (2008) stated that the primary bodily systems of humans, such as the neurological, immunological, reproductive, or cardiovascular systems, are comparatively safe and cancer-free from silver. As a result, the demand for silver has increased recently, but only in the textile, plastic, and medical sectors. Silver has been regarded as a safe and effective anti-bactericidal metal because it is not toxic to animal cells. In particular, it is highly toxic to bacteria like Staphylococcus aureus and Escherichia coli [4]. As a result, for centuries, compounds based on silver have drawn significant interest as an antimicrobial agent to stop the growth of bacteria in applications like burn care [5].

In order to remove material from a solid target, a very high energy is focused at that point during the laser ablation process. Electromagnetic radiation is absorbed by the target electrons when a laser pulse strikes a bulk material's surface, transferring energy to the material's vibrational lattice. Consequently, material is released from the surface as a plasma plume, which forms nanoparticles [6]. Because of the surrounding liquid's high pressure and the significant temperature differential between the plume and the liquid, the plasma plume is contained. A cavitation bubble is formed when energy from the plasma decays is transferred to the surrounding liquid, creating a layer of vapor that is roughly the same volume as the plasma. The cavitation bubble then experiences periodic growth and contraction until it collapses, at which point nanoparticles are released into the surrounding liquid [7]. Laser parameters like wavelength, fluence, pulse length and repetition rate, transmission, target material's light absorption efficiency, and liquid's chemical composition all affect the ablation rate. As a result, both the liquid medium and the laser parameters affect the NP features. .

2-Experimental part:

2-1 preparation silver Nano particle by laser ablation:

1. preparation the sliver Nano particle(Ag-N)when the laser beam is focused on the surface of a pallet target of silver (1*1)cm in the ambient media from liquid ,
2. The energy is different (550 mJ , 590 mJ , 630 mJ) and the number of pulses is different (600 pulse , 900 pulse) and in a fixed ambient medium is deionized water .
3. Sliver Nano particles will have deposited in glass slide for testing.

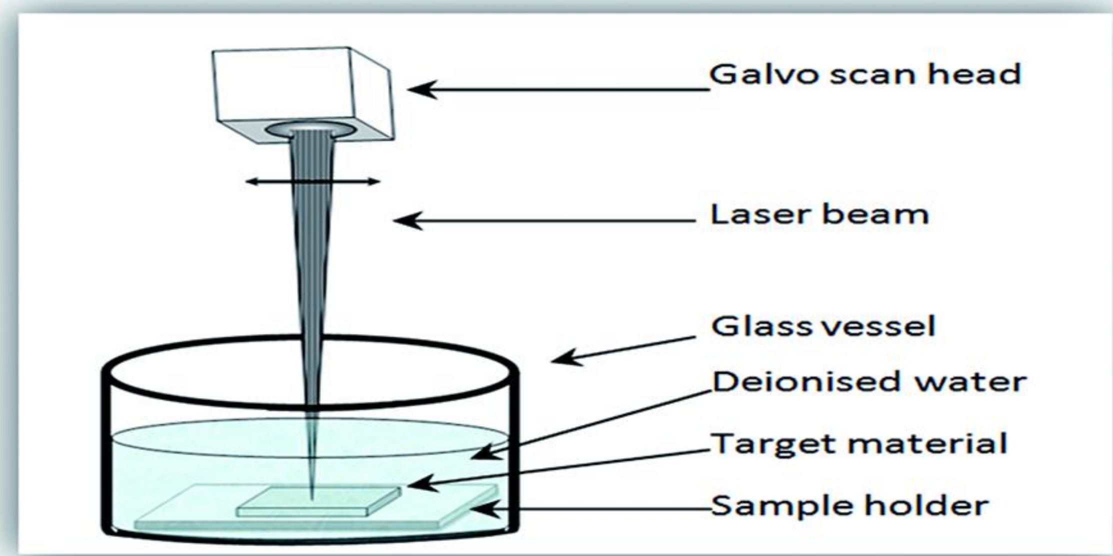


Fig. (1.1): Schematic of the nanoparticle formation process by laser ablation

3- Reasult and desiccation:

3.1 XRD-ray diffraction pattern:

The silver nanoparticles (Ag-N) crystal system Ag N, X-ray diffraction results. In good agreement with the standard Ag NPs JCPDS le (JCPDS 87-0597) and table (3.1), Fig. (3.1) displays the powder XRD pattern (Ag-N) with sharp diffraction patterns located at 38.4, 45.5could be indexed as (111), (200), facets with a face-centered cubic (fcc) structure.

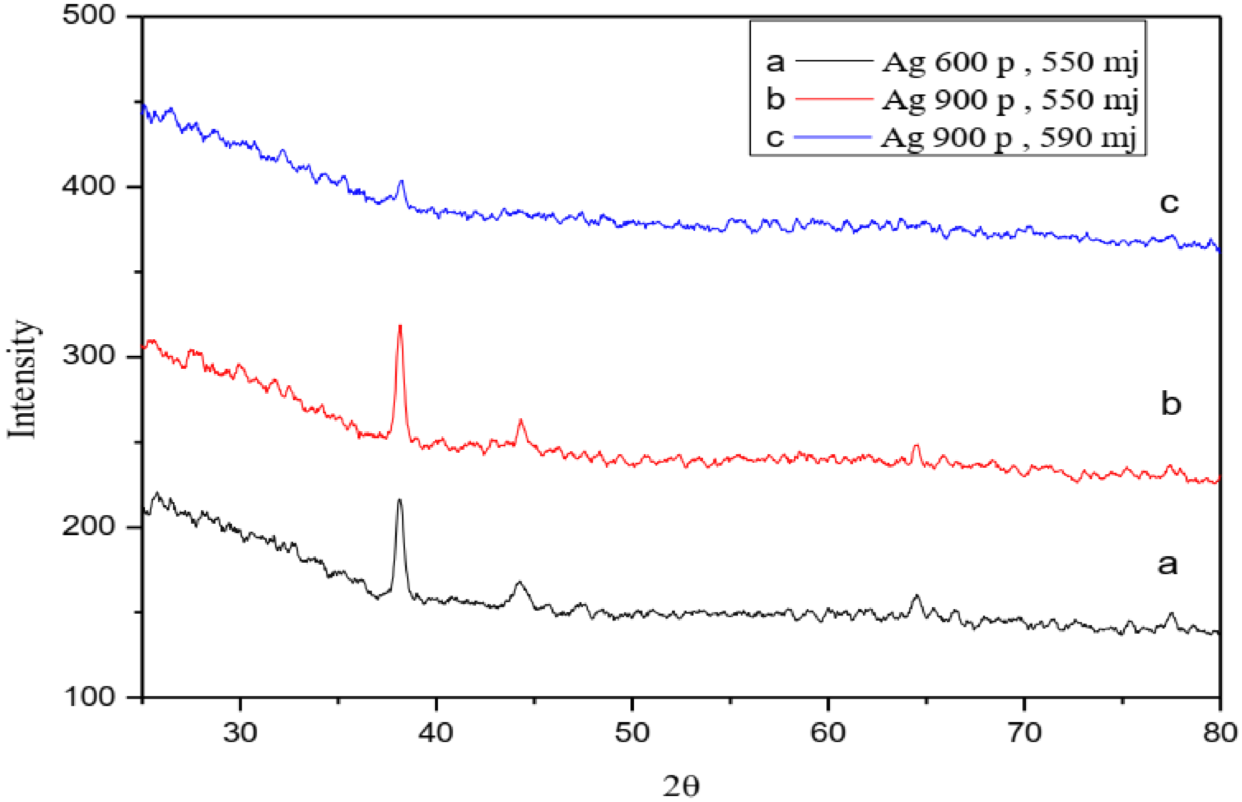


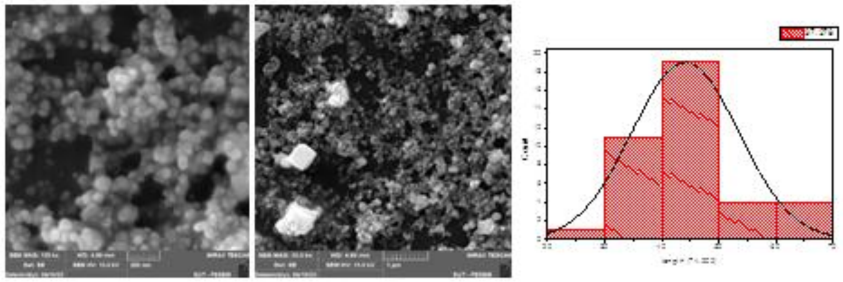
Fig: 3.1: XRD of sliver Nano particles by laser ablation in different energy and different pulse.

Table: (3.1) the properties of xrd diffraction.

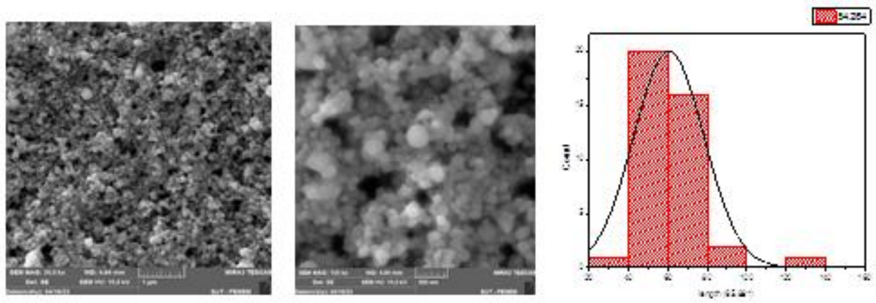
Nanomaterial	2θ	FWHM	D(c.s) nm	d_{hkl} ($\mathring{A}$)	hkl
Ag	38.15	0.3600	25.155	2.35675	111
	44.28	0.5800	15.388	2.04389	200
	64.50	0.4000	32.844	1.44349	220
	77.49	0.4667	37.740	1.23076	311

3.2 The Scanning Electron Microscopy (SEM) for sliver Nano.

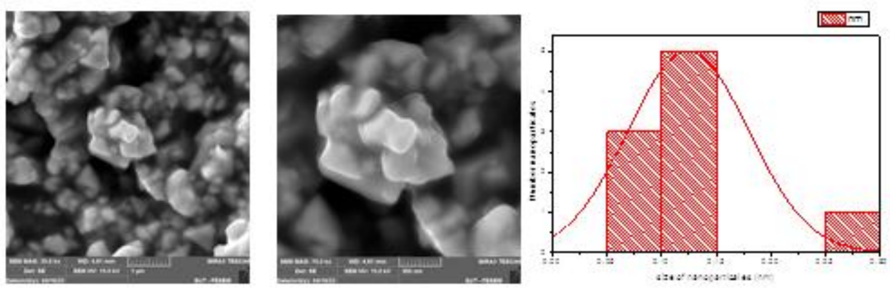
Every sample that was obtained using the laser ablation method was subjected to a SEM assay in distilled water in order to study surface topography, which involved taking high magnification photos of the surface. It is acquired using constant energy and (600) pulses. The program determined the size ratios of these particles (image j). These images of the various-sized nanoparticles on the substrates show the shape distribution. The size distribution of the nearly spherical, homogenous silver nanoparticles is depicted in the figures, which are SEM images [8].



(a) Ag 600 p , 550 mj



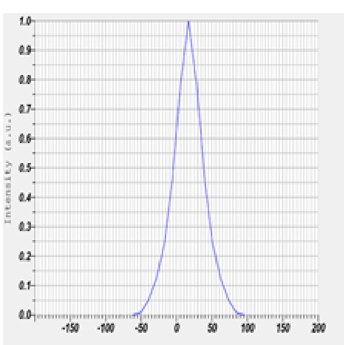
(b) Ag 900 p , 550 mj

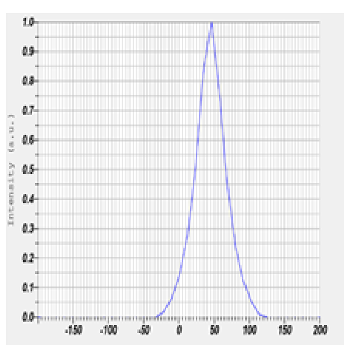


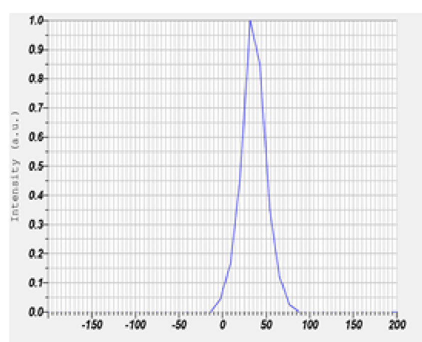
(c)Ag 900 p , 590 mj

3.3 Zeta-potential for sliver Nano:

Zeta potential (a, b, c in Fig. 3.3). "There won't be any tendency for the particles to assemble together when they all have large negative or positive zeta potentials and will instead tend to repel one another. Nevertheless, there won't be any force to stop the particles from aggregating and flocculating if they have low zeta potential values [9]".







(a) Ag 600 p , 550 mj (b) Ag 900 p , 550 mj (c) Ag 900 p , 590 mj

Fig. (3.3): zeta potential of sliver Nano in different energy and different pulse.

3.4 UV-Vis spectra analysis for sliver Nano:

UV–visible spectroscopy was used to characterize the AgNPs in a preliminary manner. After dilution with 20 times of Millipore water, the reduction of silver ions to the nanoparticle form was observed by measuring the UV-visible spectra of solutions. From 300 to 600 nm, the AgNPs solution's spectrum was observed using a UV-Vis spectrophotometer (Varian Inc., USA). The baseline was adjusted using millipore water as a blank.

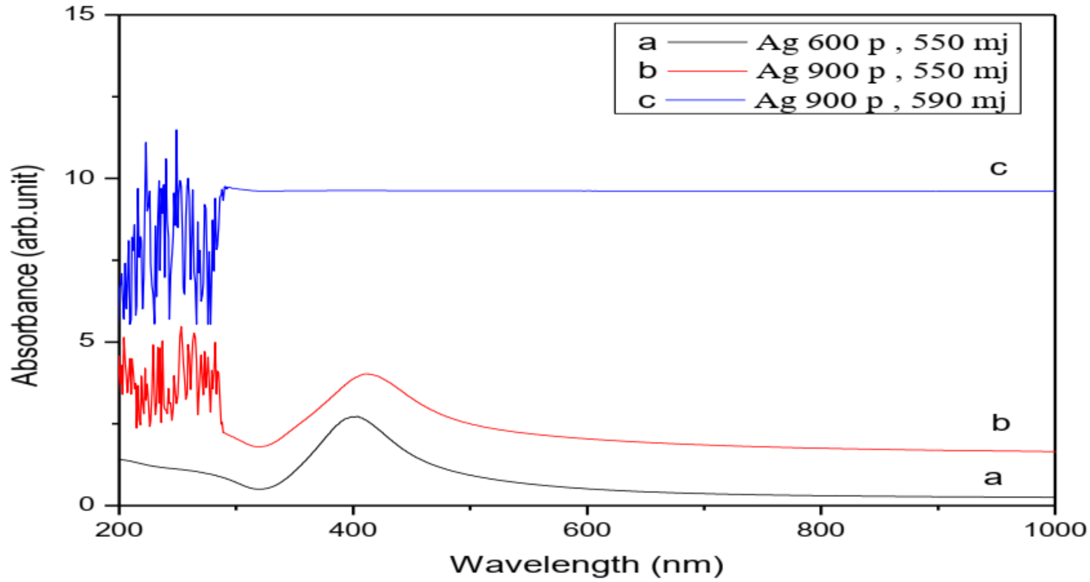


Fig (3.4): UV –visible of sliver Nano in different energy and different pulse.

4. Antibacterial properties of Nano silver:

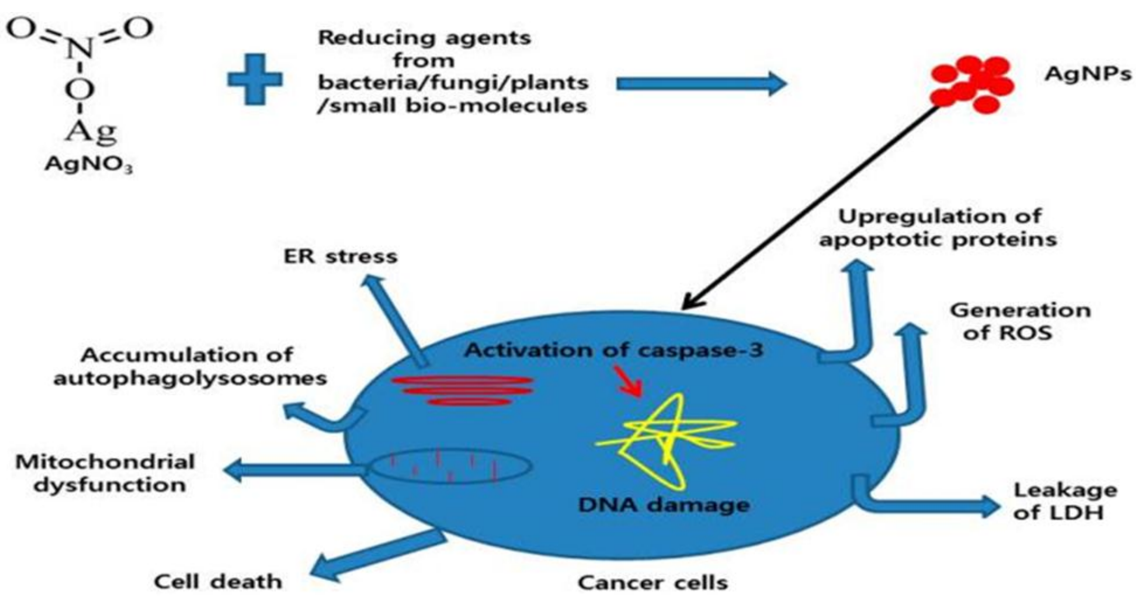
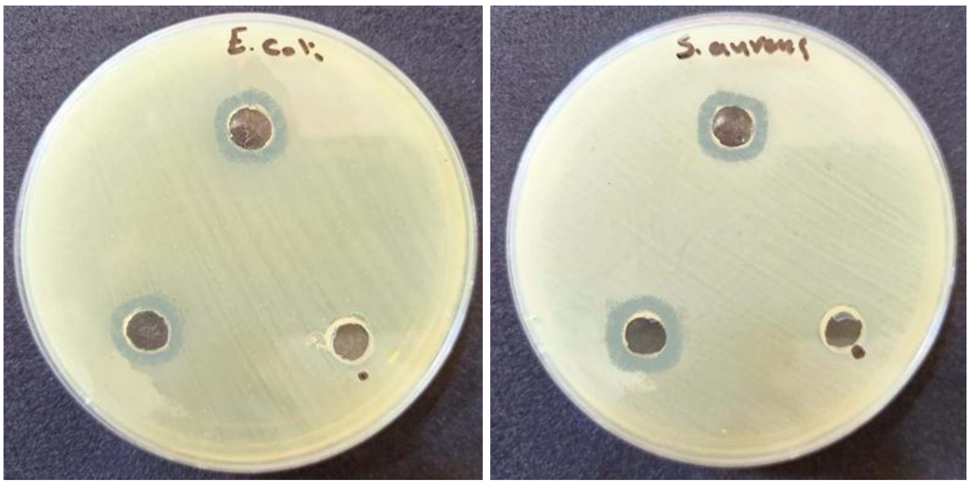
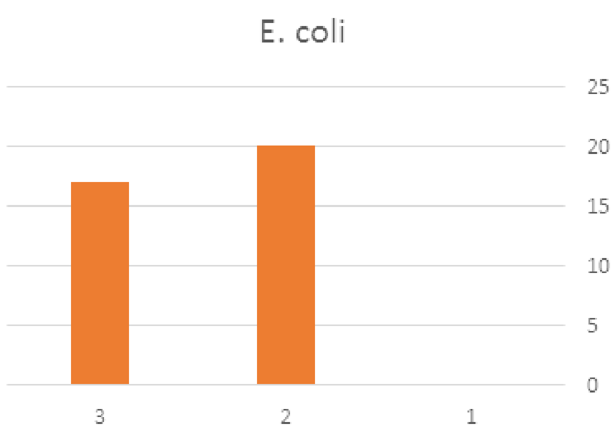


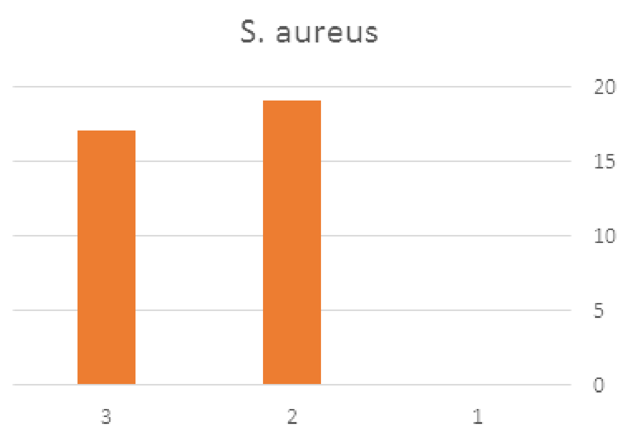
Fig (4.1): Mechanism of inhibition for sliver Nano

Since ancient times, metallic silver and its compounds have been known to have antibacterial properties. Because silver is deadly to most bacteria and viruses but safe for human cells in small concentrations, it is frequently used in medicine to prevent infections as well as to disinfect food and water in daily life.249

The distinct antibacterial and antiviral characteristics of silver compounds have been thoroughly examined thus far, with multiple thorough reviews addressing this issue [10-13] . The possibility that microorganisms could mutate themselves resistant to silver seems unlikely (unless the latter trait was present from the start), as silver ions target a wide variety of different proteins within a cell. The increasing number of pathogenic bacteria species that are resistant to narrow-spectrum antibiotics and pose a serious threat to human life and health has made this valuable property even more important today [14]. The slow oxidation and release of Ag^{+} ions into the environment that is linked to metallic silver's bactericidal properties makes the use of nano silver drugs as a unique class of biocidal agents seem promising. Nanoparticles have a high level of antibacterial activity because of their highly developed surface, which allows for maximum environmental contact. Additionally, they are small enough and able to pass through cell membranes to have an internal impact on intracellular functions.







Results

Microorganism / Tested materials	*E. coli*	*S. aureus*
D.W	Resist	Resist
Ag 600	16 mm	15 mm
Ag 900	15 mm	16 mm

5. Conclousion:

Silver nanoparticles have proven effective in inhibiting bacteria. Therefore, these particles have entered the medical fields in a wide range of ways and are currently used in various medical products, especially cosmetic ones. What has increased the speed of their spread is the ease of the methods used in preparation, as laser removal is considered one of the easiest ways to prepare nanomaterials.

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