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Research Paper

Characterization of Silver Nanoparticles Prepared in the form of Powder and Their Application on Filters and Their Efficiency in Removing Bacteria Contaminating Drinking Water

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Abstract
In order to ensure the availability of pure water free from contaminants, we focused on developing different laboratory-made filters and applying the ready-made nanosilver type Ag1 and the prepared type Ag2 prepared in the laboratory and loading them on the filters. We evaluated their effectiveness in removing and inhibiting bacteria based on the filter type and pore size, and we observed an increase in inhibition efficiency. In addition, we subjected the samples to UV testing within the wavelength range of 200-800, which is the range of nanosilver. We used EDX to confirm the presence of nanosilver in the samples. AFM examination, which shows the surface roughness values, pressure and grain size distribution of the prepared particles, and SEM examination, which shows the particle distribution, shapes and size measurement. To verify the stability of Nano silver and its strong negativity and confirm its size, a Zet test was performed to determine the negativity of the material and the nano size. The resulting water was analyzed with a TDS device to measure the dissolved salts in the water resulting from the different manufactured filters and to evaluate the drinking water and ensure that it is within acceptable levels. Then we used the Atomic Assay (AAS) to measure the percentage of nano silver in the drinking water resulting from the prepared filters and that the silver present does not affect the water because its percentage is very small and the silver loaded on the different filters has a moderate toxicity percentage that does not affect the water.

Keywords
Silver, UV, DLS, EDX, Bacteria

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1. INTRODUCTION

The term nanoparticles and nanotechnology has become popular and widely used nowadays. However, it still needs a clear definition. Nanoparticles are solid particles with a size range of 10-1000 nanometers, Nanotechnology refers to any technology implemented at the Nano scale where the structure of matter is restructured at the atomic and molecular levels with a size range of 1-100 nanometers , This technology enters into multidisciplinary fields, covering a wide and diverse range of sciences from engineering, biology, physics and chemistry (Al-Zahrani, 2019) . When the dimensions of a material are reduced from a large size, the properties remain the same at first, then small changes occur and finally when the size is less than 100 nanometers, radical changes can occur in the unique physical and chemical properties (Bhushan, 2017). There has been significant interest in researching and studying the nature and properties of water, as it is a fundamental substance essential for the survival of life. Fresh water, which accounts for less than 2% of the Earth's total water, plays a crucial role in sustaining life on Earth, covering 17% of the planet's surface. This significance is particularly relevant to human existence, as it serves as the primary source of drinking water (Kassim et al., 2007). Water is a major component of the cellular matter in all living organisms, serving as a medium for essential interactions through dissolution. It also contains various elements and salts crucial for organism survival and continuation of life. Recent research has highlighted the significant incidence of waterborne diseases and related deaths, as well as the ongoing global issue of polluted and unhealthy water affecting 71% of the world's population (World Health Organization, 2008). Understanding the fundamental characteristics of water that influence consumer health is crucial for ensuring water quality. Factors such as pH, electrical conductivity, total dissolved salts, total hardness, and microbial contamination all play a role. Excessive salt levels can alter water composition, with hard water containing high mineral content and soft water having lower mineral levels. pH levels indicate water toxicity and its potential to affect enzymatic processes. Additionally, the presence of microorganisms can impact bread quality. Regardless of its source, water must adhere to drinking water standards to avoid negative effects on human health. Compliance with specific standard specifications is necessary to ensure that the resulting bread is free from microbiological and chemical substances exceeding permissible concentrations. Numerous domestic and international research projects have been undertaken to assess the quality of water utilized in the production of bread. One such investigation took place in Albania, focusing on the impact of distinct groundwater sources (Sprig, Tepelena, Lajthiza/Trebeshin). on the characteristics and attributes of the bread produced. Chemical and biological assessments were carried out on these four water sources to ascertain which type is most suitable for producing bread with favorable specifications. This particular study successfully identified organic contamination (Rowan, 2019). We verify that the rise in bacterial count surpassing the model thresholds arises from deficiencies in the purification procedures, including low efficiency or insufficient levels of added chlorine, as well as sporadic additions by operators of liquefaction projects, or due to subpar quality of the transportation pipe network. These findings are compared with the determinants outlined in reference (Ozuni et al., 2019). Even though water is abundant on Earth, only a small fraction, 2.53 percent, is freshwater. Approximately two-thirds of this freshwater is frozen in ice-fields and consistent snow cover. The quality of water is crucial for human life as it is frequently consumed. Over the past few decades, human activities have negatively impacted the quality of water in reservoirs worldwide. Preserving the natural biological and functional properties of aquatic ecosystems, especially rivers, is one of the significant environmental challenges of this century. Achieving this goal requires understanding the condition of these active systems and how they are affected by specific agents and their potency. Today, it is evident that anthropogenic activities have introduced numerous contaminants into the environment. The destruction of natural habitats and the presence of environmental pollutants may disrupt the ecological balance of every ecosystem (Jasim et al., 2024). Nanotechnology is an expanding field focused on the creation, organization and control of particle structures at a nan scale, typically ranging from 1 to 100 nm in size. The unique properties of nanoparticles, including their small size, shape, large surface area to volume ratio, distribution, aggregation state, solubility, structure, and chemical composition, result in entirely new or improved characteristics with significant impacts. These nanoscale alterations enhance the biological, catalytic activity, mechanical properties, melting point optical absorption, thermal and electrical conductivity of materials in ways not observed at larger scales. Noble metal nanoparticles like silver, gold, titanium and platinum are commonly employed in nanomedical applications. In particular, silver nanoparticles have garnered extensive interest due to their exceptional properties such as chemical stability, good conductivity and catalytic activity. Their excellent antibacterial, antiviral, antifungal and anti-inflammatory activities have led to widespread use as a biomaterial when incorporated into polymeric matrices for applications in composite fibers, cryogenic superconducting materials, biomedical fields, cosmetic products, the food industry and electronic components. Silver's broad biocidal effect against microorganisms is achieved through disruption of their cell membrane and subsequent disturbance of enzymatic activities . The studies indicate that silver nanoparticles demonstrate greater effectiveness in controlling mosquito larvae in comparison to gold nanoparticles (Sharma and Kumar, 2021). Symptoms of *E. coli* infection Symptoms of E. coli infection may appear within 24 hours of exposure, but they often appear after three to four days, and may last for about two weeks It is worth noting that some patients do not show any symptoms, but they are able to transmit the infection to others. The possible symptoms in general are the following (National Health Service, 2018).

2. EXPERIMENTAL SECTION

2.1 Materials

The Table 1 below shows the materials used in the research.

2.2 Methods

Ready-made nano silver was purchased from the market in the form of nano powder and considered as sample 1, and aqueous silver nitrate was purchased. In the precipitation process, after dissolving the silver nitrate, we put a copper wire in the silver nitrate solution to precipitate the silver and burn it at a temperature of 500 Celsius and grind it to produce a powder and consider it as sample 4. Distilled water was used to conduct chemical precipitation preparation experiments. For comparison on a group of different filters when loading them and to know the percentage of bacterial inhibition. To learn more about the physical and chemical properties of the material, many methods were used and using UV to know the extent of the presence of nana silver. The percentages of nana silver preparation were known in EDX. Zeta potency spectroscopy was used to know the negativity of the material and its nano size.

3. RESULTS AND DISCUSSION

3.1 UV-Visible Spectrum Results

In this study, the presence of nano silver was identified, and it was observed that the absorption spectrum of nano particles exhibiting plasmon resonance occurred at wavelengths below 400 nanometers (Ahmed et al., 2024). Specifically, the plasmon resonance of nano silver for ultraviolet rays falls within the range of 200 to 400 nanometers, which corresponds to the characteristic range of silver (Tang et al., 2001). As in the Figure 1 and show the Table 2 Surface Plasmon Resonance SPR (nm) and Absorbance (a.u) at SPR.

3.2 Scanning Electron Microscope (SEM) Results

Study of the surface topography of the produced powders and colloidal solutions after placing them on a silicon chip and leaving them to dry completely. The sizes of the nanoparticles were

Table 1. List of Surfactants Used in This Study

Chemical Name	Chemical Structure	Molecular Weight	Purity	pH	Supplier
Silver nitrate	$AgNO_3$	169.87	99.9%	-	Fisher-Belgian
Deionized water (DW)	H_2O	18.0150	97.8%	7	Iraq
Copper	Cu	29	80%		Iraq
Silver nano	Ag	47	99.9%		Iraq

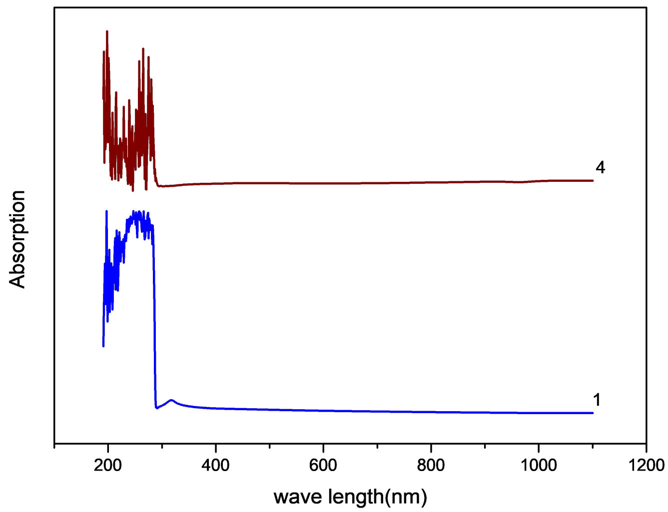


Figure 1. Ultraviolet and Visible Absorption Spectra of Silver Nanoparticles Powders

Table 2. The Absorption and Surface Plasmon Resonance Values of Metals Nanoparticles

Sample	Surface Plasmon Resonance SPR (nm)	Absorbance (a.u) at SPR
1	288.93	0.705
4	288.29	8.210

calculated using the ImageJ program. In terms of the graph, the program was used to draw the size distribution and average sizes of the nanoparticles Surface roughness Root mean square (nm) Grain size (nm), The particles we obtained were within the nanoscale and had irregular spherical shapes. The figure shows Silver nanoparticles prepared in distilled water that does not contain ions after deposition on the silicon chip at magnifications (2 μm, 5 μm, 10 μm and 50 μm). The size dimensions of the silver nanoparticles were measured and they had irregular spherical shapes and their size increased and decreased according to the type of preparation method (Raja et al., 2012). As in the Figures 2 and 3.

3.3 Atomic Force Microscope (AFM) Results

The figures show the particle and nanoparticle size distribution of the dried colloids prepared as in Sample 1 and Sample 4. By examining the representative scan line obtained from the topographic image, one can see that the protrusions protruding from the surface while the height measurements obtained from AFM can be used as lateral dimensions are affected by a detrimental effect called buckling for Sample 1 and 4. The increasing NP deposits lead to an increase in the size and extension of the structures. This indicates that the nanoparticles transition from individual entities on the surface to larger aggregated structures with deposits of additional nanoparticles. The nanoparticles were imaged by atomic force microscopy (AFM) operating in air contact mode at room temperature. The AFM images show an attractive interaction between the nanoparticles leading to the formation of distinct aggregates of well-adhered nanoparticles where each nanoparticle retains its own character. The schematic diagram shows the particle size distribution of the prepared silver nanoparticles where the surface roughness and rams values were found and the grain size distribution shows the particle size of the prepared particles (Pletikapic et al., 2012). As in the Figure 4 and Figure 5 as show the Table 3 (μm) × Grain Size (nm), and Averge size (μm).

Table 3. Values Particle Size of the Prepared Nanoparticles

(μm) × Grain Size (nm)	Averge Size (μm)	Sample
1	66	0.066
4	52	0.052

3.4 EDX Results

The presence of silver nanoparticles was verified through energy dispersive X-ray spectroscopy (EDX) analysis. The highest silver peak was detected at 3 kV, followed by a peak at 2.7 kV. Additionally, peaks for oxygen and magnesium were observed at 0.5 kV and 1.3 kV, respectively (Jasim et al., 2021). As in the Figure 6.

Moreover, a peak for aluminum was identified at 1.5 kV, while silicon exhibited a peak at 1.8 kV. This investigation aims to ascertain the composition of the sample and determine the proportion of silver as well as other materials present (Sabri et al., 2024). As in the Figure 7.

3.5 Zeta Potential (ELS) Results

The purpose of this study was to investigate the stability of materials produced through pulsed laser ablation in a liquid environment with varying energies, and to identify the clusters present in aqueous solutions by immersing the powders in distilled water (Sanchez and Blazquez, 2007). The zeta potential

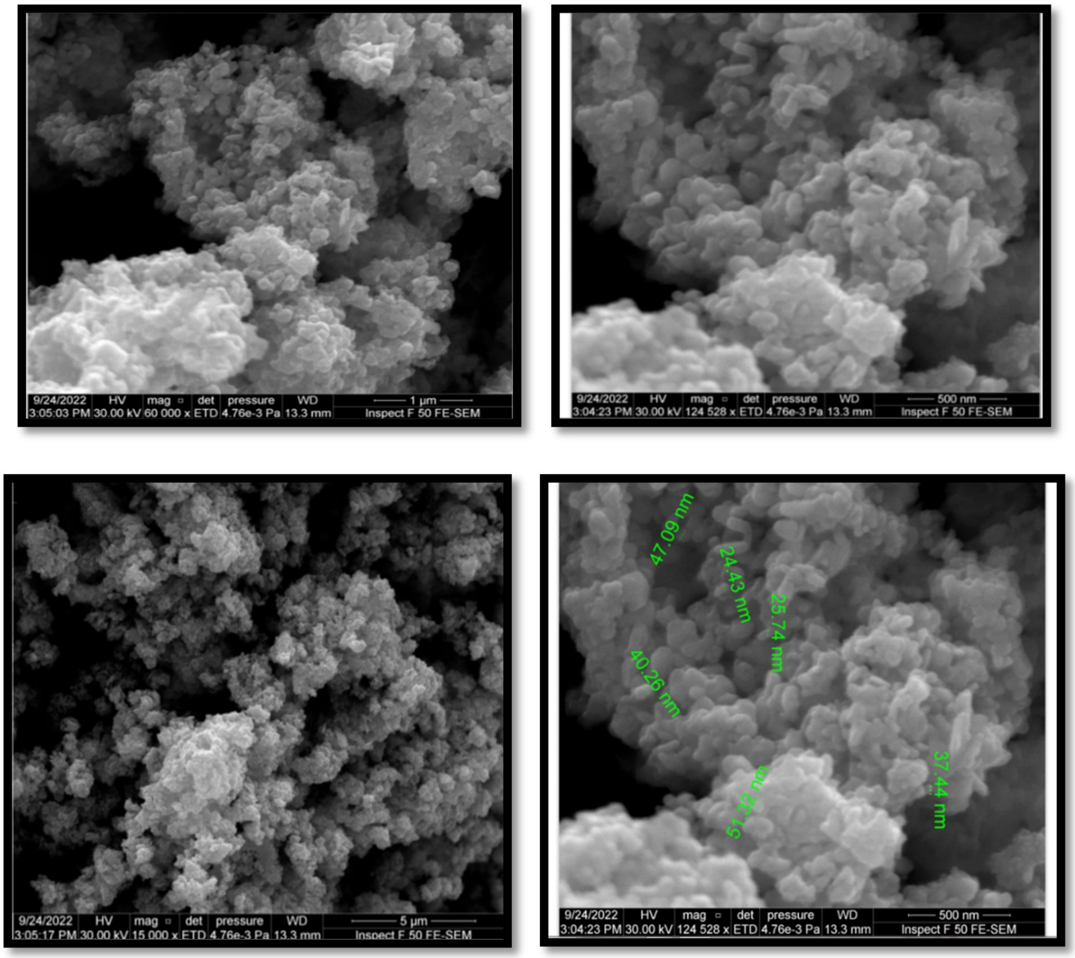


Figure 2. SEM Images of Sample 1

serves as a critical indicator for assessing the stability of colloidal dispersions in liquids. It signifies the level of electrostatic repulsion between similarly charged neighboring particles in the dispersion. A small zeta potential may indicate stronger attractive forces relative to repulsion. Consequently, colloids with high positive or negative zeta potentials are electrostatically dispersed, while those with low zeta potentials are prone to coagulation, aggregation, or agglomeration (Zhu, 2009). The stability of colloids can be assessed within a range of zeta potential values from high (+30 mV) to low (-30 mV) (Elsaesser and Howard, 2012), as in the Figure 8.

The zeta potential distributions of metal nanoparticles synthesized in various liquid environments are illustrated. It is observed that negative values signify greater stability of the nanoparticles. Nevertheless, the zeta potential value is influenced by the concentration of surfactant, as higher surfactant concentration results in an elevation of the zeta potential value (Suha et al., 2013).

The decreased magnitude of the negative zeta potential may have a significant impact (Misra et al., 2012). and the Figure 9 as Show the Table 4 Zeta potential values.

Table 4. Basic ELS Report Zeta Potential Values of Silver Nanoparticles

Sample	Zeta potential (mV)	Mobility (M\s)(v\cm)
1	41.67	2.20
4	45.91	2.42

3.6 Size anoparticles (DLS) Results

The study investigated the nanoparticles of powdered liquids dispersed in distilled water and solvents. An ultrasound device was used to examine the nanoparticles of the powders dispersed in the liquid, followed by their placement in a tube and further examination for nano-size. Additionally, colloidal solutions dissolved by laser in the liquid and remaining suspended were analyzed for differences in energies. Subsequently, images were scanned using a zeta-potential device, revealing results indicating close-to-nano sizes (Jasim et al., 2021). As in the Figures

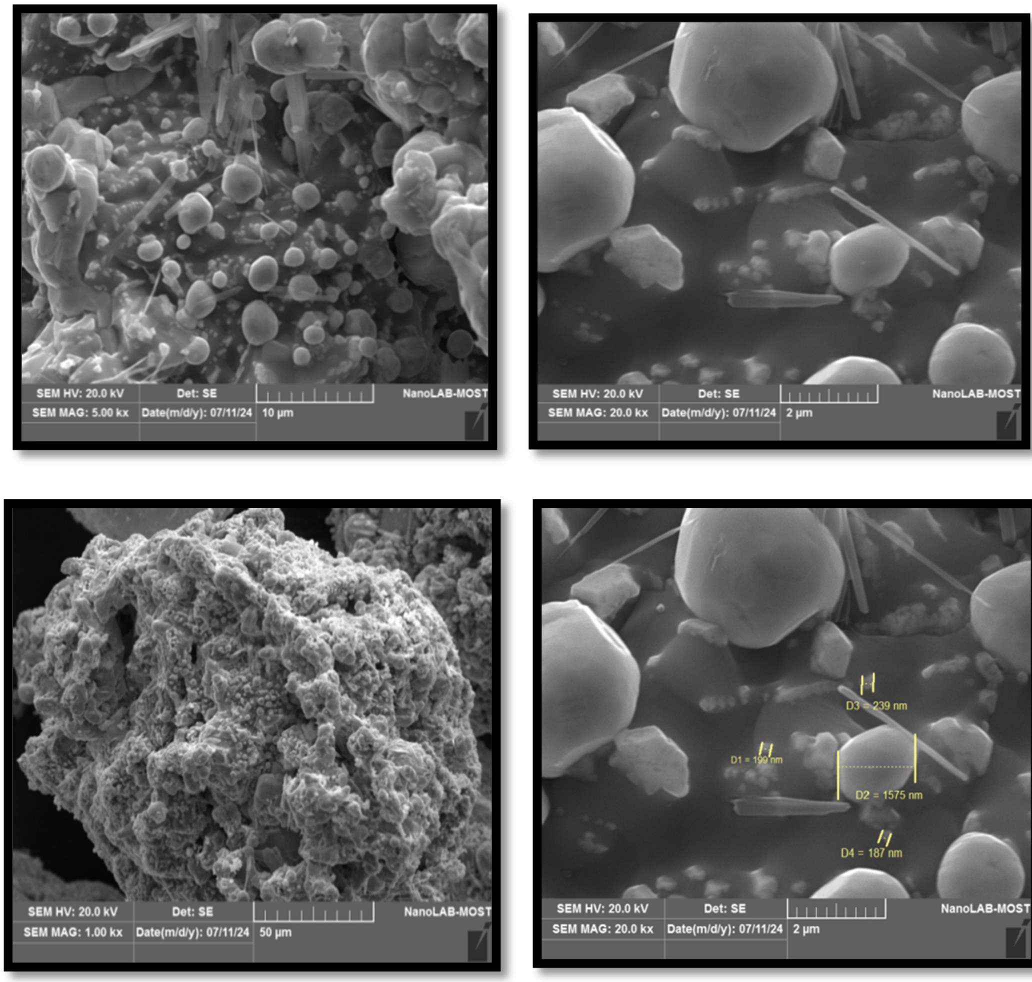


Figure 3. SEM Images of Sample 4

10 and 11 and Show the Table 5 Show Eff Diam (nm) and poly dispersity.

Table 5. Basic DLS Report Nano partical values of silver nanoparticles

Sample	Eff Diam (nm)	Polydispersity
1	564.14	0.321
4	295.25	0.344

3.7 Laboratory Filters Prepared in a Circular Shape with Different Manufacturing Specifications and Studying the Effect of Silver Nanoparticles Loaded on the Filter Paper on the Viability of *E. coli* ATCC 25922 in the Resulting Water for Two Types of Silver Sample 1 and Sample 4

The filters A1 consists of a circular disc-shaped membrane paper with a diameter of 4.5, without nano silver and the filters A2 Ready membrane filter with silver type Sample 1 and A3 Filter membrane with added manufactured silver, type Sample 4, As in the Table 6. The focus of the study was *Escherichia coli* ATCC 25922, a prevalent bacteria in water contaminated with fecal matter. Its presence indicates the presence of other pollutants, including sewage mixed with raw water, leading to intestinal infections. The study evaluated six filters based on their removal efficiency and ability to prevent bacteria from passing through . Filter A1 demonstrated a 53% removal rate, while filter A2 and A3 showed rates of 65%, and 68%, respectively. The presence of

Table 6. Shows the Effect of Silver Nanoparticles Loaded on Filter Papers with Different Manufacturing Specifications on *E. coli* ATCC 25922 Bacteria and Shows the Percentage of Inhibition.

Removal rate (%)	Bacterial Number	Treatment
0.0	1×108	Control
53	47×106	A1
65	35×106	A2
68	32×106	A3

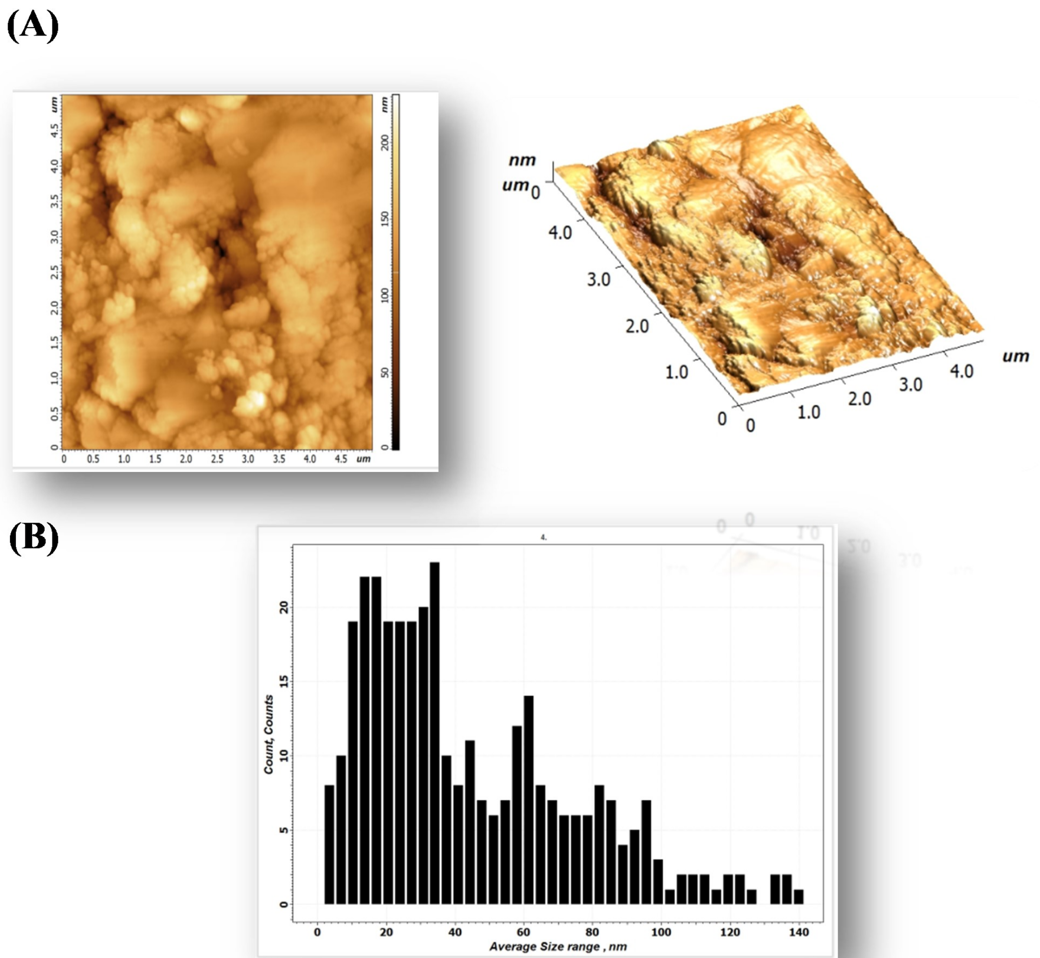


Figure 4. AFM image of Sample 1 (A) 2D, 3D, (B) Particle Size Distribution

silver in the filters was observed to both kill and inhibit bacteria, contributing to their removal and preventing them from passing through the filter (Letterman, 1999).

3.8 Studying the Effect of Silver Nanoparticles Loaded on Filters Prepared with Different Manufacturing Specifications on the Inhibition of *E. coli* ATCC 25922

The plate casting technique was used to study the effect of prepared silver nanoparticles loaded on filters prepared with different manufacturing specifications. The study followed the procedure described to evaluate the effects and activate bacterial cells by growing them in brain infusion broth medium for 24 hours at 37°C with continuous shaking. Also, adjusting the number of cells in the bacterial suspension to (1×108) cells/mL. The water containing the bacterial cells was passed through filter paper with different manufacturing specifications. 1 mL of filtered water was mixed with 25 mL of liquid Mueller Hinton medium and left to solidify at room temperature. Then the mixture was incubated for 24 hours at 37°C. After 24 hours, the plates containing the bacterial cultures were removed from the incubator and the number of colonies was counted . Then calculate the inhibition percentage based on the following equation: Inhibition percentage (%) = 100 - number of test colonies / number of control colonies × 100%, (Al-Khafaji, 2019) as in Figure 12 and Table 7 shows the types of filter paper.

Tables 8 and 9 show the inhibition in the crop and the different manufactured filters. The polluted water passes through the filters and we plant the water in a dish and through it we know the number of bacteria growing in it. The filters are good, but they vary in inhibition and according to the size of the pores of the manufactured filter diameter through which the polluted water passes.

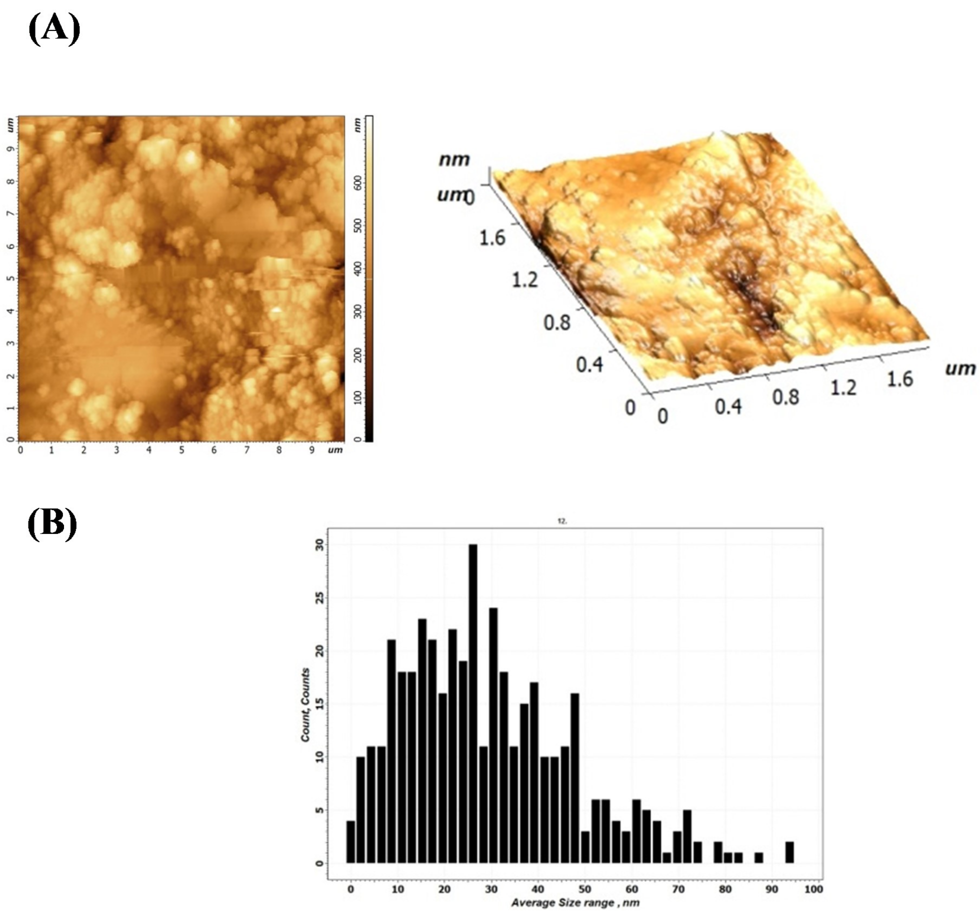


Figure 5. AFM image of Sample 4 (A) 2D, 3D, (B) Particle Size Distribution

Table 7. Shows the Types of Filter Paper Prepared in a Circular Shape and Added Silver

#	Description of Filter Paper
1	Factory filter paper without any additives
2	Factory filter paper containing silver particles type 1
3	Factory filter paper containing silver particles 4
4	Laboratory filter paper without any additives
5	Laboratory filter paper containing silver particles type 1
6	Laboratory filter paper containing silver particles type 4
7	Laboratory filter paper containing silver particles type 4
8	Filter paper stripped without addition
9	Filter paper stripped middle layer + silver particles1
10	Filter paper stripped first layer + silver particles4
11	Filter paper stripped first layer glued with silicon + silver particles
12	Filter paper stripped first layer glued with silicon + silver particles4
13	Filter paper stripped first layer glued with silicon + silver particles1

3.9 Atomic Absorption Spectroscopy (AAS) for Silver

Atomic spectroscopy is a significant component of analytical chemistry, especially when dealing with extremely low concentrations of metallic elements. Upon examination of the table, it becomes apparent that the control sample, which consists of distilled water devoid of ions, contains minimal salts and is not entirely free of minerals and ions. Kirchhoff's observations confirmed that each element has the capacity to absorb a spectrum similar to the one it emits, known as the resonance beam of the element. The atomic absorption method provides a rapid, selec-

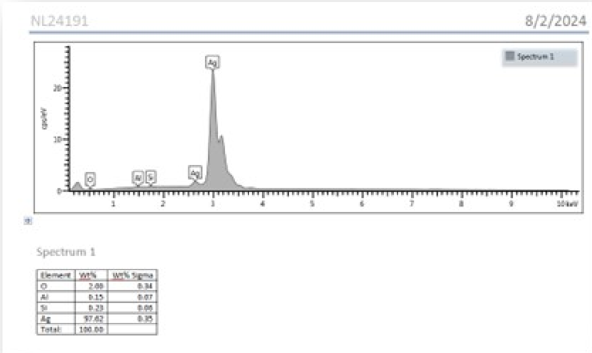


Figure 6. EDX Spectra Analysis of Sample 1

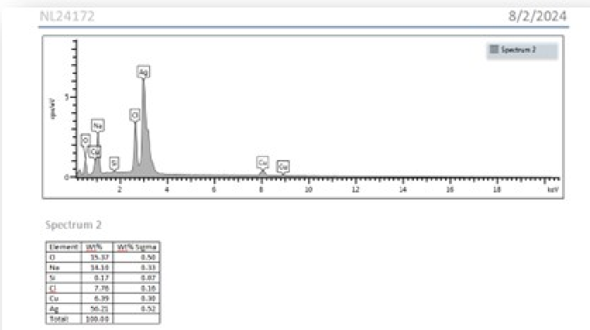


Figure 7. EDX Spectra Analysis of Sample 4

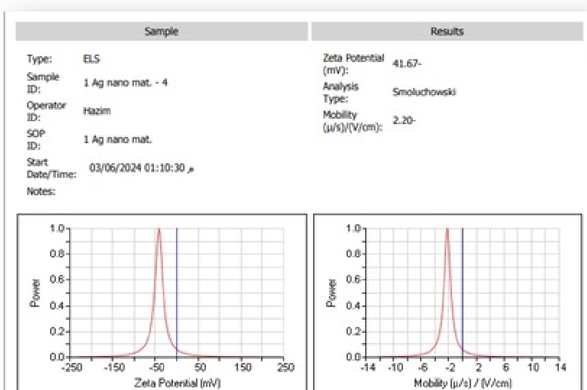


Figure 8. Shows ELS the Zeta Potential of the First Ready-Made Sample 1 as a Powder and Liquid Dispersion

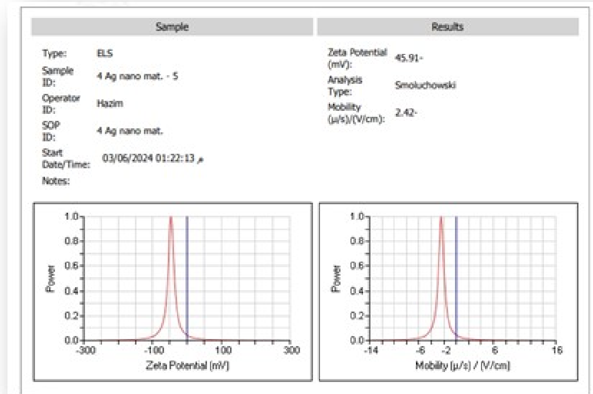


Figure 9. Shows ELS the Zeta Potential of the First Ready-Made Sample 4 as a Powder and Liquid Dispersion

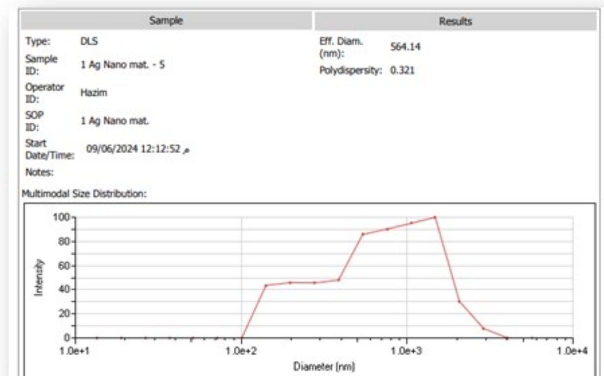


Figure 10. Shows DLS the Zeta potential of the First Ready-Made Sample 1 as a Powder and Liquid Dispersion

tive, and sensitive means to analyze approximately 80 elements from the periodic table without encountering spectral interferences. This method is utilized to identify the presence of harmful or harmless elements in liquids on a parts per million (ppm) scale. Testing was conducted on drinking water and distilled water. The study revealed that the percentage of silver passing through the filters poses no harm to human health. Samples labeled Ag 1 and Ag 4 were taken and mixed with a small amount of non-ionic distilled water before being filtered and examined using an Atomik device at the Department of Chemistry in Diyala University. The resulting percentage was minimal and did not pose any risk to drinking water or human health (Arjomandi and Shirkhanloo, 2019), as in the Table 10 show the ppm.

The data in Table 11 indicates the presence of salts in the water. In sample 1, the salt concentration increased by three times compared to the distilled control water. This increase correlates with the concentration of the added substance. Additionally, powder samples mixed with distilled water were dispersed using an atomic device for one hour and then filtered to remove gran-

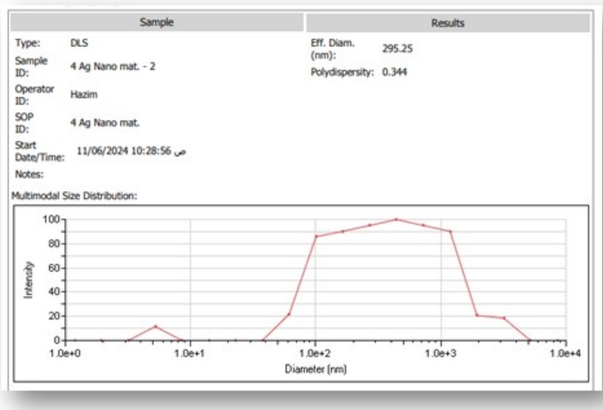


Figure 11. Shows DLS the Zeta potential of the First Ready-Made Sample 4 as a Powder and Liquid Dispersion

Table 8. Shows the Results of the Filter Papers and Indicates the Number of Bacteria and the Removal Percentage

Removal rate (%)	Bacterial number	Type of Treatment
0.0	1×10^8	0.0
45	55×10^6	1
69	31×10^6	2
82	18×10^6	3
34	6.6×10^7	4
87	1.3×10^7	5
89	1.1×10^7	6
92	$0.\ 8\times10^7$	7
99.9	1×10^6	8
95	5×10^6	9
92	8×10^6	10
98.8	1.2×10^6	11
98.9	1.1×10^6	12
91	9×10^6	13

ular masses that could interfere with the device's examination. Subsequent examination revealed that the dispersed powders in samples 1 and 4 exhibited the highest ppm levels. Furthermore, there was no significant difference between tap water and distilled water; their difference was marginal .

According to the data presented in the Table 11, it is evident that the presence of ppm salts can be attributed to silver Ag1 as it permeates through the filter. Consequently, there is a negligible increase in salts that does not have an impact on the potability of the water. Conversely, salts containing vitreous rubber or silicone result in a substantial increase in ppm and percentages. However, these increases do not have a significant effect on the water due to their minimal levels. The toxicity level of the silver used is considered moderate based on cellular toxicity studies, with very little fatal toxicity at ppm = 3200. Therefore, the percentage of passage is minimal and does not cause an impact. Furthermore, most of the silver does not pass through

Table 9. Shows the Results of the Water Produced from the Filter Papers Measured by the TDS Meter (Jasim et al., 2016)

Water output number	ppm	EC MS\Cm	°C	°F
0 deionized water	2	4	35.3	96.8
1	227	451	34.4	94.2
2	370	336	34.0	93.5
3	396	782	35.1	95.5
4	812	606	36.2	97.3
5	583	168	35.8	96.8
6	407	794	35.1	95.1
7	125	249	34.3	94.2
8	168	185	35.2	95.3
9	40	77	35.0	95.1
10	70	145	33.3	92.3
11	93	193	34.2	94.1
12	60	115	34.2	93.9
13	54	121	33.8	93.2

Table 10. Percentage of ppm in the AAS Assay for Samples Dissolved in HNO_3 for A1, A4

Sample	ppm	Abs	BG
Control	0.9304	0.0879	0.0022
A1	13.5942	1.9976	0.0245
A4	14.3541	2.1122	0.0332

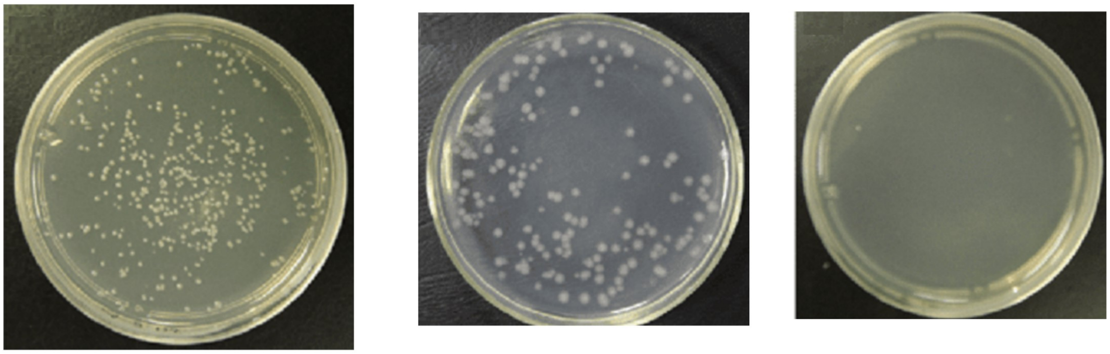
Table 11. Shows the ppm Levels in Distilled Water, Tap Water and Samples A1 and A4 in the Order of the Samples

Sample	ppm	Abs	BG
Control Distilled water	0.4721	0.0188	0.0017
1	4.0345	0.5560	0.0020
4	3.9350	0.5410	0.0028
Liquid tap water	0.5046	0.0237	0.0018

and remains adhered to the membrane or filter due to its rough spherical shape, regardless of its type as in the Table 12 shoe type of filter added sample 1 and the ppm.

3.10 Conducting Salt Measurements in a TDS Device for a Group of Different Manufactured Filters

The TDS device provides information about the water temperature in Fahrenheit and Celsius, in addition to measuring the dissolved salts in the water PPM and the electrical water EC. The pH is measured by another device to determine whether it is acidic, basic or neutral water through the device reading. The manufactured filters were tested and compared with tap water. C1 is a membrane filter loaded with silver Sample 1, filter C2 is a membrane filter with silver and silicon, C3 is a FibreClass Zero 90 filter with silver, filter C4 is a wax fiber filter with silver, C5 is a circular cellulose filter paper with silver Sample 1, and C6 represents the liquefied tap water used in the home (DeZuane, 1997) and the Table 13 Shows the ppm and for filters.



Control without treatment (A1) (A2) (A3)

Figure 12. Colony Count of *Escherichia coli* ATCC 25922 Exposed to Different Concentration of Ag NPs and Filtration Conditions

Table 12. Shows the Atomic Sorting of Some Circular Filters to Which Ag1 Was Added by Dipping the Filters in it and Their ppm Was Measured

Sample	Type of filter added Ag1	ppm	Abs	BG
C1	Tap water with silver	0.5729	0.0340	0.0004
C2	Fibre Class with Vydrin Rubber	0.9350	0.0886	0.0010
C3	Fibre Class with Silicone	1.4111	0.1604	0.0015
C4	Waxed Fibre with Silicone	2.0809	0.2614	0.0021
C5	Waxed Fibre with Rubber Vedrine	0.3448	-0.0004	-0.0004
C6	Membrane Filter Paper with Vedrin Rubber	0.4430	0.0144	-0.0003
C7	Membrane Filter Paper with Silicone	0.3442	-0.0005	-0.0003
C8	Plain Filter Paper	0.3495	0.0003	-0.0006
C9	Tap water control	0.3501	0.0004	-0.0006

Table 13. Shows the ppm Which is Parts per Million of Dissolved Salts in the Water Produced by the Filters Tested at Home in a TDS Meter

pH	F	C0	MS\CM	PPM	Filter
7.71	68.7	20.5	745	350	C1
7.82	73.5	23.0	734	261	C2
8.00	65.4	18.4	765	381	C3
8.03	72.8	22.5	749	369	C4
8.42	69.0	20.5	707	354	C5
7.90	67.1	19.3	748	376	C6

3.11 We Conducted an Experiment in a Home Water Filter to Filter with a Membrane Filter Stage 4 After the Three Stages and Desalination of Water and Knowing Its ppm and Measuring It with a TDS Device

The home filter device is operated with a new ampere and ppm=10. The filter device is operated with a modified filter with Ag1 added after cutting the filter layer and placing silver in it, and the salts after operating the device became ppm=30. After an hour of operation and rinsing the filter, the salts remain constant and ppm=26. The new blower is also operated and ppm=11 and the new white sweetener increases ppm=22.The new blowers are operated with the factory sweetener and the sweetener is cut from one side and a circular filter with Ag1 silver added to it is placed in the same way as before and returned to the previous one only by adding circular filters to it and re-welding it again and operating it in the filter device as a factory sweetener and the salts ppm=17 (Environmental Protection Agency, 2017).

The device is used with the original factory filter that contains 26 parts per million (ppm), and silver was introduced by modifying the filter. This included opening one side of the filter and adding half a gram of nano silver and closing it with adhesive tape and ensuring its tightness. This adjustment resulted in a reasonable increase in salts within an acceptable range until the total dissolved solids (TDS) reached 40 ppm. Beyond this level, there was a noticeable change in the taste of the water and an increase in water hardness. However, with the inclusion of the artificial sweetener, the salts decreased to 30 ppm during continuous operation. After several hours, the salt levels stabilized at 26 ppm, and remained within a reasonable range without significantly affecting the water quality. The benefit of using this commercially produced filter and processed dessert lies in the fact that it allows water to flow through it, effectively eliminating bacteria and inhibiting the proliferation of fungi, thereby enhancing the taste and revitalizing the water.

3.11.1 The Additional Salts Are Derived from the Following Sources

The filter allows for the retention of a portion of the water salts, which are essential for human physiological functions. The nano-silver added to the water also permeates through the filter as small ions. As previously explained, this silver is either non-toxic or mildly toxic and has no harmful effects on humans; in fact, it is believed to have therapeutic properties for some diseases (Wayback Machine, 2017). The presence of silver in the water purification system acts as a channel for the flow of water, improving clarity with retained salts, although the water is not completely purified. This increases the productivity of the filtered water, but also increases the salt content of the filtered water. While this may be seen as a disadvantage, it is actually an intentional aspect necessary to allow essential salts to pass through to the drinking water. These salts are essential for supporting bone growth and replenishing mineral deficiencies in the body. In addition, they are essential for kidney function, as a lack of salts and ions in filtered water can lead to kidney dysfunction over time (O'Donoghue, 1988) .

4. CONCLUSIONS

The ready-made and manufactured nano silver were verified to make a comparison and the tests were verified and within the range of the wave number in the UV the presence of nano silver and through the EDX the proportions of the ready-made and prepared material and the oil were known and it was recognized that its negativity is very high, so the adhesion of the manufactured silver material is high on the filters and its size is the first nano and the second is close to nano and the filters used are good in the process of inhibiting microorganisms and bacteria, and the salts present in the water do not affect the water, and it is considered that the silver loaded on the filters is good for the water and that it is suitable for drinking and for human use, and that the first filters are all good because they purify the water from pollutants.

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