# Silver Nanoparticle Generation

Summary:

1. lower ppm has lower nm sizes
2. lower current helps with smaller nm sizes (<1mA/sq in of electrode)
3. production is likely linear with constant current, hence it is possible to estimate ppm vs time
4. real time resistance can be known based on current limit and voltage. Resistance is related to ppm
5. clearer water (less yellow) means smaller particle size.
6. Laser point will not detect (diffuse) when particle size **much** smaller than wavelenght (slight fog)
7. Water circulation helps keep particle size small, and electrodes cleaner. (magnetic stirrer, air bubbles, water pump, ....)

https://www.amazon.com/Colloidal-Generator-Equipment-Produce-FromBora/dp/B0887FZMFC

Frombora Generator Kit combines all the tools you need to Produce Pure Colloidal Silver Solution FROM 1 TO 20 PPM.

CONSTANT Current through rods ensures equal particle size during generation which is very important when producing Colloidal Silver.

air mix version: Selectable 2 or 10 mA constant current output

https://silverlungs.com/faq.html

Colloidal silver has been "loosely defined" as a suspension of very small silver particles and silver ions evenly dispersed in a water-based solution.

To be more correct, colloidal silver is properly defined as a solution comprised of silver particles rather than silver ions. Alternately, ionic silver is a solution comprised of silver ions rather than silver particles.

1 PPM equates to 1 milligram of silver per 1 liter of water.

Silver Ions - A single silver atom missing one of its negatively charged electrons

**Silver Oxide ($Ag_2O$)** - A compound of silver that is formed during the electrolysis process that slowly dissociates over time after the process completes. This silver compound is formed by two atoms of silver and one atom of free oxygen. Silver oxide will decompose slowly over time to form a diatomic particle of silver and the oxygen is released as free gas.

We simply consider silver oxide to be ionic silver as this is ultimately what final form the silver oxide will take once administered systemically.

A high-powered red laser pointer is an indispensable tool for checking the quality of your silver solutions.

The presence of large and **undesirable** silver complexes will reveal themselves easily with a red laser pointer.

While The SilverLungs Generator has been carefully engineered to create clean and consistent silver solutions that are free of large and undesirable silver complexes, there is still nothing more reassuring than a quick visual inspection of your product.

**Dynamic polarity reversal?**

Standard polarity reversal is already a very useful and functional feature in a silver generator as it spreads the wear and load of the dissolving silver evenly across both electrodes.

Dynamic polarity reversal technology™ uses very specific and ever-changing timing intervals as an advancement to standard "fixed timing" methods. This greatly reduces the total amount of silver hydroxide that inherently collects on the electrodes during production.

**What causes the high pH in the final solution?**

Dissolving silver into a solution of deionized/distilled water typically involves a process known as oxidation, in which silver metal (Ag) loses an electron to become a silver ion ($Ag^+$). This process may involve the reaction with some form of oxidizing agent, such as dissolved oxygen from the air. Here's a simplified version of the reaction:

$$2Ag(s) + 1/2O_2(g) + H_2O(l) \rightarrow 2Ag^+(aq) + 2OH^-(aq)$$

As you can see, this reaction produces hydroxide ions ($OH^-$). The presence of hydroxide ions increases the pH of the solution, making it more alkaline (basic).

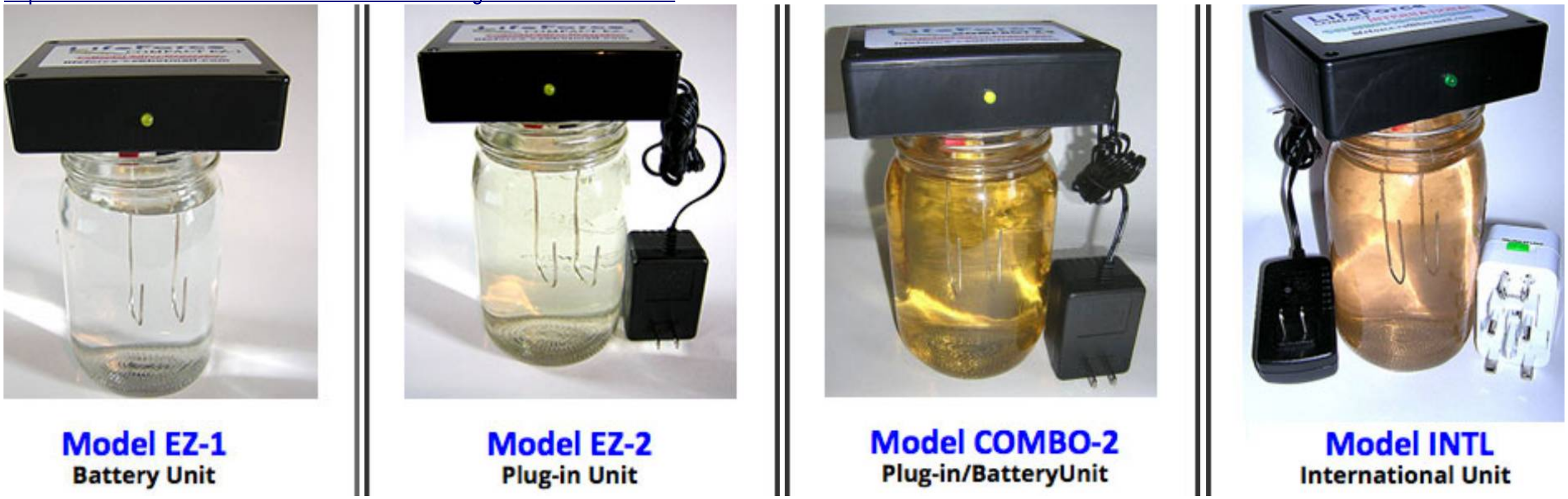
The pH scale is a measure of how acidic or basic a solution is. It is a logarithmic scale based on the concentration of hydrogen ions ($H^+$) in the solution. A high concentration of $H^+$ ions results in a low pH (acidic solution), while a high concentration of $OH^-$ ions results in a high pH (alkaline or basic solution). Thus, when dissolving silver in deionized/distilled water, it generates $OH^-$ ions and decreases the concentration of $H^+$ ions relative to $OH^-$ ions. This is what increases the solutions pH.

We suggest a simple oral daily maintenance dose of 1 teaspoon for keeping silver present systemically.

The SilverLungs Generator produces a 10 PPM solution in 90 minutes and a 20 PPM solution in 150 minutes.

https://www.amazon.ca/Realgoal-TDS-3Blue-Resolution-Hydroponics-Gardening/dp/B01FXRB6KM/ref=sr_1_3?crid=257UNVYGW7LIS&dib=eyJ2IjoiMSJ9.afnnzIe0ZHZRCquD2_S-z4DKYLRjAw3pq_UX8Vqy_pzGjHj071QN20LucGBJIEps.HCBcwjrTkoixgj9UZnRwFTHn8VOkX5h8YJGWyU7epVA&dib_tag=se&keywords=realgoal+tds&qid=1732467643&sprefix=realgoal+tds%2Caps%2C107&sr=8-3
-matching TDS meter

https://lifeforcecolloidalsilver.com/colloidal-silver-generators-overview/



The photographs above demonstrate from left to right 10 ppm, 15 ppm, 20 ppm and 30 ppm concentrations using 14 gauge silver wires (each generator model produces ALL four colors depending on the concentration made, which is adjusted by running longer times). (ppm = parts per million)
The colors are due to the particle size ranges present:
at 5 ppm, smallest particles (1 nm to 100 nm),
at 10 ppm, small to medium particles (5 nm to 300 nm),
at 15 ppm, small to large particles (5 nm to 500 nm),
at 20ppm, small to larger particles (20 nm to 570 nm),
and at 30 ppm, medium to largest particles (50 nm to 590nm). (nm =nanometer)
Also, the range of colloidal silver nanoparticle sizes can be controlled by changing the processing time, where constant current colloidal silver generators can produce only one size nanoparticle or a very limited range of nanoparticle sizes, no matter the concentration.
The H+ ions pick up free electrons present due to the electrical current and form diatomic hydrogen (H2), which bubbles out near the negative electrode. Excess negatively charged OH- (hydroxyl ions) remain in the water surrounding the positively charged colloidal silver particles.This can be proven by the pH going from 7 to 10.5 or 11. Also, the charges of the colloidal silver particles and the remaining hydroxyl ions balance, so the suspension is electrically neutral.

Finally, when storing the freshly made colloidal silver, over a period of 2 weeks to a month, the pH drops back to 7 and a little brown silver hydroxide is found on the bottom of the container.This indicates that the charged colloidal silver particles eject a silver ion (Ag+) from time to time, which immediately reacts with the hydroxyl ions (OH-) surrounding them and forms silver hydroxide which falls to the bottom of the container.This is a small fraction of the silver present, so the remaining suspension still has 98 to 99% of the original suspended particles, they are just not charged any more.

I am university educated in Chemistry. What happens when you make colloidal silver with distilled water is this: First when passing an electrical current through water a process called electrolysis occurs where the water molecules are split into ions H+ and OH- and O--. Second, silver colloid particles are ejected from the positive electrode (colloids are suspensions of nano-particles that are larger than ions, atoms or molecules - in the case of silver these are clumps of silver atoms) . Third, some silver ions are formed on the surface of the positive wire. The OH- ions produced by electrolysis react with the silver ions to form the insoluble ionic compound silver hydroxide which is brown and clings to the positive wire (well a lot of it is ejected into the water as the positive electrode is also where silver is being ejected into the water, so you will also see a brown cloud between the electrodes - see photos under the heading on the website Making Colloidal Silver). The O-- ions produced by electrolysis react at the surface of the negative wire forming the insoluble ionic compound silver oxide which is black and clings to the negative wire (the instructions have a protocol for wiping the wires off periodically to maintain the speed of the process of making colloidal silver). The H+ ions formed by electrolysis combine with each other and free electrons from the electrical current and bubble off the negative wire as the diatomic hydrogen molecule H2.

All that is left at the end are colloidal particles of pure silver suspended in the distilled water and insoluble brown silver hydroxide clinging to the positive wire and insoluble black silver oxide clinging to the negative wire. The colloidal silver nano-particles have numerous charges on them and are surrounded by OH- ions. This can be verified because the suspension's pH rises from 7 to about 10.5. Also, you can perform the Tyndall test to verify the presence of colloidal silver. Shine a bright penlight through the clear suspension. Amazingly, the beam appears as if passing though fog.

https://www.colloidalsilver.com.au/Making-CS.html

**Should I store it in the refrigerator?**

Absolutely not. Always store colloidal silver at room temperature. The reason is pretty simple. Colloidal silver is simply water with silver dissolved in it. If you lower the temperature of the water then you reduce the ability of that water to keep the silver in solution. Cooling the water reduces it's 'saturation point', forcing the silver to precipitate out of solution and eventually settle to the bottom of the bottle.
For the same reason you should NOT make colloidal silver with hot water. You are simply artificially and temporarily raising the saturation point of the water. When the water cools the silver will be forced out of solution to create large particles that will eventually settle to the bottom of the jar.

**What's this stuff about Ions and Particles?**

Good quality CS generators are designed to make (1) a high concentration of ions that stay in solution and (2) the smallest possible particles because these are believed to be more 'bio-available'. (i.e. more easily absorbed by the body.) It is much better to have lots of very small particles than to have just a few relatively big ones. LVDC generators like the Silver Well make colloidal silver in which the total silver content is about 85% Ionic and 15% particles.

If you want a clear, stable product, rich in isolated silver ions and small particles you need to build a much more sophisticated generator and have an excellent understanding of the principles of colloidal silver making.

The TDS (Total Dissolved Solids) meter also just measures conductivity but then uses an inbuilt conversion factor to give a readout that (when doubled) is accepted as a reasonable approximation of the PPM.

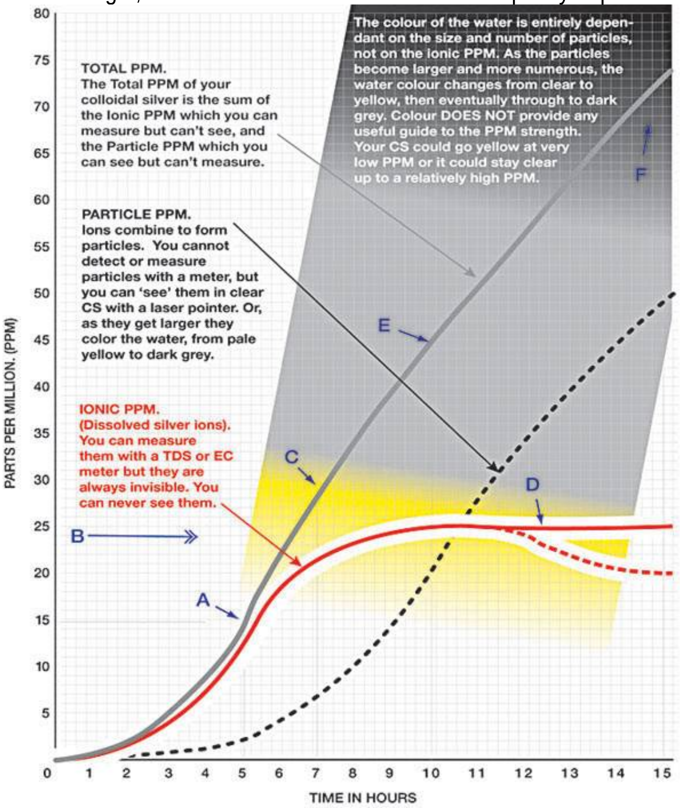
Colloidal Silver Generators with current controls (like the Silver Well) also use electrical conductivity to estimate the PPM.

Today however, current controlled, generators with a stirring system like the Silver Well are designed to only produce small particles and isolated ions, so the CS usually remains perfectly clear even when relatively high PPM colloidal silver is produced. So the short answer is: Yellow is OK, but clear is best.

The larger the particles, the brighter the reflection, so with practice the Tyndall Effect can be used as a visual guide to the type of colloidal silver you are making: for example whether you have numerous very small particles, mixed fine and large (sparkling) particles, or mainly large particles. (In fact small particles are preferable, so a dense 'matt' beam is the ideal.)

Commercial producers of both high and low voltage colloidal silver often achieve a long shelf simply by producing CS that is so low in silver (below about 5ppm) that there is almost nothing to drop out.

When you use a TDS/PPM or EC meter in water you are actually just measuring the electrical conductivity of the water. (The meter then 'guesstimates' the ppm). So when you use one of these meters to measure colloidal silver you are only measuring the electrically conductive IONIC PPM. (Thats the dissolved silver). Only these silver ions increase the electrical conductivity of the water. Meters can't measure the silver that's contained in the PARTICLES because the particles are not conductive, but it's worth remembering that the particles (or colloids) hold significant additional PPM's within the batch. Although color is no accurate indicator of PPM strength, it does at least indicate that there are plenty of particles in the batch.



The colour of the water is entirely dependant on the size and number of particles, not on the ionic PPM. As the particles become larger and more numerous, the water colour changes from clear to yellow, then eventually through to dark grey. Colour DOES NOT provide any useful guide to the PPM strength. Your CS could go yellow at very low PPM or it could stay clear up to a relatively high PPM.

TOTAL PPM. The Total PPM of your colloidal silver is the sum of the Ionic PPM which you can measure but can't see, and the Particle PPM which you can see but can't measure.

PARTICLE PPM. Ions combine to form particles. You cannot detect or measure particles with a meter, but you can 'see' them in clear CS with a laser pointer. Or, as they get larger they color the water, from pale yellow to dark grey.

IONIC PPM. (Dissolved silver ions). You can measure them with a TDS or EC meter but they are always invisible. You can never see them.

https://silverpuppy.com/

**Coyote Zenterprizes** manufactures and distributes a State of the Art Current Controlled, Voltage Referenced Colloidal Silver Generator Systems that produces a fine, pure, clear and stable Colloidal Silver made for less than a dollar per gallon...monitors the water like a PPM meter and turns itself off when done at around 10PPM...or you can also make it as strong as you dare.

1/4 to 1/2 teaspoon of Baking Soda in about 1/2 cup water
Drink it down, wait a few minutes.
Follow that with "Silver Water" according to perceived need ....maybe a cup.
Repeat now and then. What that does: The Baking Soda converts stomach acid into salt and carbon dioxide gas [BURP ! ]
The resulting salt absorbs into the blood making it "thirsty" for more water to flush the excess salt out with.
Add "Silver Water" to satisfy the thirst....instant absorption and little or no stomach acid to make "Silver Chloride"
DO NOT put baking soda in the silver water before, during or after making it
Electrodes can be cleaned by immersing them in 3% Hydrogen Peroxide for a just a few minutes. Rinse with Distilled Water.

**TE [Tyndall Effect] using a laser pointer...what it tells you**

Ions are too small for visible light to reflect from, so they are invisible...it's also possible to have particles below the ability to reflect light in the visible wavelengths, hence also be invisible.

A distinctly fuzzy appearance to the beam indicates that the dominant particle sizes are too small to reflect a photon stream large enough for your eye to distinguish between streams..very small particles just over visible light size ranges. [less than 5/10th micron as an "eddycated" guess]

The next effect towards larger particles will be a sort of sharpness to the beam that says you are very close to being able to distinguish between photon streams. [ ~.5 to 1 micron as a good guess ]

Fuzzy and sharp can be mixed and you can tell when they are..that they are, but not where anything ends or starts.

If you can apprehend individual bright spots, that's the next size range up. These will probably settle out in a few days and are probably about ~1-2 microns in diameter.

Then there's the "stars" aka "sparklies" Most of those are harmless electrode sludge silver hydroxides, essentially waste matter and will settle out in a few hours, yet are small enough that nothing but a really good lab filter will catch them all.

Then "chunkies" or Silver Hydroxide [electrode sludge] clusters that immediately hit bottom. They look like asteroids.

Generally, you'll see a fuzzy [velvety] backdrop with all the other effects at first, in different comparative degrees, then in a few days, nothing but fuzzy to fuzzy/sharp. Anything bigger than that settles out on its own.

Also, TE doesn't usually start becoming apparent in a current controlled system until around 10-13 uS ionic has been reached. There is another threshold at around 25-30 uS

**The problem with using meters**

TDS (PPM) meters such as the TDS3 also measure conductivity but then convert that measurement to an estimated PPM using water industry standard tables for dissolved salts. [NaCl in this case] (also known as Total Dissolved Solids or TDS)

Since Ionic/Colloidal Silver is not a mineral salt, it behaves differently and requires a different technique for reading the TDS meter.

The reading can generally be taken ‘as is’ when checking pure distilled water or when checking any other water source such as tap or well water. (ie 200 on the meter = 200 PPM)

However, when checking Colloidal Silver made with pure distilled water the reading should be doubled. [If it reads 10, it’s actually 20 PPM of colloidal silver]

Due to range and resolution limitations, when measuring colloidal silver with this meter you should also allow for an error factor of at least +/- 10% . So for example 10 on the TDS meter could be as high as 22 PPM or as low as 18 PPM (when doubled).

The only REAL way is to use an Atomic Absorption Spectrophotometer, which none of us can afford [50 to 250 thousand dollars] and requires high training to operate...and is as big as a desk or a closet and uses a great deal of heat by electric furnace or acetylene flame to evaporate the water and turn the metal itself into a light emitting gas plasma.

..or pay a "good" lab ~$200 per sample to do that for us. [Even most labs have problems and they ALL average at least 3 tests of the same sample ]

Current Density: The optimal 1 MilliAmp over 1 square inch of electrode surface area
Conductivity Monitored Auto Off at 10 PPM to "Set it and forget it" [works like a PPM meter]

https://ietresearch.onlinelibrary.wiley.com/doi/full/10.1049/mnl.2017.0805

**Facile formation of colloidal silver nanoparticles using electrolysis technique and their antimicrobial activity 2018**

In this research, colloidal silver nanoparticles were generated by electrolysis due to the simple procedure and yet environmental friendly. In this study, several important parameters such as applied voltage, time of electrolysis reaction and mass change in silver electrodes will be studied in order to produce the optimum concentration of colloidal silver nanoparticles for high antibacterial performance. It is expected that the higher concentration of colloidal silver nanoparticles produced, the higher the potential of antimicrobial activity.

The experimental set up consists of immersing two polished 99.99% in purity of silver rods (7 mm in diameter) being 10 mm apart from each other in 50 ml distilled water as an electrolyte and connected to a direct current (DC) power supply and ammeter. The electrolyte was stirred at a constant rate of 100 rpm to homogenise the electrolyte and maintain a uniform current during the electrolysis process. The two silver rods act as a source of colloidal silver nanoparticles and a DC power supply was used as a power source to force the dissolution of silver electrodes to occur since it is a non-spontaneous reaction. Next, the ammeter was employed to measure the current which indicates the rate of reaction or the rate of dissolution of silver electrodes. On the other hand, the electrolyte used was distilled water in order to produce higher purity of colloidal silver nanoparticles and the small amount of impurities present in distilled water actually increases the conductivity of the electrolyte that facilitates the rate of dissolution of silver electrodes.

Table 1. Different applied voltages and different currents produced during the electrolysis

| Voltage, V | Time, min | Current, mA |
|---|---|---|
| 2 | 15 | 0.01 |
| 4 | 15 | 0.26 |
| 6 | 15 | 0.50 |
| 8 | 15 | 0.74 |
| 10 | 15 | 0.97 |

Table 2. Average conductivity reading (µS/cm) for different electrolysis reaction times obtained by a conductivity meter

| Voltage, V | Time of reaction, h | Conductivity readings, µS/cm | Average conductivity, µS/cm | Current, mA |
|---|---|---|---|---|
| 60 | 0.5 | 3.08<br>3.09<br>3.13 | 3.10 | 6.23 |
| 60 | 1 | 3.82<br>3.81<br>3.83 | 3.82 | 6.23 |
| 60 | 2 | 4.34<br>4.33<br>4.33 | 4.33 | 6.23 |
| 60 | 3 | 4.58<br>4.55<br>4.56 | 4.56 | 6.23 |
| 60 | 4 | 4.86<br>4.90<br>4.89 | 4.88 | 6.23 |
| 60 | 5 | 5.04<br>5.06<br>5.06 | 5.05 | 6.23 |

Table 3. Average parts per million (ppm) of the silver nanoparticles present in colloidal at different electrolysis reaction times obtained by AAS analysis

| Different time of electrolysis reaction, h | Concentration of silver ions produced, ppm |
|---|---|

| | |
|---|---|
| 0.5 | 0.0165 |
| 1 | 0.0193 |
| 2 | 0.0429 |
| 3 | 0.2225 |
| 4 | 0.2344 |
| 5 | 0.5575 |

https://www.researchgate.net/publication/225983563_Electrochemical_method_for_the_synthesis_of_silver_nanoparticles

**Electrochemical method for the synthesis of silver nanoparticles 2009**

Silver nanoparticles suspended in water solution that were produced by the present technique are nearly spherical and their size distribution lies in the range of 2 to 20 nm, the average size being about 7 nm. Silver nanoparticles synthesised by the proposed method were sufficiently stable for more than 7 years even under ambient conditions. Silver crystal growth on the surface of the cathode in the electrochemical process used was shown to result in micron-sized structures consisting of agglomerated silver nanoparticles with the sizes below 40 nm.

We employed two polished silver plates (85 mm x 20 mm x 4 mm) as the anode and the cathode, being vertically placed face-to-face 10 mm apart. The electrodes were immersed in an electrochemical cell filled with 500 mL of distilled water obtained from an ordinary commercially available water distiller (DE-25, Russia). Electrolysis was performed in the temperature range 20–95 °C at a constant voltage of 20 V. Additional technological keys to the electrochemical synthesis of silver nanoparticles lie in changing the polarity of the direct current between the electrodes every 30–300 s, and intensive stirring during the process of electrolysis to inhibit the formation of precipitates. The silver nanoparticle solutions produced in this way were stored under ambient conditions in glass containers.

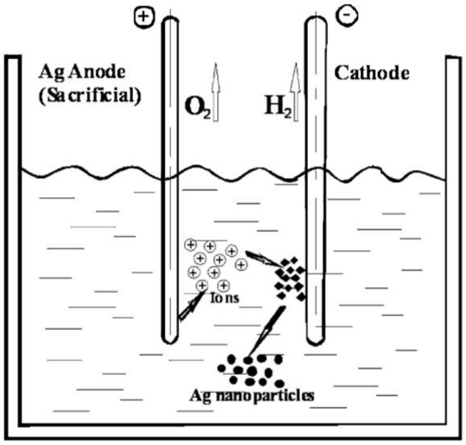


**Fig. 1** Electrochemical formation of silver nanoparticles in distilled water

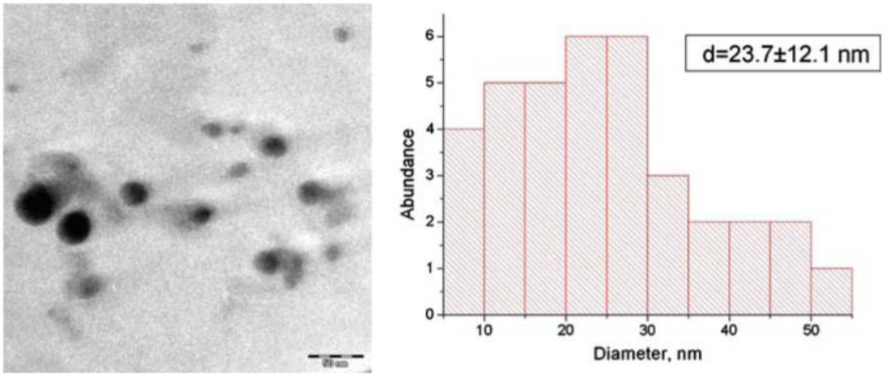
In the described first stage of the electrochemical synthesis, the polarity of the direct current between the electrodes was periodically changed, which significantly reduced the electrodeposition of silver on the cathode.

It was found empirically that 4 min was an optimum period. At smaller values, agglomeration of particles in the solution was enhanced at the cost of silver film deposition at the cathode.

The rate of the reaction was shown to increase with decrease in the distance between the electrodes and increase in the voltage. A longer reaction time for each individual trial resulted in a larger average size and a higher concentration of silver nanoparticles. In order to obtain stable silver nanoparticles with a concentration in the range of 20 to 40 mg/L, it was necessary to ensure a reaction time of 50–70 min in the temperature range of 50 to 80 °C

Passing the colloidal solution through a paper filter, narrows the range of size distributions of the synthesised silver nanoparticles (see Fig. 4) and also provides additional reduction of Ag ions:

**Fig. 4** Typical TEM image and size distribution of silver nanoparticles obtained after Stage II



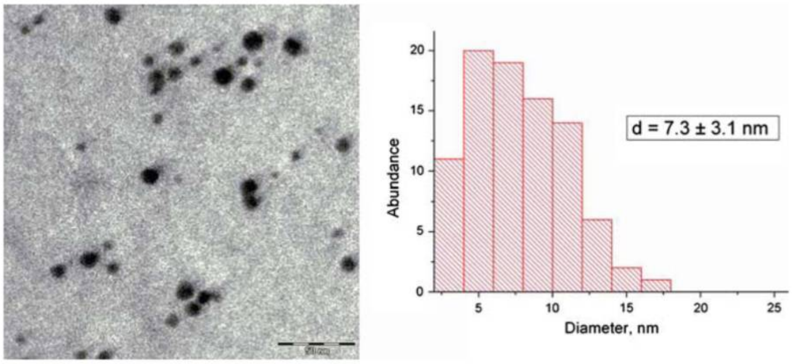
**Stage III: additional treatment**

A third stage of Ag nanoparticle synthesis involves the additional treatment of the smallest-size fraction of silver nanoparticles remaining in solution after the filtering stage. It consists in adding hydrogen peroxide to a level of up to 0.005% concentration of H 2 O2 to the solution. Due to the reaction

Ag 2 O þ H 2 O 2 ! 2Ag þ H 2 O þ O2;

silver oxide is reduced to Ag which is released in the solution. Due to this process, the size of the silver nanoparticles is reduced while new Ag nanoparticles may be forming as well. The details of this process, whose outcome consists in a significant refinement of the nanoparticle size, are not fully understood as yet. Examination of TEM images taken 2 weeks after the addition of H2 O 2 revealed that silver nanoparticles suspended in water solution were nearly spherical and that their size distribution fell in the range of 2 to 20 nm, the average size being about 7 nm (cf. Fig. 5).

**Fig. 5** Typical TEM image and size distribution of silver nanoparticles obtained after Stage III



https://www.sciencedirect.com/science/article/pii/S1026918523001063
**Bio-mediated electrochemically synthesis of silver nanoparticles using green tea (Camellia sinensis) leaves extract and their antibacterial activity 2024**
The green tea extract solution acts as an electrolyte in the system, ensuring that the electrolyte occurs and facilitating the formation of AgNP. The AgNP formation was indicated by a single peak at 421 nm. FTIR spectra revealed that green tea extract plays a dual role as a reducing and stabilizing agent. The method produces polycrystalline nanoparticles with sizes ranging from 8 to 26 nm, a mostly spherical shape, and a high purity (96.25 % in mass).
It has been known previously that green tea extract, besides being a bio-reductant in forming AgNPs, also acts as a stabilizer for the formed AgNPs (Gao et al., 2017).
This study uses the electrolysis method to increase the effectiveness of employing green tea extract in synthesizing AgNPs. The effect of the electrolysis method on the character of the AgNP particles formed, as well as the antibacterial activity, has been studied. The antibacterial activity of the prepared AgNPs was studied against E. coli and S. aureus.
Green tea extract solution is used as a bio-media which has a function as a reducing agent in the process of forming AgNPs and a stabilizing agent for the formed AgNPs. It is prepared by soaking 1 g of green tea leaves in 100 mL of a double-deionized distillate boiling for 10 min. This extract solution was diluted to 500 mL at room temperature. The resulting extracts were analyzed qualitatively for phytochemicals as done by Yadav et al. (2020). Finally, two parallel silver metal rod electrodes with an electrode spacing of 0.5 cm were immersed in a 500 mL beaker, which was filled with green tea extract solution under magnetic stirring conditions at 2000 rpm for 2 min, and both electrodes were connected to a 10 V DC voltage source, and changes in the polarity of the anode and cathode are carried out every 1 min through a switch as a polarity controller (Huang et al., 2015). When the color of the solution changes from greenish yellow to brownish yellow, the electrolysis and stirring are stopped.
The formation of AgNPs, in general, can be seen in the color change of the solution, where the solution changes from greenish yellow to brownish yellow, as seen in Fig. 1. Over time, the color of the solution gets thicker due to AgNP formation. The phenolic compounds in green tea extract act as bio-reductors through their functional groups that can reduce $Ag^+$ ions to $Ag^0$. For this purpose, a qualitative analysis of phytochemicals was carried out, and the results showed the presence of flavonoid and terpenoid compounds rich in -OH groups in green tea extract.

https://preventology.co/
**Preventology Colloidal Silver Generator / Bioactive Silver Hydrosol Generator**
The Preventology generator is a sleek full featured unit with a one touch UI. We guarantee 100% safe crystal clear consistent 10 PPM and 20 PPM batches producing the highest quality bioactive silver hydrosol with the majority of **nanoparticles in the 0.3nm to 0.7 nm size** range suspended in a solution of silver ions which are needed for maximum bioavailability.
It features an integrated 16 oz silicone protected borosilicate cylindrical flask, programmed circuitry with self diagnostics at power on, impure water warning with override function, a low constant current assuring ultra small nanoparticles, polarity switching self cleaning even wearing electrodes that gently vibrate for optimal stirring, plus short circuit protection. Hidden LEDs attractively project into your solution, clearly indicating PPM selection and operational status.
It will quickly brew 10 PPM (about 45 minutes) and 20 PPM (about 90 minutes) crystal clear highly bioactive colloidal silver hydrosol in 16 Oz batches within its self contained reservoir. Our generator is extremely rugged and can be used continuously for back to back brews in volume production. You can brew up to 4 gallons in 24 hours!
It's microprocessor controlled and fully automated, featuring an ultra low constant current polarity switching circuit allowing the ***.99999 (5N) pure*** silver electrodes to self clean while ***gently stirring*** the solution via our unique vibrating system to insure optimal silver nanoparticle sizes for maximum bioavailability.
- Self-cleaning electrodes: The CS-PRO features self-cleaning electrodes that use an alternating polarity technology to prevent electrode fouling.
- Vibrational stirring: The CS-PRO features a unique vibrational stirring mechanism that gently mixes the solution during generation, ensuring ultra-small nanoparticle sizes for maximum bioavailability.

Our constant current is **below 0.1ma** which is a key factor for the smallest and most effective silver nanoparticle sizes. The Preventology generator has beencarefully engineered with a specific distance between our pure silver electrodes which further insures the highest bioactive silver hydrosol solution with the fastest brew times.

http://www.silvermedicine.org/silvergen-generators.php
The SilverGen SG7 is an excellent large capacity generator that produces an end product that is roughly 98-99% ionic silver. The silver particulates are evenly distributed throughout the CS, as verified by TEM analysis. The system runs extremely clean due to the water circulation and the correctly implemented reverse polarity system.
The system utilizes timed reverse polarity, precision electrode spacing, and includes a water circulation pump along with the 4 silver electrode plate assembly ( each electrode is 1.5 inches wide). This configuration allows for higher current use, which results in faster production runs.
Production time is between 2.5 - 6 hours for 5 gallons, depending on the desired concentration.

https://silverengines.com/quality/
As a start, it is quite easy to demonstrate that the particle size is less than half a micron… You can prove this for yourself using an inexpensive laser pointer to produce what is called the Tyndall effect. This test demonstrates that the nano silver particles produced by the SILVERengines proton are less than the wavelength of the laser light. The most readily available lasers (often to be found at your neighborhood “dollar store”) are red in color (about 650nm wavelength).

You can also purchase lasers in the shorter, violet range (about 405nm wavelength). With either laser, you can see that the predominant particle size is smaller then the light's wavelength.
Of course, the Tyndall test does not tell us *how much smaller* the particles are, but the science behind the "**constant-current method**" that the **SILVERengines *proton*** employs to produce its results tells the rest of the story. By continuously regulating the current flow between the pure (.999 fine) silver rods at a very low value (~ 1/1000th of an Ampere per square inch), the **SILVERengines *proton*** ensures that the average particle size is ***considerably*** less than 100 microns, thus falling in the "nano" category.
The size of the silver particles is further proven by the fact that **the resulting fluid is as clear as water**, with no coloration resulting from the silver content. This lack of spectral absorption indicates that the silver particles are less than 5 nanometers in size. The largest commercial manufacturer of quality colloidal silver, Sovereign Silver, also mentions this on their website (look for **"Surface Plasmon Resonance" on this linked page**).

https://www.ecrater.com/p/36074413/nano-particle-colloidal-silver-generator-105
Slow rate of silver particle production equals smaller silver diameters. Constant circulation of the colloidal silver during production. Power Limiting prevents current runaway from occurring. **Aeration** technology keeps the silver particles uniquely minuscule throughout the entire colloidal silver-making process.

https://elixa.com/shop/silvonic/
We recommend **5-15 PPM CS for best results**. Nano-particle CS works better than stronger solutions which typically have larger particles. Instead of making stronger CS, just take more 5-15PPM.
Diluting stronger yellow CS does not work as well as clear 10 ppm.

https://www.quantumbalancing.com/makeyourowncs.htm
Using the current limiting diode will allow the current to maintain at a set amount. Many people that brew their own CS, limit there current to stay under 1 ma. I've done a lot of experimenting and actually prefer keeping the current much lower, around max .28 milliamps, using a 30VDC power supply. This keeps the solution crystal clear, which tells me that the end product has extremely small particles. There is a slight metallic taste. You know the CS is there because when the solution is done, if you temporarily bypass the diode you will see the water conductivity is now about 1.2 milliamps, 10Xs greater than at the start.

https://www.ijser.org/researchpaper/The-Effect-of-Electric-and-Magnetic-Field-on-Silver-Nanoparticles-Prepared-by-Pulse-Laser-Ablation.pdf
**The Effect of Electric and Magnetic Field on Silver Nanoparticles Prepared by Pulse Laser Ablation 2016**
The electric field used 30 V/cm, figure (1) show schematic diagram of electric field , the magnetic field is 0.327 Tesla, figure(2) show magnetic field used in this work .
TEM image of the silver NPs with magnetic field at laser power 500 and 300 pulses is shown in figure (9), the average size diameter is around 10 nm and have a spherical shape, so particle size of Ag NPs by applying magnetic field is smaller than that without magnetic field...

https://www.researchgate.net/publication/339596696_Influence_of_Magnetic_Field_on_Silver_Nanoparticles_Synthesized_by_Laser_Ablation
**Influence of Magnetic Field on Silver Nanoparticles Synthesized by Laser Ablation 2020**
According to AFM results, the presence of magnetic field did not affect the average diameter of Ag NPs. The presence of a magnetic field causes a change in grain size of Ag NPs with increasing laser energy
A magnetic field of 4.4 mT was applied using a permanent magnet.

www.researchgate.net/publication/356881602_Effect_of_voltage_and_anodizing_time_on_nano_colloidal_silver
Theoretically, the particle size of nano colloids increases with the increase of voltage and anodizing time. As shown in Figure 1 and Figure 2, the effect that voltage and anodizing time have on the particle size of the nano colloidal silver developed can be seen