

# The Real Facts on Colloidal Silver

by Marshall Dudley with special thanks to Mike Devour, Brooks Bradley, Frank Key, Ode Coyote, Trem, Richard Harris, Rowena Evans [others to be added].

(Please note that this page is actively updated when new information becomes available and any errors found are corrected).

There is much information, and unfortunately misinformation, on colloidal silver. I will attempt to set the record straight in this document. Absolutely no funding was received for the creation of this document, I have researched the information, run experiments, and am writing this document for the benefit of mankind. Reproduction of this document is permitted as long as credit is given and a link to this url is provided so that any corrections or updates to the document can be easily found by others.

This document is in several parts.

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## **Definitions**

The following definitions will be used throughout this document:

- **EIS** - Electrolytically isolated silver. This is what most people call colloidal silver, but is a combination of both colloidal and ionic silver.
- **CS**- Colloidal silver. A colloid is a mixture of solid particles and a liquid. The particles are so small and support a charge, called the zeta potential, that they can stay suspended as a colloid indefinitely. With colloidal silver the particles of silver range from 2 atoms (.2 nm) to thousands of particles (100 or so nm) in size.
- **Ionic Silver** - Silver compounds that disassociate when in water to form an Ag<sup>+</sup> or Ag<sup>2+</sup> cation and an anion. For EIS this will be a mixture of silver hydroxide [Ag<sub>2</sub>(OH)<sub>2</sub>] and silver oxide [Ag<sub>2</sub>O] and usually small amount of silver carbonate.
- **H<sub>2</sub>O<sub>2</sub>** - Hydrogen peroxide 3% grade.
- **LDVC** - Low voltage direct current (even when using polarity switching)
- **HVAC** - High voltage alternating current.
- **Particle** - In this document a particle refers to a silver crystal suspended in water by mutual repulsion of a charge. Although an atom, molecule or ion could be called a particle, we are only using the term for silver crystals to avoid confusion.

- **ppm** - parts per million, for EIS this is expressed in milligrams of silver per liter or water.

## **What is EIS?**

EIS is a combination of ionic silver and colloidal silver. It is typically about 90% ionic and 10% colloidal by weight, but can vary between 5% and 20% colloidal depending on how it is made.

There are two general methods of making EIS. The easiest method is to use pure silver electrodes (silver strips or wire) and apply a DC voltage between them. These are inserted into distilled water and the process is allowed to run until the desired ppm of the EIS is reached. This is the LVDC method.

The second method uses HVAC, typically 10,000 volts at 60 hertz once again in distilled water. To maintain the voltage with reasonable currents the electrodes can be either placed just above the water, so that the electrostatic field pulls the water up to the electrodes, or they can be placed inside of insulating glass tubes so that only the tip of the wire is exposed and submerged in the water. We will not be discussing the HVAC method any more since it is more difficult to build, operate, and has deadly voltages, plus if not done properly will produce nitrogen compounds.

## **Making LVDC EIS**

The basic method of taking from one to 3 nine volt batteries and hooking up two electrodes placed into distilled water works, but has some major limitations. First the initial conductivity of the water is very low, but as ionic silver is produced increases.

Since increased conductivity increases the current, EIS is produced faster as time goes on. The result is basically an exponential where the conductivity increases exponentially, and the production (integral of the current) will also increase exponentially. This creates two problems, the first is that the appropriate brew time for a certain ppm will vary widely depending on the initial conductivity and temperature, and second the high currents toward the end causes an excessive increase in the particle size of the colloidal portion, making the brew less than optimum for both stability as well as effectiveness. Brewing a good quality EIS of over 5 or so ppm is almost impossible with this simple setup.

The best EIS is made by using a constant current source where the current is equal to 1 mA per square inch of anode material. For 14 gauge wire about 1 foot 4 inches of length is 1 square inch. Secondly it is best to limit the concentration of the colloid at any point, so it is best to stir it as well. Although the stirring can be gentle, the closer the electrodes are to each other, the more vigorous it should be. Stirring can be accomplished by placing a Christmas light bulb under the container, using a soda straw submerged into the water attached to a motor, or an aquarium bubbler or pump. Using a light bulb to generate thermal currents is likely the least expensive method to use, but will result in a less optimum brew than using any of the other methods. Or one can stir it by hand every few minutes if you don't mind being bored. It will typically take an hour or more to make EIS of 10 ppm or so. Making EIS over 20 ppm becomes increasingly difficult so stick with less than 20 ppm.

The colloidal portion of the EIS is easily seen by using a laser pointer and sending the beam through the water in a darkened room. If you can see the beam then you have colloid. This is referred to as Tyndall. The ionic portion can be measured with a dissolved solids meter, and a number of colloidal silver generator sites sell those.

A more advanced system can be made by using a flow through process, where the EIS is drained off and new distilled water is added continually. Also, during electrolysis there will be a black buildup of silver powder on the cathode, and brown silver oxide on the anode. Reversing the polarity of the voltage every minute or so will cause these buildups to dissipate during the cycle. If you do not reverse polarity during brewing, then the electrodes should be cleaned after each use without using any soap or detergent.

### **Why use distilled water?**

If you do not use distilled water, or add a salt or other ionic component to the water before brewing, then the time it takes to make something is greatly reduced. However what you make will not be good. What happens is that instead of making colloidal silver, you will make 100% silver chloride or other salts (from the salt, or chlorine in the water, or silver fluoride from the fluoridation). As the silver chloride builds up it begins precipitating out (it has a solubility of only about .89 ppm). If you drink this you will not only not be getting any colloidal silver, but will be getting a silver salt which by itself can cause argyria. Stan Jones is a prime example of this happening, he was making a witch's brew of silver compounds by not using distilled water.

### **What happens when you take silver compounds?**

A silver compound will typically become silver chloride as soon as it hits the stomach. The silver chloride is sparingly soluble, about .8 ppm. The dissolved silver chloride will move into the blood stream and once there will be exposed to chemicals that will induce the silver to plate out on any other silver particles present. However initially there will be no other silver particles present, so the silver chloride circulates in the blood until exposed to light in the skin, where they are photo reduced to silver atoms. This is the photographic process that occurs when you take a picture (with a film camera). Once the silver atoms are produced in the skin, then the rest of the silver chloride will begin reducing onto those particles making them grow very fast, and resulting in many of them getting stuck in the skin. Since the particles are so small, they will appear as black or blue, giving the skin a bluish cast. This is called argyria, and can result from taking silver compounds without any colloidal component.

### **What happens to EIS when taken internally?**

Since there are two components to EIS, then two different things happen.

The colloidal portion diffuses through the stomach wall rather quickly and enters the blood stream as long as the particles are small enough.

The ionic portion is a combination of silver hydroxide and silver oxide. While in solution they continually convert from one to the other and back again. Each has a solubility of about 13 ppm, so any EIS which is less than about 26 ppm and a pH of 7 will be totally dissolved. Upon contact with the HCl (hydrochloric acid) of the stomach both of these compounds will immediately form silver chloride. The silver chloride has a solubility of .8 ppm, so most of the

silver chloride will precipitate out, but the remaining part will quickly move into the blood stream. As it does, that which precipitated will redissolve and move into the blood stream as well. The end result is that most of the silver chloride will move into the blood stream over time, but at a lower rate than the colloidal portion.

Once it is in the blood stream it is exposed to the same effects we discussed for silver compounds above. Basically it will try to plate out on any silver particles it finds. Since there will be colloidal silver which already passed into the blood, there will be lots of particles for it to plate out on. So in short order the silver in the silver chloride plates out onto the colloidal particles already there, and they grow by a small amount. Typically for an EIS of 10% particulate content, the particles should grow to about double in size. This is insufficient to cause them to get caught up into tissues, and they eventually get removed by the kidneys.

So, as it turns out. colloidal silver is actually a prophylactic against argyria, instead of a cause as some would have you believe.

### **How does H<sub>2</sub>O<sub>2</sub> affect EIS?**

When H<sub>2</sub>O<sub>2</sub> is added to EIS (one or two drops per glass of EIS), it will be noted that there is an immediate clearing effect. The Tyndall (what you see if you shine a laser pointer through the liquid) will become very faint as well. If the ppm of the EIS is sufficiently high (25 to 30 ppm) a white cloudy precipitate may form as well.

There are a number of reactions that occur. H<sub>2</sub>O<sub>2</sub> is normally thought of as an oxidizer, but it can act as a reducer as well. Also silver is considered a catalyst for H<sub>2</sub>O<sub>2</sub>, but in actuality gets directly involved in the reactions.

The H<sub>2</sub>O<sub>2</sub> reacts with the silver particles, producing ionic silver, a combination of silver hydroxide and silver oxide. This makes the large particles disappear, reducing the tyndall. However H<sub>2</sub>O<sub>2</sub> also reacts with the silver oxide and silver hydroxide producing a 2 atom colloid of silver plus oxygen (and water in the case of silver hydroxide). Over time this 2 atom colloidal particle can end up being converted back to silver oxide and silver hydroxide, and so forth. The final result is a mixture of ionic silver (hydroxide and oxide) and very small colloidal particles. Thus if you add H<sub>2</sub>O<sub>2</sub> to freshly made EIS, you can sometimes see the oxygen bubble off, and the tyndall may change significantly. But more importantly, the particulate portion of the EIS will go from being medium or large particles to many more very small particles, and the particle content will increase from a typical 5-15% to around 30-50%. If you have a strong tyndall from large particles, it will decrease, and if you have a weak or no tyndall it will increase with the formation of the 2 atom particles. This enhances absorption, as well as effectiveness. Note that it is recommended to let the EIS sit for 5 or more minutes if you do add H<sub>2</sub>O<sub>2</sub> to it to let it stabilize.

### **How does adding Gatorade to EIS affect it?**

One study group, as reported by Brooks Bradley, found that mixing 1/3 EIS with 2/3 Gatorade enhanced the absorption of the EIS significantly. I undertook an analysis to find why this is so and believe it is due to the solubility of AgCl in water with additional chlorine ions present. Normal theory indicates that in the presence of chloride ions, the solubility of silver chloride drops. In fact it drops from about .8 ppm to about .2 ppm in the concentration of these ions in the stomach and blood.

However that ignores that silver will form soluble complexes of chloride when there is an excessive amount of chlorine in the liquid. The result is that as you increase the hydrochloric acid or salt in water the solubility of silver chloride decreases significantly, but then begins increasing again, so that when it reaches the level in the stomach and blood it is right back to .8 ppm again.

So if you take EIS by mouth, it dilutes the stomach acid so that the solubility of silver chloride is reduced to below .8 ppm. But if you mix it with an electrolyte solution, such as Gatorade, it forms complexes with the chlorides so that solubility is maintained and that improves the absorption into the blood by several times.

An alternative theory proposed by Ode Coyote is that water is absorbed slowly by the stomach since the body has to maintain the correct electrolyte balance in the blood. However Gatorade with the proper electrolyte content is absorbed much faster since it matches the blood levels, and thus carries the colloidal portion into the blood immediately, and also allows transfer of the silver chloride at a much faster rate as well. Although both theories are completely different, fact is that the actual action is most likely due to both.

Note that adding Gatorade increases the speed that EIS is absorbed into the blood. Thus for food poisoning, or attacking pathogens in the stomach or intestines, Gatorade should NOT be used since you want the EIS to remain in the stomach as long as possible.

### **Can I do both?**

If you add a small amount of H<sub>2</sub>O<sub>2</sub> (1 drop to 4 to 8 oz) to the EIS and let sit for 15 minutes, then add the Gatorade and drink immediately, then you should be able to get both effects. Do NOT add the H<sub>2</sub>O<sub>2</sub> and Gatorade at the same time, or you will end up changing all the colloidal silver to silver chloride which would NOT be good.

### **Why is the ionic component important?**

Ionic silver has the proven ability to cause DNA to dedifferentiate or revert back to stem cells (See The Electric Body by Robert Becker). Normally once DNA has expressed certain genes, it cannot return, so once a cell is skin, or a blood cell, it cannot morph to another cell type. Now, if you apply silver ions to a burn or an injury, the blood cells can convert to the necessary skin, nerve and other cell types as needed. Without it, they can only form scar tissue. So using an EIS that has ionic content promotes healing without scarring. I personally cut the end off of my thumb and kept the stub wet with EIS for days. The result was a complete regrowth with fingerprint, so now I can't even tell which thumb was cut. Burns, even 3rd degree burns, can heal without scarring when silver ions are present. This is used by many burn units now, with such products as Silverlon bandages and acticoat.

### **Why is the colloidal component important?**

As stated above the colloidal component provides sites for the silver chloride to precipitate out on that are numerous, and in the blood. Without them, they would be photoreduced in the skin, then plating out on those few particles can cause them to grow rapidly and get caught causing argyria.

### **How does it kill pathogens?**

Now we are getting into an area that is not nearly as clear cut as the above. That it does kill microbes, and disable viruses is a fact, but how it does it is still up to dispute. The following are some theories.

1. Silver particles are an oxidizing catalyst, and as such oxidize pathogens killing them. This is how H<sub>2</sub>O<sub>2</sub> works as well.
2. Silver interferes with the microbe's respiration.
3. Silver ties up or disables the sulfur in the microbe.
4. Silver short out the electrostatic fields in the cell

Most of the above would not apply to viruses though. Instead the possibilities for disabling viruses are:

1. Silver particles are an oxidizing catalyst and oxidize the virus killing it.
2. Silver causes the virus DNA or RNA to revert back to being undifferentiated, and without the proper expression for that host is disabled.
3. Silver repairs the broken (segment of) DNA of a virus, making it complete, but no longer a functional virus which by design has an incomplete DNA.

### **What is this about Argyria?**

As outlined above argyria is caused by the photographic process. Silver salts/compounds are exposed to light in the skin and reduced to silver atoms. If the level of salts is sufficiently low, the atoms are swept out of the skin by the blood flow and everything is fine. If however the level of salts in the blood is over some minimum level the atoms will increase in size as the silver salts plate out on them, growing so rapidly that they will become stuck in the tissues. This is the photographic development process. To prevent argyria it is essential to keep blood levels of silver compounds below a threshold value. This is done by taking a combination of both silver compounds and colloidal silver (the composition of EIS), so that when the silver salts plate out, there are huge numbers of silver particles in the colloid present so that growth of any particle (even those formed in the skin by the sun) is minimized, and no particle grows large enough to get stuck.

Some people who have taken large amounts of IES (several quarts or more a day) have reported blueing of the moons of their fingernails. This can occur when the level of EIS exceeds some amount, which seems to vary depending on the person, and whether they are deficient in vitamin E and selenium or not. Vitamin E and selenium have a prophylactic effect on argyria, and on the blueing of the fingernail roots. Apparently taking silver over time can also cause a loss of selenium and even a deficiency. If you take EIS over long periods of time it is suggested that you supplement your selenium intake ( Natural sources of selenium are listed at Dietary Supplement Fact Sheet: Selenium, and Brazil nuts are very high in selenium). Anyway, the body disposes of silver by several routes ( see <http://www.silvermedicine.org/AltmanStudy.pdf> ), the kidneys, the liver, sweating, and by putting metals into hair and nails. The body collects excess amounts of metals in the nail bed to allow it to put those in the nails. If concentrations exceed some amount in the nail bed, then aggregation can occur, causing the nail bed to turn blue. Although this appears to be argyria of the fingernail moons, the mechanism is totally different. Also it is probably a pretty good warning that you might be taking more silver than you should, and unless you are taking it for a chronic condition, should cut back, and/or you should supplement with selenium.

Note that although the medical community considers argyria permanent, there have been some successes reported by taking selenium, Vitamin E and Vitamin C. Because of the nature of argyria, EIS will not cause argyria, but can make it worse if you already have it. The reason is that EIS contains particles that quickly reduce any silver salt levels in the blood so that any silver seed particles formed in the skin are unable to grow enough to get stuck. However if you already have particles in the skin that are stuck, then ANY silver compounds in the blood at all will over time plate out on those particles making them grow even larger. That is why some people who have gotten argyria (from other sources than EIS, such as silver citrate, attempting to make EIS with tap water, silver nitrate nose drops, silver acetate smoking gum/lozenge or MSP) and have managed to get rid of the argyria's color using selenium, vitamin A and C, find that it tends to return even when taking high quality EIS. That is because the protocol is reducing the particle sizes to where they no longer absorb light, but not to the point of getting them unstuck in the skin. If the protocol is continued without any silver intake over a long enough period it might be possible to eliminate these seed particles completely, but at this point there is no data on this.

There have been reports that the following protocol is capable of eliminating argyria:

This protocol is found at <http://www.silverprotects.com/argyria.html>

1. 200mcg of selenium per day is a safe supplement to take on an ongoing basis.
2. He also advises a high-quality,\* mixed vitamin E, at 1000 IU per day for people over 50 years of age who may be at risk of stroke, and 2,000 IU per day for people under 50 who are not at risk of stroke. I told Dr. Gruenn that I was taking 4,000 IU a day. He replied that this was still safe for a strong healthy person. The danger of high doses of vitamin E is that it thins the blood. This could be dangerous in many situations where bleeding is hard to stop.
3. Personally, I would also drink lots of water, simply because that's how the body clears out debris. No one knows if this therapy will prove efficacious, or if it does in how many cases. If my liver spots are any kind of indicator, some lightening of the skin ought to be visible within six weeks if this therapy really is working. Three to six months should be a sufficient amount of time to completely eliminate argyria provided that no additional silver is being ingested. (Since my conversation with Dr. Gruenn, I've had some additional ideas for getting the most out of this nutritional therapy for argyria.)
4. 2 tsp. of MSM per day. Sulfur (MSM) binds with silver and can help to pull it from the body. More information on silver and sulfur can be found on page 74.
5. 4,000 mg. of vitamin C per day.
6. 1 tablet a day of a good quality multiple mineral since this therapy may deplete needed minerals from the body.

\* Most vitamin E supplements are of poor quality and some even contain rancid oils that will be an additional burden rather than an aid to the body. Dr. Gruenn recommends a vitamin E that has a mix of d-alpha, beta, delta and gamma tocopherols. (Avoid tocopheryls, which are artificial and will not work).

D.M., Portland, ME (the argyria cure only)

Marshall Dudley

This paper is provided as a research tool for those wanting to research and understand colloidal silver. No claims are made to its accuracy or suitability for any use. If there are any errors found we will be happy to correct them.

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## F.A.Q.

Q: Which CS are we actually looking to create, mostly particular or mostly ionic (which is the one that actual does something)?

A: Mostly ionic. (About 85% - 95%) All generators make mostly ionic. Which part 'works' is still debatable. I think they both do.

Q: Generation of proper solution - which EC and PPM values indicate good quality Distilled Water?

A: Less than about 2 ppm or about 4.5 uS is satisfactory.

Q: Best voltage to run is: (9V, 27V, 30V, 40V...)?

A: You can make it with any voltage but generally lower voltage are better/easier. If you try to make it with anything above 12v you need to be pretty attentive.

Q: Does voltage need to alternate between electrodes and how often > (60sec, 5min, 10min...)?

A: No. It doesn't need to but reversing polarity every couple of minutes will keep the electrodes clean and probably make CS with a slightly higher particle content. But I find that polarity reversal is much slower. Personally I prefer straight DC.

Q: Is stirring necessary and how much (slow stirring, fast stirring)?

A: Stirring is very helpful for making clearer CS. A nice steady speed is fine. Doesn't have to be fast. Stirring gets the ions away from the anode and away from each other.

Q: Is current limiting required and is the current limited to a specific amount from the start (1mA, 2mA, 5mA...) using a fixed current rectifier such as 1N529X/1N530X or is it some sort of a dynamic process (which one and how)?

A: Its not essential but current limiting is just one more thing that helps you make a good batch more often. It slows down the process so the ions are released into a less saturated zone and the batch wont go too conductive too fast. 1 mA is the ideal for the average system but its just part of a whole range of variables such as voltage, electrode spacing, electrode surface area, stirring etc that effect the end result.

Q: How does one know the process is complete, is there a time variable (run for four hours then stop) or some other factor (until current reaches some value, ie. 3mA, but then how does current limiting work)?

A: Stop just before it starts to change color. That takes practice, or get a good EC meter and stop at around 15 ppm. An auto-shut off generator that shuts off based on water conductivity will solve a lot of your questions.

Q: Does one need to run the solution through a coffee filter(s) after the "brewing" is done to get rid of large silver clusters?

A: Coffee filter paper will only remove the fuzzy deposits that sometimes fall off an electrode. It won't remove any genuine colloidal particles. But its best just to let the batch sit for an hour then just use the paper to filter the last 10% of the batch.

Q: Should there be a (big) build-up on the electrodes (crystal formations) during the process and at the end, and if so what color should it be?

A: Some grey fuzz on one electrode (the - cathode) is common. The less the better. The color of the fuzz is not important. Only the color of the water is important. (But a black coating on the + anode often indicates bad water).

Q: Color of the finished solution, tyndall effect: Should the solution be clear, pale yellow, golden yellow...?

A: Clear is best. Very pale yellow is OK.

Q: How strong should a Tyndall effect be (strong defined beam, pale beam, none at all)?

A: A matt 'creamy' beam is best but it doesn't really matter. It varies from batch to batch. Sometimes there's almost no TE.

Q: Should there be sparkling particles in the solution or not?

A: Preferably not. They indicate larger particles.

Q: What about darker bands seen floating when intersected with the laser beam, should we see those?

A: I don't know what you mean. Maybe you mean the 'ion cloud' that looks like gold smoke coming off an electrode. That should disperse and not be visible in a batch that's been stirred.

Q: Concentration and measurement: Using a HM COM-100 meter, do we measure in KCl, NaCl, 442 solution range?

A: uS/KCL is a 1:1 conversion. (eg 10.1 uS is 10.1 ppm of colloidal silver). But its just a guide. Its not dead accurate. (ppm/NaCl mode is the same as an ordinary TDS meter.).

Q: Using a HM COM-100 meter, which values of EC are we looking for and what do they mean (do we convert those to PPM)?

A: About 15 - 20 ppm (15 - 20 uS) is about an average good result for clear CS.

Q: Using a HM COM-100 meter, which PPM concentration of the solution are we looking for and is that measurement accurate?

A: See above. Its not accurate. Its just a rough guide. But its the best rough guide you'll get.

Q: Consumption - do we ingest (drink it, how much) (argyria comes to mind as a potential risk if ingested due to creation of AgCl in the stomach)?

A: Hold it in your mouth for as long as possible then swallow. Or you can nebulise it. You won't get argyria if you stick to clear CS made with distilled or demineralised water.

Q: Gargle, swish and spit out?

A: I don't. Some do. I guess it depends to some degree on how much you take.

Q: Apply orally (as a topical solution or gel)?

A: You can do that. A spray is nice. Especially on the face and in the eyes.

Q: Something else?

A: You could put it in an ultrasonic room vaporizer.

Q: Storage - Should H<sub>2</sub>O<sub>2</sub> be added to the solution (35% food grade)?

A: Never in my opinion. For human consumption just make it nice and clear in the first place.

Q: Should the solution be stored in glass or plastic containers?

A: Doesn't matter. Good plastic is as good as good glass. PET (Coke bottle) plastic is possibly the best.

Q: Do the containers need to be in amber or cobalt blue color?

A: No, but store it out of the light. Keep a small amber glass bottle on the bench top for daily use.