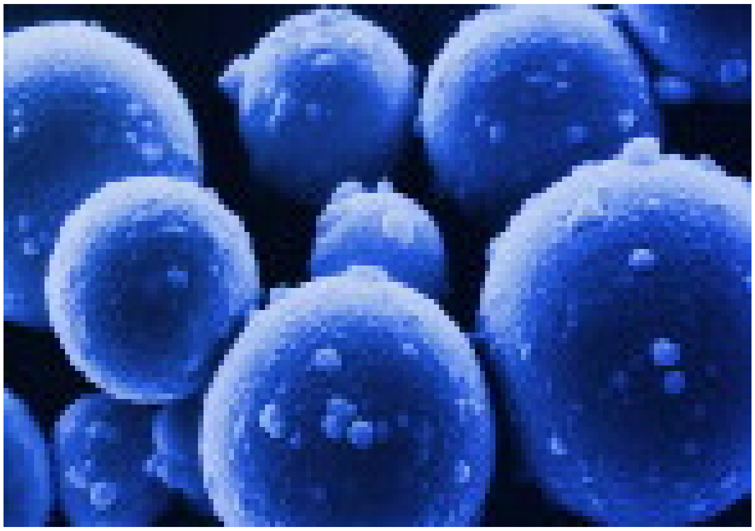
Understanding and Using the TDS Meter

For those of us that makes our own colloidal silver, the Total Dissolved Solids (**TDS**) meter is the best method for measurement of the silver concentration in a distilled water base. The TDS meter is a variation of the Electric Conductivity (**EC**) measurement process, where the EC value is converted to TDS in parts per million (ppm). TDS measurements are typically expressed in a unit-of-measure known as **Parts Per Million** (**ppm**). It is a measurement of mass and determined by weighing, called a gravimetric analysis. **A small concentration of pure colloidal silver suspended equally throughout an enclosed volume of distilled water at a strength of 10 ppm means that there are approximately 10 milligrams if microscopic silver particles present for every liter of the water.**

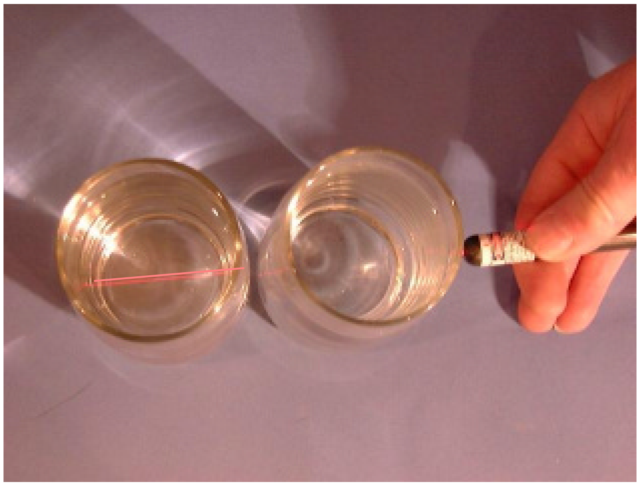


One way to accurately calculate total suspended solids is to evaporate a measured filtered sample to dryness, and weigh the residue. This type of measurement requires accurate liquid measurement, glassware, a drying oven, and a milligram balance. Example: 50 mL of the 700ppm solution would leave 35 mg of mineral residue at the bottom of a crucible after the water evaporates.

Electrical Conductivity (**EC**) is expressed in a unit-of-measure call "**Siemens per centimeter**" (**s/cm**), milliSeimens per centimeter(**mS/cm**), or microSeimens per centimeter (**µS/cm**). Mineral atoms in a colloidal suspension are really electrically charged **ions** that have a charge value that is expressed as a whole number, usually a positive or negative 1, 2, or 3, depending on the number of electrons gained or lost. EC is a measurement of all those charges in the solution based on the conductivity electricity. The greater the quantity of ions in a solution, the more electricity that will be conducted by that solution. A material has a conductance of one siemens if one ampere of electric current can pass through it per volt of electric potential. It is the reciprocal of the Ohm, the standard unit of electrical resistance. At one time the "siemens" unit-of-measure was called a "mho" (Ohm backwards) and then the international scientific naming committee decided to honor another scientist with the unit name.

EC measurements often are converted to TDS units (**ppm**) by the internal meter circuitry. The meter cannot directly measure TDS as described above and instead uses a linear conversion factor to calculate it. Every solution is different, so no factor will be exact. The meter uses an approximate conversion factor, because the exact composition of the mix is not always known. Conversion factors range from .50 for nearly pure water measurements to .72, which more closely matches heavier salts and mixed soil mineral profiles. Since colloidal silver solutions are closer to pure water in nature, the **.5 conversion factor** is more accurate and therefore typically used for colloidal silver measurements.

The Tyndall Effect is where a Laser Beam reflects off silver particles in the Colloidal Silver solution on the left but has no effect in pure water solution in the right glass. This effect can be seen in is little as 5 ppm CS solution.



Comparing mS, g/l, mg/l, ppm, ppt and converting from one to the other

The relation between conductivity and dissolved solids is approximately:

2 µS/cm = 1 ppm (which is the approximately the same as 1 mg/l)

In other words, the typical and approximate relationship between EC and TDS is 2 microSiemens per centimeter electrical conductivity is equal to 1 parts per million total dissolved solids or about 1 milligram of solids in one liter of water.

100 µS/cm EC equals approximately 50 ppm TDS or about 10,000 Ohms of solution resistance in a centimeter measurement gap between meter electrodes. Some meter companies may adjust their instruments slightly above or below these figures to compensate for mixed mineral solutions. Measurements are usually made with a very small alternating current to avoid errors caused by the buildup of polarization affects when direct current is used.

The approximate conductivity of water from various sources is:

Absolute pure water - 0.055 µS/cm (.0275 ppm)
Distilled water - 0.5 µS/cm (.25 ppm), This equates to a resistance of over 2 million Ohms
Pure mountain water - 1.0 µS/cm (.5 ppm)
Highly filtered bottled water - 8 to 20 µS/cm (4 to 10 ppm)
Typical drinking water - 500 to 800 µS/cm (250 to 400 ppm)
Average sea water - 56 mS/cm (2800 ppm)
Maximum allowed for potable water - 1055 µS/cm (528 ppm)

Some common conductivity conversion factors are:

mS/cm x 1 000 = µS/cm
µS/cm x 0.001 = mS/cm
µS/cm x 1 = µmhos/cm
µS/cm x 0.5 = mg/l of TDS
mS/cm x 0.5 = g/l of TDS
mg/l TDS x 0.001 = g/l of TDS
mg/l TDS x 0.05842 = gpg TDS

The key point is that a solution of colloidal silver is typically useful in a range between 5ppm and 50ppm depending on the application, the amount consumed and the cyclic periods of usage or exposure intervals (See section on suggested mG intake levels). Above that an little benefit is gained while exposure to possible over accumulation of silver is increased. While the zone between usefulness and possible harm appear to be fairly wide, it is still the responsibility of each user to carefully monitor their intake of colloidal silver per unit of time to both measure effectiveness of the colloidal silver and avoid over accumulation of silver in the tissue.

Another key point is that colloidal silver solution represents a highly non-linear electrical load while it is being produced. That is to say, the resistance levels of the water solution start out at several million ohms and drop to just a few ohms as the silver content increases, this can lead to current runaway and large over-sized silver particles if not carefully controlled by your controller circuitry.

Finally, the TDS meter should be checked of proper calibration every two to three months. Calibration fluids are available for this purpose but they are typically not shipped with the basic meter and must be ordered separately. Remember that a calibration solution rated at 84 µS/cm will read 42 ppm on a TDS meter due to the .5 conversion factor. Some manufacturers will supply a precision calibration resistor that performs the same task with for less mess and confusion. Follow the simple instructions supplied with the calibration resistor to check and adjust your meter. Also, remember that TDS measurements are temperature sensitive, so check to make sure your meter has a Automatic Temperature Compensation (ATC) feature built in.