What is TDS?

Total Dissolved Solids (TDS) are the total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water, expressed in units of mg per unit volume of water (mg/L), also referred to as parts per million (ppm). TDS is directly related to the purity of water and the quality of water purification systems and affects everything that consumes, lives in, or uses water, whether organic or inorganic, whether for better or for worse.

What Are Total Dissolved Solids?

- "Dissolved solids" refer to any minerals, salts, metals, cations or anions dissolved in water. This includes anything present in water other than the pure water (H20) molecule and suspended solids. (Suspended solids are any particles/substances that are neither dissolved nor settled in the water, such as wood pulp.)
- In general, the total dissolved solids concentration is the sum of the cations (positively charged) and anions (negatively charged) ions in the water.
- Parts per Million (ppm) is the weight-to-weight ratio of any ion to water.
- A TDS meter is based on the electrical conductivity (EC) of water. Pure H20 has virtually zero conductivity. Conductivity is usually about 100 times the total cations or anions expressed as equivalents. TDS is calculated by converting the EC by a factor of 0.5 to 1.0 times the EC, depending upon the levels. Typically, the higher the level of EC, the higher the conversion factor to determine the TDS. NOTE - While a TDS meter is based on conductivity, TDS and conductivity are not the same thing. For more information on this topic, please see our FAQ page.

Where Do Dissolved Solids Come From?

- Some dissolved solids come from organic sources such as leaves, silt, plankton, and industrial waste and sewage. Other sources come from runoff from urban areas, road salts used on street during the winter, and fertilizers and pesticides used on lawns and farms.
- Dissolved solids also come from inorganic materials such as rocks and air that may contain calcium bicarbonate, nitrogen, iron phosphorous, sulfur, and other minerals. Many of these materials form salts, which are compounds that contain both a metal and a nonmetal. Salts usually dissolve in water forming ions. Ions are particles that have a positive or negative charge.
- Water may also pick up metals such as lead or copper as they travel through pipes used to distribute water to consumers.
- Note that the efficacy of water purifications systems in removing total dissolved solids will be reduced over time, so it is highly recommended to monitor the quality of a filter or membrane and replace them when required.

Why Should You Measure the TDS Level in Your Water?

The EPA Secondary Regulations advise a maximum contamination level (MCL) of 500mg/liter (500 parts per million (ppm)) for TDS. Numerous water supplies exceed this level. When TDS levels exceed 1000mg/L it is generally considered unfit for human consumption. A high level of TDS is an indicator of potential concerns, and warrants further investigation. Most often, high levels of TDS are caused by the presence of potassium, chlorides and sodium. These ions have little or no short-term effects, but toxic ions (lead arsenic, cadmium, nitrate and others) may also be dissolved in the water.

Even the best water purification systems on the market require monitoring for TDS to ensure the filters and/or membranes are effectively removing unwanted particles and bacteria from your water.

The following are reasons why it is helpful to constantly test for TDS:

Taste/Health

High TDS results in undesirable taste which could be salty, bitter, or metallic. It could also indicate the presence of toxic minerals. The EPA's recommended maximum level of TDS in water is 500mg/L (500ppm).

Filter performance

Test your water to make sure the reverse osmosis or other type of water filter or water purification systems has a high rejection rate and know when to change your filter (or membrane) cartridges.

Hardness (and Water Softeners)

High TDS indicates hard water, which causes scale buildup in pipes and valves, inhibiting performance

Aquariums/Aquaculture

A constant level of minerals is necessary for aquatic life. The water in an aquarium or tank should have the same levels of TDS and pH as the fish and reef's original habitat.

Hydroponics

TDS is the best measurement of the nutrient concentration in a hydroponic solution.

Pools and spas

TDS levels must be monitored to prevent maintenance problems.

Commercial/Industrial

High TDS levels could impede the functions of certain applications, such as boilers and cooling towers, food and water production and more.

Colloidal silver water

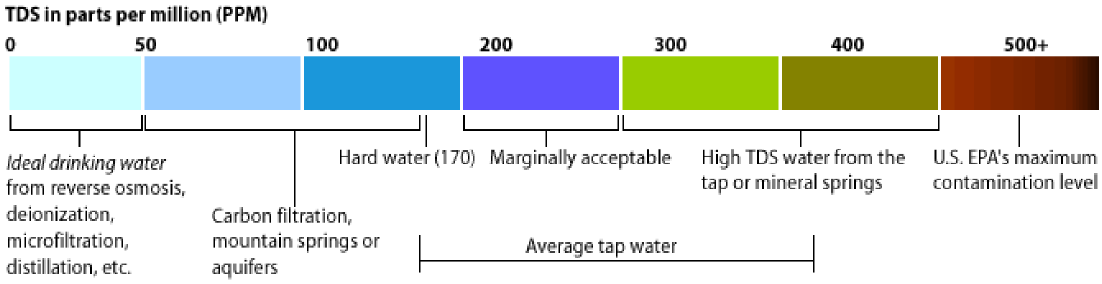
TDS levels must be controlled prior to making colloidal silver.

Coffee and Food Service

For a truly great cup of coffee, proper TDS levels must be maintained.

Car Washing and Window Cleaning

Have a washer with a spotless rinse? An inline dual TDS monitor will tell you when to change the filter cartridge or RO membrane.



How Do You Reduce or Remove the TDS in Your Water?

Common water filter and water purification systems:

Carbon filtration

Charcoal, a form of carbon with a high surface area, adsorbs (or sticks to) many compounds, including some toxic compounds. Water is passed through activated charcoal to remove such contaminants.

Reverse osmosis (R.O.)

Reverse osmosis works by forcing water under great pressure against a semi-permeable membrane that allows water molecules to pass through while excluding most contaminants. RO is the most thorough method of large-scale water purification available.

Distillation

Distillation involves boiling the water to produce water vapor. The water vapor then rises to a cooled surface where it can condense back into a liquid and be collected. Because the dissolved solids are not normally vaporized, they remain in the boiling solution.

Deionization (DI)

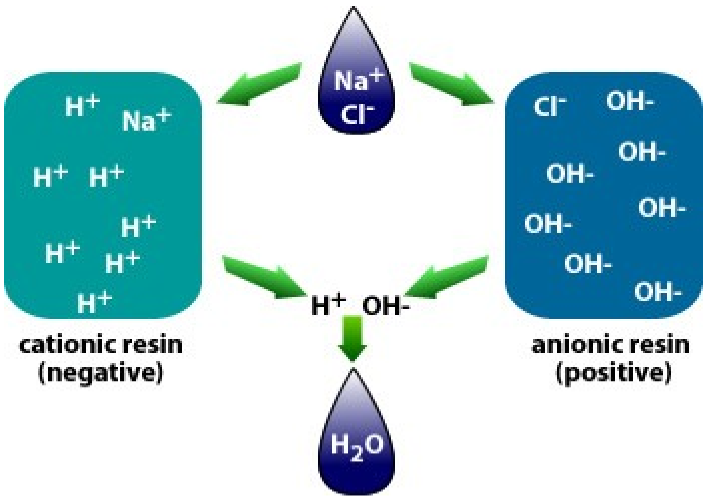
Water is passed between a positive electrode and a negative electrode. Ion selective membranes allow the positive ions to separate from the water toward the negative electrode and the negative ions toward the positive electrode. High purity de-ionized water results. The water is usually passed through a reverse osmosis unit first to remove nonionic organic contaminants.

Deionization (DI) / Ion Exchange

Deionization (DI) is a water filtration process whereby total dissolved solids (TDS) are removed from water through ion exchange. In simple terms, by controlling the electric charge of ions in the water, it is possible to remove the TDS. Much like a positively charged magnet will attract a negatively charged magnet (and vice-versa), DI resins attract non-water ions and replace them with water ions, leaving a more pure water form.

The process of deionization uses two resins that are opposite in charges – the cationic (negative) and the anionic (positive). The cationic resin is typically made from styrene containing negatively charged sulfonic acid groups, and will be pre-charged with hydrogen ions. This resin will attract the positively charged ions in the water (Ca++, Mg++, Na+, etc.) and releases an equivalent amount of hydrogen (H+) ions.

Like the cationic, the anionic resin is also made from styrene, but contains positively charged quaternary ammonium groups, and will be pre-charged with hydroxide ions. This resin will attract the negatively charged ions (HCO3-, Cl-, SO4--, etc.) and releases an equivalent amount of hydroxide (OH-). The hydrogen and hydroxide ions then combine to form water. (H+ + OH- = HOH or H2O.)



The two resins can be ionized at a certain level, usually weak or strong. The cationic can be either a strong or weak acid. Likewise, the anionic resin can be either a strong or weak base. A weaker ionization will exchange only the weak ions, providing for a greater capacity (meaning longer filter cartridge life), while a stronger ionization will provide a higher degree of ion exchange, but at the cost of reduced capacity (shorter filter cartridge life).

As with many other types of filtration or purification processes, a single deionization cycle may not remove all the TDS. Some of the ions will not be attracted by the resins, so running the DI water through a second cycle will provide for additional purification. In other words, the more you run the deionized water through the more pure the yielding water will be. However, it is important to test the filtered water with a TDS meter after each cycle to determine the effectiveness of your DI system. Compared with other filtration and purification methods, DI has a relatively short filter cartridge life and once it begins to fail, the TDS level of the purified will “rise” exponentially.