



ADVANCED WATER SYSTEMS GROUP

Proudly Presents

Frequently Asked Questions (FAQs) About Residential Water Quality

What is Silica and Do I Have It??

Silica is a mineral compound with the formula SiO_2 . This very common mineral has many different forms and is most easily recognized in nature as the mineral quartz (SiO_2) (see Figure 1).

Silica is actually silicon dioxide. Silicon is the 7th most abundant element in the universe and the second most abundant element in the Earth's crust, after oxygen. In fact, the vast majority of all rocks are comprised of silicate minerals which have SiO_2 as their fundamental building block.

Although the solubility of silica in water is low, and the dissolution rate of silicate minerals is very slow, its sheer abundance means that it is ubiquitous in ground water supplies at some level.



Figure 1. Natural quartz crystals, a common form of silica

Many rock types are rich in silica, especially granites and sandstones, which underlie large portions of the Triangle area. Anyone with a granite countertop in their home can see silica (quartz) as well as a range of silicate minerals just by studying the minerals present in their countertops. It is no wonder that wells drilled into normal rocks pick up silica over the span of years as the groundwater slowly dissolves the rocks.

Silica In Water Supplies

Silica can exist in water supplies in two main forms. The

first of these is called "Reactive Silica". Reactive silica is dissolved in water as the bisilicate ion (HSiO_3^-) making it a very weak acid. This type of silica can be removed by using specialized ion exchange resins since the silica is dissolved. However, these resins are difficult to regenerate requiring harmful strong bases like caustic soda (NaOH) and their use is generally restricted to industrial applications.

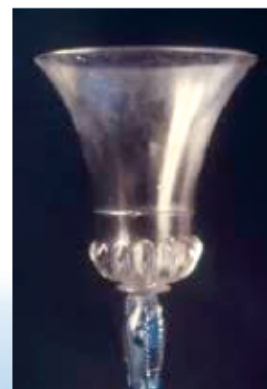
The other form of silica in the water is known as "Colloidal Silica". This form is a polymeric form of silica where the particles are ultra-fine and cannot be filtered out of the water using normal filtration techniques. Colloidal silica cannot be removed using ion-exchange methods.

Evidence of Silica in the Home

We have found that when the concentration of silica in ground water reaches levels of about 20-25 mg/L, silica deposit problems may become apparent in the home. There are several areas where silica deposits are common.

Silica etching of glassware

All glass is primarily comprised of SiO_2 as the major constituent. Etching of glassware can be a common problem in the dishwasher when aggressive detergents are used and silica levels are sufficient in the water. The early stages of this start with a silica film. This can cause the glasses to be milky colored or even have a rainbow sheen. It is difficult to remove this from glassware and once etching advances, the glassware is damaged beyond repair. These reactions are generally enhanced with soft water. An example of this is shown in Figure 2.



*Figure 2.
Silica film
etching on
glassware*



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Silica scale deposits

In addition to damage to glassware, it is common to see silica deposits in the home. The most common places to observe these deposits are summarized below.

COMMON PLACES TO SEE SILICA DEPOSITS

- Water line in toilet bowl - vary hard build-up can only be removed with pumice stone or scraping
- On polished chrome surfaces like tub fixtures
- Obvious on black porcelain sinks and surfaces as hard white spots, "islands", or spidery networks
- Silica domains on glass shower doors - "frosted look"
- Dull, white silica build-up on granite counters

An example of silica deposits on a chrome shower fixture is shown in Figure 3.



Figure 3. Silica deposits on a polished chrome shower fixture

The most common attribute of all silica deposits is how hard and stubborn they are. These deposits are very tough and normal calcium scale scale removers (acids) will not remove silica deposits.

Treatment for Silica

There are only a few ways to reduce silica in the water and most of these are not applicable to residential settings.

1. Lime-soda softening: This is a complex chemical precipitation process using CaOH and Soda Ash to raise

the pH to extreme levels causing precipitation of CaCO_3 and MgOH. Silica binds to the MgOH and settles out. This method is impractical for residential use.

2. Ultra-filtration: Specialized polymeric ultra-filters have been developed for industrial water treatment to capture silica. They can be used on colloidal silica but not reactive silica. They are expensive and have not been scaled down for residential use

3. Anion Exchange: This ion-exchange method can be used for reactive silica, but not colloidal silica. Regeneration of the resins is restricted to industrial applications due to hazardous material handling requirement.

4. Whole-House Reverse Osmosis: For residential settings, whole-house RO is one way to reduce all types of silica. These systems have to be sized properly and normally pre-treatment for iron & hardness is required.

Because it is so difficult to remove silica from the water, the most common approach to deal with it is one of prevention and mitigation of deposits:

MITIGATION OF SILICA

- Lower water temperature below 140° F in dishwashers
- Use soft-water detergents with no phosphorus and air-dry only in dishwashers
- Wash delicate glassware by hand only
- Keep water off of chrome surfaces and glass shower doors to prevent silica spotting
- Clean deposits at water line in toilet before they build up using a cleaner like AMAZ or by scrubbing
- Use cleaners like AMAZ to clean silica from chrome fixtures and shower doors
- Some cleaners with hydrofluoric acid (HF) may help remove silica
- Protect glass surfaces using Rain-Ex or other glass coating

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