National Testing Laboratories, Ltd.
Quality Water Analysis

The Relationship Between Iron and pH

First, let us define pH as the concentration of hydrogen ions. This concentration is calculated by the negative logarithm of the hydrogen ion (H+) concentration, which means the higher the pH level, the less free hydrogen ions. Additionally, this means a change in one pH value represents a ten-fold change in the concentration of hydrogen ions. To further explain, there are 10 times as many hydrogen ions available at a pH of 7 than at a pH of 8, and 100 times as any at a pH of 6. The pH scale goes from 0 to 14 with 7 being neutral. Anything below is considered acidic and anything above 7 is considered alkaline or basic.

The pH of water is very important because it can determine solubility and biological availability of nutrients, specifically metals such as iron. Solubility refers to the amount of a substance that can be dissolved in water and the lower pH level, the more soluble the iron will be. Biological availability is the amount of a substance, which can be utilized by aquatic life.

There are several types of iron: insoluble (ferric hydroxide), soluble (ferrous bicarbonate), organic, colloidal and bacteria. Insoluble, commonly called red water iron, is immediately apparent upon pouring a glass. The water can appear rusty or yellowish in color. This happens because the iron is being oxidized by the atmosphere and forming ferric hydroxide - also known as rust. Soluble iron is also called clear water iron. Upon pouring a glass it will appear clear, but given time the iron will eventually oxidize into particulate and settle to the bottom of the glass. Organic iron is combined with an acid, which can be clear, but usually has a yellowish-to-red color. Colloidal iron refers to very fine iron particles held in solution so the water appears discolored. Iron bacteria utilize iron as a nutrient source and can present significant clogging problems. Iron bacteria can grow enough to block pipes and clog well screens within weeks. Iron bacteria growth is very dependent upon the pH level, occurring over a range of 5.5 to 8.2 with 6.5 being the optimum level.

Acidic water tends to keep minerals in solutions and will typically cause corrosion problems when levels are below 6.5. This explains the formation of rust when insoluble iron is exposed to the atmosphere, lowering the pH in the water and oxidizing the iron. Bacteria can produce insoluble iron compounds like ferric hydroxide or iron carbonate as a waste product, which can end up as film on fixtures and appliances. Scaling and encrustation usually occurs when the pH is above 8.5. Keep in mind, if other ions like calcium or carbonate are present, they make a variety of precipitates that mix in with the iron hydroxide precipitates produce a crusty, gnarled coating that can be difficult to remove.

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