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ChemScan® Method Summary #129 Total Iron in Water or Wastewater

Iron Analysis

Iron is a major constituent of the earth's crust. It occurs naturally in groundwater and surface waters. Drinking waters containing iron are not known to cause any harmful effects in humans. Iron does interfere with laundering operations, imparts objectionable stains to plumbing fixtures, causes difficulties in distribution systems by supporting growths of iron bacteria and imparts a taste to water and products manufactured using water containing iron which is detectable at very low concentrations. For these reasons the U.S. Public Health Service Drinking Water Standard recommended limit for iron in public water supplies is 0.3 mg/L.

In groundwater and anaerobic surface waters, within the pH range of natural waters, iron is present in the reduced state, ferrous, Fe^{+2}, in its soluble forms. When such waters are exposed to air so that oxygen can enter or an oxidizing agent such as chlorine is introduced, the ferrous iron is converted into the oxidized form of iron, ferric, Fe^{+3}. These waters become turbid and highly unacceptable from the aesthetic point of view due to the oxidation of iron and the formation of colloidal precipitates.

Because of the implications of the presence of iron in water supplies and the requirement for iron removal through various treatment methods, iron is often monitored. Standard analysis techniques include atomic absorption, inductively coupled plasma or colorimetric wet chemical methods. Of the three noted methods, wet chemistry lends itself most readily to on-line analysis. Wet chemical methods used by others typically employ a reduction step and the addition of 1, 10 - phenanthroline reagent. A number of chemical substances commonly found in potable water and wastewater, including nitrite and phosphate interfere with the standard wet chemistry analysis. Excessive amounts of organics complicate the standard analytical procedure by requiring additional processing steps such as acid digestion of the sample.

ChemScan Total Iron Analytical Method

ChemScan monitors chemical constituents in water by measuring the amount of light from specific wavelengths transmitted through a water sample and absorbed by dissolved chemical constituents present. Both ferrous, Fe^{+2}, and ferric, Fe^{+3}, exhibit naturally occurring absorbance spectra within the ultraviolet wavelength range of 190 - 400 nm however, the absorbance of soluble ferrous ions is weak and not useful at the levels of ferrous iron typically present in groundwater. Soluble ferric ions have strong absorbance

and provide sufficient spectra to analyze ferric at a detection limit of approximately 0.05 mg/L. For this reason ChemScan reads total iron by converting all ferrous to ferric, maintaining a soluble condition and then analyzing the total ferric iron in the sample.

ChemScan accomplishes iron analysis through the use of two readily obtainable, very inexpensive and innocuous chemical conditioning agents. Because of the innocuous nature of these chemicals they can be disposed of directly to drain or returned to the process stream and do not require collection and disposal. One chemical employed is a hypochlorite solution to oxidize the ferrous iron to ferric and the second is a hydrochloric acid solution to solubilize any insoluble iron present and maintain a suitable pH for the procedure.

Site specific calibration to compensate for the presence of any other light absorbing substances such as organics is also typically conducted.