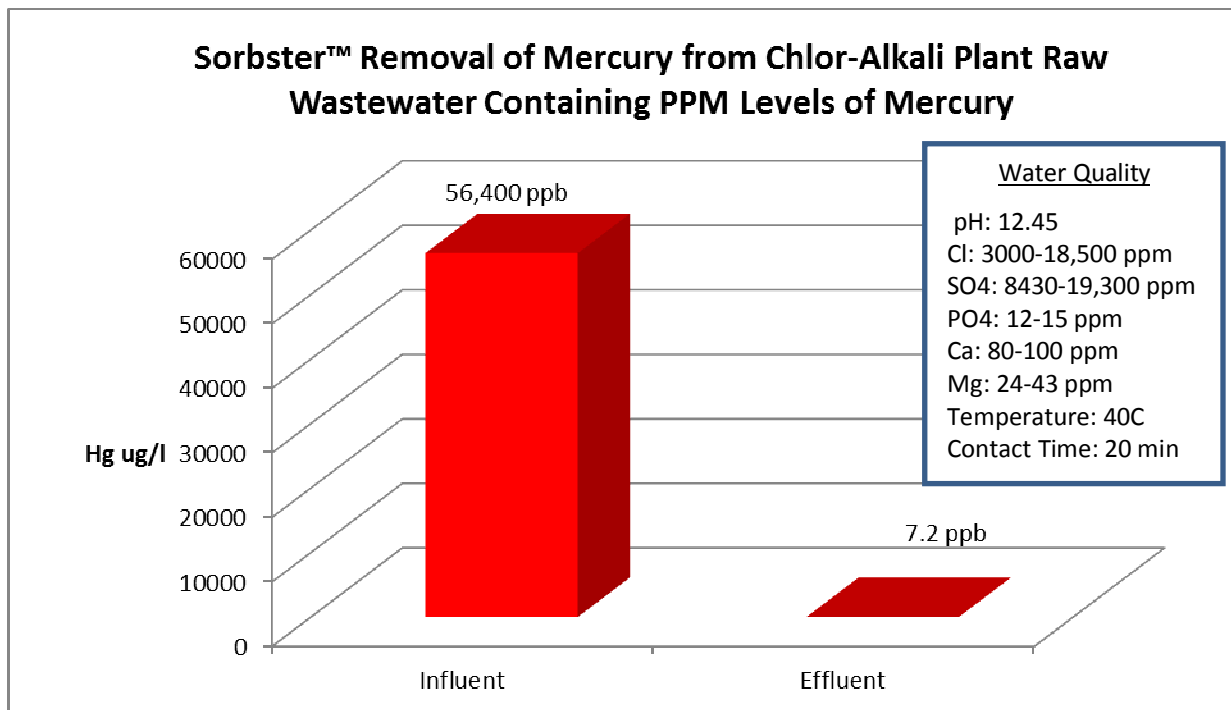


Sorbster Hg Media and Mercury Removal

Recent field and laboratory studies with mercury contaminated industrial wastewaters under a variety of conditions demonstrate the outstanding performance attributes of Sorbster™ Hg media for the removal of this hazardous metal from discharge streams, contaminated groundwaters and other mercury laden effluents.

Sorbster is efficient in reducing both high and low levels of mercury. In the case study below, a chlor-alkali plant had high levels of mercury in its wastewater following mercury cell caustic manufacturing operations. This water was classified as hazardous as it contains 56,400 ppb (or 56.4 mg/L Hg.) Sorbster™ media was evaluated in lab studies as a primary treatment to reduce the mercury level. With a water stream contact time of 20 minutes through a Sorbster media packed bed, the mercury was reduced from 56,400 ppb to 7.2 ppb. This water had unusual characteristics of very high anions and pH, which did not interfere with metals removal performance. Mercury removal was done in the presence of up to 18,000 mg/L chloride and 19,000 mg/L sulfate at a pH of 12.45. Sorbster™ media performance in this 20 minute pass through the media outperformed the sodium sulfide precipitation process for primary mercury removal currently in use at this plant by achieving single digit ppb mercury levels.

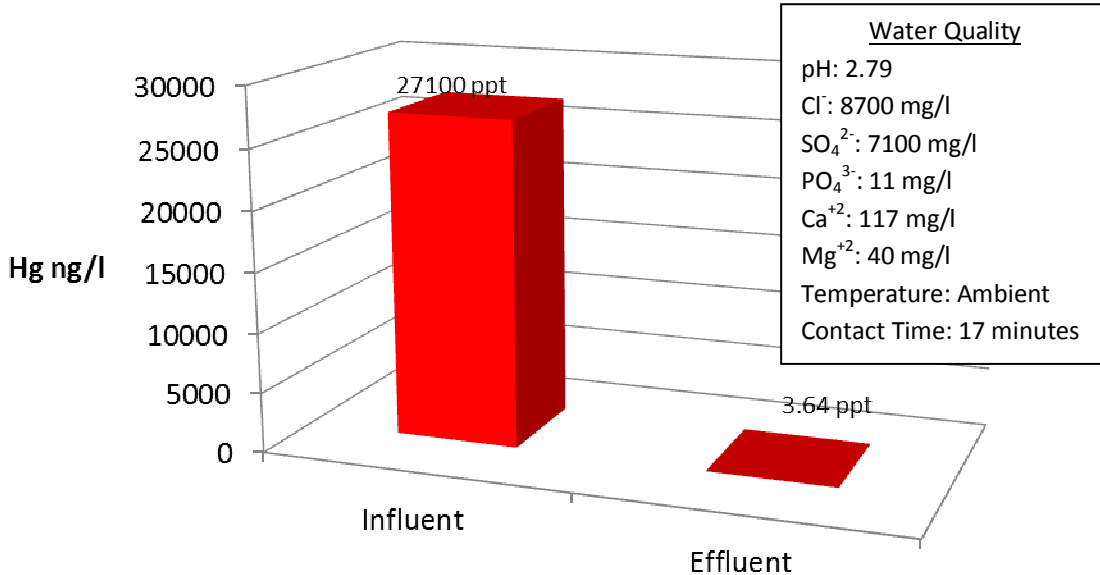


Mercury removal in this raw wastewater was excellent because the mercury was present in a soluble ionic form that is ideal for adsorption media such as Sorbster™ media. There are four keys to Sorbster™ media's successful removal of mercury from water: characterizing the mercury, characterizing the water, conditioning the mercury/water and correctly setting the operating parameters of media contact time and distributed water flow.

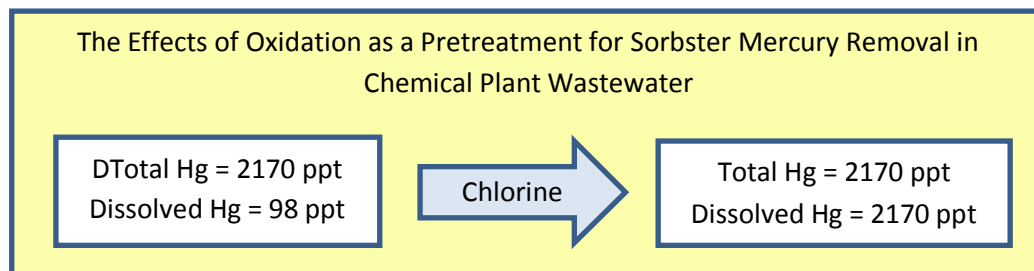
Sorbster™ media is designed to adsorb inorganic soluble ionic mercury. Monovalent and divalent ionic mercury is attracted to specific proprietary sites on Sorbster™ media where they chemically bond at these sites. When mercury is present as precipitated insoluble colloidal particles, it is already chemically bonded and not free to readily react with Sorbster. Insoluble mercury compounds will tend to be filtered by Sorbster™ media but not be permanently adsorbed. A simple comparison of the total mercury level present in a water to the dissolved mercury present in the water will indicate the presence of insoluble colloidal mercury and satisfactorily characterize the mercury. Dissolved mercury for Sorbster™ media applications is defined as the mercury passing through a 0.45 micron filter. If the dissolved Hg equals the total Hg (unfiltered value) in a water sample, then the mercury is considered to be soluble/ionic and ready for a Sorbster application.

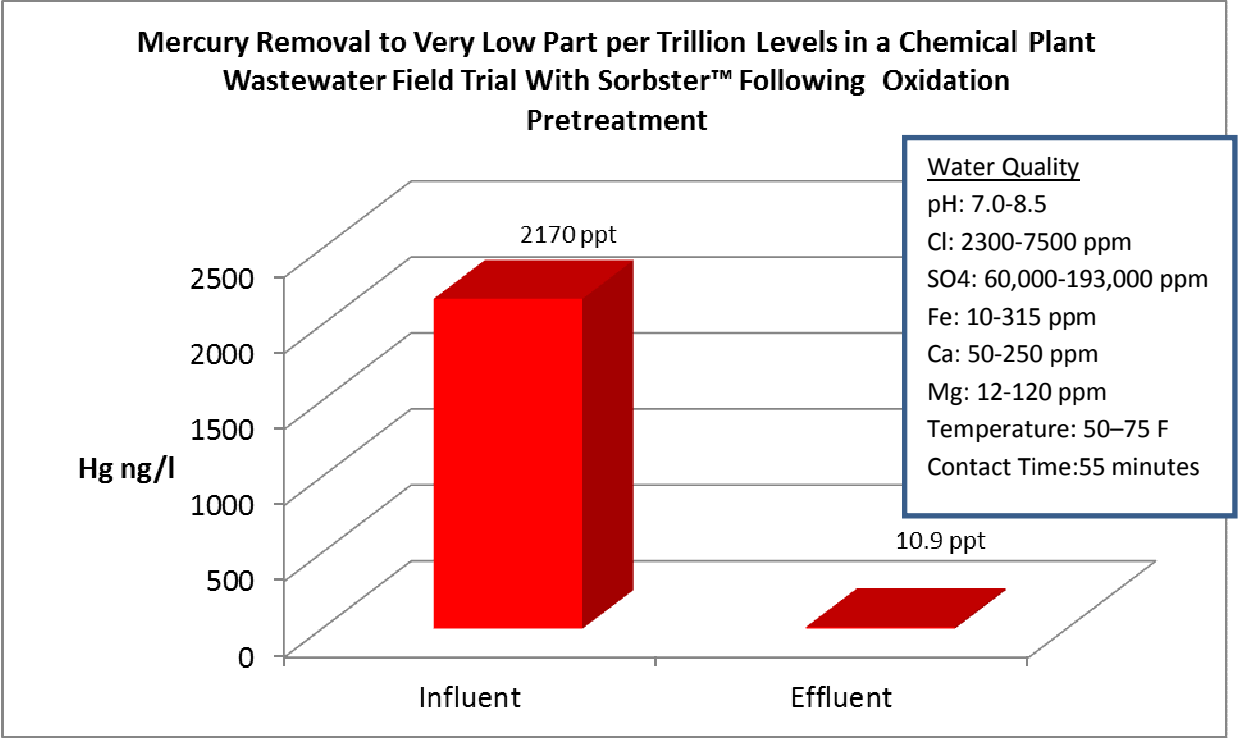
If the dissolved Hg value is significantly lower than the total Hg, then the water contains insoluble colloidal mercury and requires conditioning or pretreatment in order for the mercury to be successfully removed by Sorbster™ media. In an application where Sorbster™ media was applied to polish the water for further mercury removal following a sulfide precipitation mercury removal process, the sulfide precipitation process effluent contained nucleated and growing mercuric sulfide colloidal particles. Since mercuric sulfide has a solubility of less than 1.0 mg/L in water, little dissolved mercury was present. To successfully treat this water for further mercury removal, it was oxidized prior to passage through the Sorbster™ media bed. Oxidation converted the mercury from insoluble mercuric sulfide to 27,100 ppt as dissolved Hg. This 27,100 ppt of dissolved mercury was then successfully removed by Sorbster to a level of 3.64 ppt, well below the 50 ppt target at this plant. The calcium, phosphate, chloride and sulfate were high in this pH 3 application but none of these variables interfered with metals removal performance, as shown below.

**Low Part per Trillion Levels Achieved with Sorbster™
Following a Sulfide Precipitation Process, where Oxidation
Pretreatment was Used to Solubilize the Mercury**



At a chemical manufacturing plant, mercury present in raw materials carries into the discharge effluent. Much of the mercury is insoluble and during a wastewater pH neutralization step, calcium, iron and the any soluble mercury precipitate as carbonate and sulfate salts to form a turbid water. Understanding and characterizing the water was important for designing the Sorbster process. In this case, the mercury required oxidation pretreatment and the wastewater pH adjustment was minimized to reduce turbidity. With oxidation pretreatment, the mercury was successfully removed from 2170 ppt dissolved mercury by Sorbster™ media to 10.9 ppt, well below the 20 ppt target of the plant.





Sorbster™ media is effective at all mercury concentrations across a wide range of water quality and temperature. These three case histories represent a variety of industrial water conditions and mercury levels. Meeting new mercury discharge limits at part per trillion targets is achievable with Sorbster™ media, as it readily attains very low ppt mercury levels. Sorbster™ media has a capacity for mercury removal up to 75 weight % mercury to media and Sorbster™ media can be applied in standard vessels designed for water flow through. Once capacity is attained, Sorbster™ Hg Media passes EPA TCLP leaching tests that enables disposal of mercury laden Sorbster into non-hazardous landfills.