



PRI-SC® PEROXIDE REGENERATED IRON – SULFIDE CONTROL

Introduction

Sulfide odor control within sanitary sewers has been practiced for over 50 years, yet only recently have substantive advances been made. Where once the choice of chemical treatment was either chlorine or iron salts, safer and more environmentally benign technologies based on hydrogen peroxide, nitrates and/or magnesium hydroxide have gained acceptance. These new alternatives, however, can increase treatment costs substantially and present limitations in themselves. USP Technologies identified and addressed this issue by lessening the adverse impacts of the older, cheaper mainstays, particularly iron salts such as ferrous/ferric chloride or sulfate that provide other benefits to wastewater treatment operations.

USP Technologies developed a proprietary technology called PRI-SC® (Peroxide Regenerated Iron-Sulfide Control). PRI-SC is a combination treatment that integrates iron salts with hydrogen peroxide (H₂O₂) in a synergistic fashion. At the most basic level, PRI-SC treatment may be viewed as an oxidant (hydrogen peroxide) regenerating the spent iron salt (FeS) in-situ, yielding fresh ferric (Fe³⁺) iron and colloidal sulfur. The combined treatment provides cost benefits superior to either chemical alone, while allowing greater flexibility as to the placement of storage and dosing facilities. For example, practical control of sulfides to very low levels (e.g. <0.1 mg/L dissolved sulfide) is afforded with minimal reaction time (<5 minutes). Other benefits are accrued to the reaction, including: reduced solids (FeS) loadings, accelerated reaction rates and enhanced flocculation in clarifiers. The process has particular benefit when employed for gravity interceptors, force main discharges and headworks treatment.

PRI-SC in Practice

The conceptual basis of PRI-SC is to use iron for primary sulfide control and use H₂O₂ to regenerate the iron from FeS. The process can be represented as a regenerative cycle (Figure 1), where a working inventory of iron is maintained with H₂S as the input, elemental sulfur as the output and H₂O₂ as the driver.

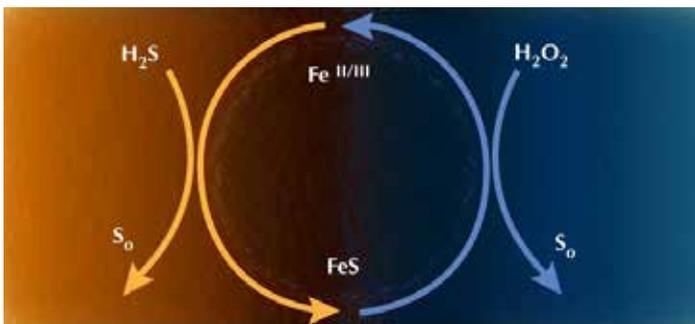


Figure 1: PRI-SC regenerative cycle process

The process occurs in three steps:

Step-1: Iron complexation with dissolved sulfide;



Step-2: H₂O₂ oxidation of the FeS complex to provide elemental sulfur and free iron (hydrated ferric iron); and



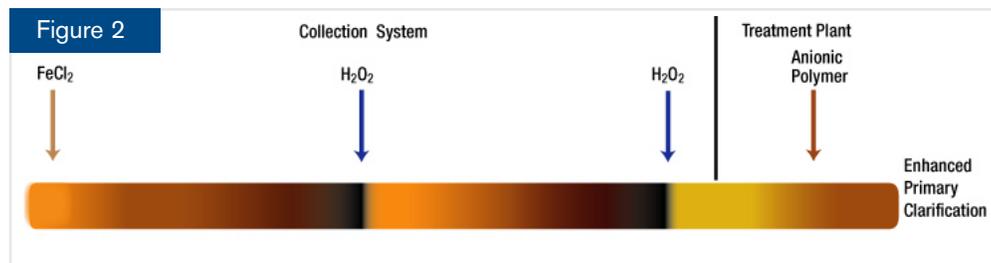
Step-3: Oxidation of additional sulfide by the ferric iron to produce elemental sulfur and FeS.



Net: The net reaction requires 0.67 lbs Fe (or 1.45 lbs FeCl₂) and 0.6 lbs H₂O₂ per lb-Sulfide. This yields a theoretical control cost of about \$0.50 – 0.75 per lb-Sulfide, which is less than one-half that of alternative nitrate or magnesium hydroxide treatments.



In practice, PRI-SC involves adding an iron salt at the upper reaches of the collection system and using hydrogen peroxide to regenerate the “spent” iron as FeS at one or more points downstream (Figure 2). The analogy is one of a capturing agent (iron salt) added at the top of an interceptor, which then absorbs dissolved sulfide



as it moves down the line. Intermittent hydrogen peroxide injection serves to regenerate the capturing agent thereby allowing additional sulfide to be absorbed downstream. Incorporating a final regeneration site at the treatment plant provides rapid oxidation of sulfides to very low levels, effectively reducing the H₂S loading to the influent scrubbers. It also provides hydrous ferric iron that can be used for additional odor control in primary treatment or for enhanced clarification.

Practical Benefits of PRI-SC

While the theoretical cost of PRI-SC is similar to that for either iron or H₂O₂ in the oxidation mode, there are practical benefits that lower the actual costs. Among these is the reduction or elimination of the disadvantages of using only iron – e.g., solids production is reduced by >40%, salinity levels by >60% and acidity levels by >60%. PRI-SC can also be engineered in such a way that actual costs are closer to theoretical costs. For example, where iron is being used to control sulfides for >4 hours duration, thereby increasing iron requirements by 2-4 fold, the feed rates can be reduced to control for <4 hours duration. H₂O₂ can be injected prior to the discharge to oxidize the remaining sulfide, affording residual sulfide levels of <0.1 mg/L within 1-2 minutes. This is something that is not afforded by either chemical alone, even at 2-4 fold excess doses. Further, if this discharge were into the headworks of a treatment plant, the iron would enter the plant as free (hydrous) ferric oxide, which enhances odor control and settling through the primary clarifiers. Residual free iron in the primary solids would also enhance control of H₂S and/or struvite in the digesters. Thus, the combination treatment accentuates the advantages of H₂O₂ and iron while minimizing (or eliminating) their respective disadvantages.

Full-Service Program

USP Technologies offers PRI-SC as a full-service program that includes comprehensive applications development, integrated engineered storage and dosing systems, complete chemical inventory management and on-going system maintenance and performance monitoring. PRI-SC is ideally suited for large municipalities with gravity interceptors and/or force main systems that are characterized by high sulfide loading rates and atmospheric H₂S problems. Our turn-key program allows PRI-SC to be implemented on a limited resource budget, making the solution to a complex problem a lot simpler.

About USP Technologies

USP Technologies' ongoing mission is to help customers meet their water quality objectives by providing eco-efficient solutions that reduce and recover cost, energy, resources and space. Through a collaborative method of working closely with customers to solve problems, we are dedicated to developing innovative, sustainable and cost-effective solutions that successfully meet the highest standards of environmental stewardship. Our consultative approach includes application assessment, technology selection and field implementation of a custom engineered treatment solution. Our turn-key programs seamlessly integrate storage and dosing equipment systems, chemical supply, inventory and logistics management, and ongoing field and technical support. USP Technologies has been serving the water, wastewater and remediation markets for more than 20 years and has offices and field service locations throughout North America. We are the largest direct supplier of peroxygen-based technologies for environmental service applications and we manage hundreds of successful full-service chemical programs that treat over 1.0 billion gallons of water per day.

Getting Started

We look forward to supporting your treatment needs, whatever the scale of your requirements. To obtain a streamlined treatment solution tailored to your specific project, give us a call at (877) 346-4262.

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