



Breakthrough Technology Delivers Powerful Ferrate Reagent On-site and On-demand

One of the most powerful known water treatment chemicals is the oxidant ferrate (Fe^{+6}), which has a higher oxidation potential than ozone and almost twice that of chlorine. This potent reagent has been widely documented to effectively address a wide range of the most challenging contaminants faced by the global drinking and wastewater treatment industry.

Unlike chlorine, ferrate is environmentally friendly, and when applied for disinfection purposes to water containing organic matter, it does not produce toxic disinfection byproducts. During its reaction with contaminants, ferrate is reduced to ferric hydroxide, which has been widely documented to act as a powerful coagulant, before decomposing into its final form as ferric iron. Because this residual precipitates quickly, it can be removed as a non-toxic sludge that does not require specialist treatment before disposal.

Until now, a ferrate (Na_2FeO_4) solution has not been commercially available or widely used in treatment processes because it decomposes rapidly and cannot be manufactured, transported, or stored. Now, following the successful development of a proprietary in-situ electrolytic ferrate reagent generation system (SafeGuard™ H2O) by AMS, the commercial use of ferrate is a reality. The SafeGuard H2O system generates a ferrate solution concentrate by electrolysis at the point of use and on demand, producing a high-yield reagent ($> 7,000$ ppm as iron (VI)).

SafeGuard H2O addresses the inherent problems of industrial-scale ferrate solution supply, including instability, yield, and concentration, by producing a non-toxic reagent through a simple and cost-effective electrolytic process. This breakthrough technology requires only three widely available consumables: a sacrificial iron anode, caustic soda and electricity. It is a one-step process in which the electrolyte caustic soda solution is continuously fed into the electrolytic generator, and the outflowing ferrate reagent is dosed into the flow or batch of contaminated water requiring treatment. Because caustic soda is a low-value industrial by-product, its use in the production of a ferrate solution represents the beneficial transformation of an otherwise unwanted chemical into a high-value and safe chemical reagent.

Facilitating the Evaluation of Ferrate: AMS's Frozen Reagent Solution

To streamline application and research, while eliminating the requirement to produce this reagent at-site for every project, AMS also offers the ferrate solution in frozen form for those wishing to evaluate contaminant-specific applications (Figure 1). By generating the reagent at its facilities in Sunnyvale, California, and immediately freezing it, the high-purity reagent, which maintains its chemical properties while frozen, can be readily shipped anywhere in the world. Chemical engineers, university researchers, water treatment specialists, and other professionals can conveniently use these frozen samples to evaluate the performance of ferrate for their specific application needs. AMS supports such evaluations with advice on protocols and testing. By providing ferrate in this format, AMS aims to accelerate awareness and adoption of this transformative chemical.

The frozen ferrate solution samples are fully representative of the high-yield reagent produced on-site by the SafeGuard H₂O system, and they are easy to handle. The electrogenerated ferrate solution product is packed, frozen, shipped and stored at -28 °C for use as required. Frozen samples are available in batches of two sizes to accommodate bench-scale or full-scale field testing:

- 2mL (batch of 25) for bench-scale
- 50mL (batch of 16) for field-testing

AMS is also making available the opportunity for stakeholders to participate in the open sourcing of results from other users, albeit anonymously, based on application, contaminant, and treatment efficacy.

The development of SafeGuard H₂O's proprietary in-situ ferrate generation system represents a significant advancement in water treatment technology. By enabling the safe, sustainable, and on-demand production of a high-purity ferrate solution, AMS has addressed the traditional challenges of ferrate synthesis, stability, and application. The availability of frozen, stable samples for various testing scenarios further expands the reagent's accessibility and utility. As more stakeholders engage with this innovative system and contribute to shared knowledge, widespread adoption and improved water treatment outcomes are inevitable.

Figure 1. Onsite Generated Ferrate Solution on Left and Frozen Form on Right

