



TECHNICAL SUMMARY

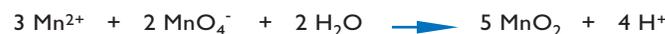
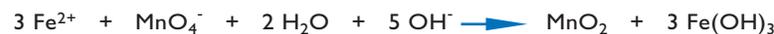
Permanganate is used in the iron (Fe) and Manganese (Mn) removal processes in both surface water and ground water systems that employ filtration. Permanganate oxidizes soluble iron and manganese to insoluble precipitates. The precipitates are removed from the water supply in the clarification and filtration processes.

Factors that affect removal efficiency include water chemistry, pH, temperature, and application point. Reaction times are rapid under normal conditions of temperature and pH. Generally, temperatures <35° F, and pH values <5.5 require reaction times longer than two minutes. In most cases, 5 to 10 minutes of reaction time is sufficient.

APPLICATION

Oxidized precipitates are removed more easily in hard water than soft water. Sufficient time (approximately 30 minutes) is required for coagulation of the oxidation by-products. The preferred location for feeding potassium permanganate is the point that gives the longest contact time ahead of coagulation, usually at the intake of the plant.

CHEMISTRY



DOSAGE

1 mg/L of soluble iron requires 0.94 mg/L of CAIROX® potassium permanganate.
1 mg/L of soluble iron requires 0.84 mg/L of CARUSOL® liquid permanganate.

1 mg/L of soluble manganese requires 1.92 mg/L of CAIROX potassium permanganate.
1 mg/L of soluble manganese requires 1.71 mg/L of CARUSOL liquid permanganate.

FACILITY REQUIREMENTS

Proper feed equipment specially designed to handle permanganate is recommended and available from Carus. For proper removal of Fe or Mn, the utility must have filtration or coagulation/filtration to remove the MnO₂ and Fe(OH)₃ formed during oxidation. In addition, alkalinity and hardness > 50 mg/L are recommended for proper coagulation of these precipitants.

BENEFITS

Permanganate quickly oxidizes Fe²⁺ and Mn²⁺ in most cases without pH adjustment. The freshly precipitated manganese floc will further adsorb metal ions and organic compounds while enhancing the effectiveness of the coagulation process.

Permanganate also:
Helps control tastes and odors
Aids in the coagulation process, and
Acts as a substitute oxidant to chlorine in a Disinfection By-Product (DBP) control program.

REFERENCES

Knocke, W. R., Van Benschoten, J.E. Kearney, M., Soboroski, A., Reckhow, D.A., Alternative Oxidants for the Removal of Soluble Iron and Manganese. AWWA Research Report (March 1990)

Ficek, K.J., Manganese Removal Using Potassium Permanganate in Low pH, Low Hardness Waters. AWWA Annual Conference, Washington D.C. (1985)

Vlastnik, E., Evaluation of CAIROX® KMnO₄ Feed for Color Removal, Tech #8441, Carus Corporation, 2001

For further information on CAIROX® potassium permanganate or CARUSOL® liquid permanganate product characteristics and availability, contact Carus Corporation at 1-800-435-6856.



OTHER APPLICATIONS

- Taste & Odor Control
- Biosolids Odor Control
- Iron & Manganese Removal
- Arsenic & Radium Removal

CARUS VALUE ADDED

LABORATORY SUPPORT

Carus Corporation has technical assistance available to answer questions, evaluate treatment alternatives, and perform laboratory testing. Our laboratory capabilities include; treatability studies, feasibility studies, and analytical services.

FIELD SERVICES

As an integral part of our technical support, Carus provides extensive on-site treatment assistance. We offer full application services, including technical expertise, supervision, testing, and feed equipment design and installation in order to accomplish a successful evaluation and/or application.

EQUIPMENT SERVICES

Standard feeders are designed specifically for CAIROX® potassium permanganate. Various options and accessories are available to meet a wide range of applications. Carus offers custom-Engineered Feed Systems, pre-engineered and prepackaged systems through an equipment partner. They provide efficient, dust-free methods of storing, mixing, and feeding CAIROX potassium permanganate. System designs are customized to meet specific applications and customer needs.

CARUS CORPORATION

During its more than 98-year history, Carus' ongoing reliance on research and development, as well as its emphasis on technical support and customer service, have enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.