



TECHNICAL SUMMARY

Trihalomethanes (THMs) and Haloacetic Acids (HAA's) are formed when chlorine reacts with the organic precursors in raw water. These precursors include humic and fulvic acids. Moving the point of chlorination from the raw water to later in the treatment and practicing effective coagulation of the precursors can result in a 40% to 70% reduction in trihalomethane levels. Current regulations limit THM concentrations in finished water to 80 µg/L and HAA concentrations in finished water to 60 µg/L.

Permanganate is used in these systems as an alternate oxidant to pre-chlorination. Further reduction (5%-20%) in THM and HAA concentrations may result from permanganate addition. The primary purpose of permanganate treatment in these cases is as a substitute pre-oxidant for chlorine to oxidize organics causing tastes and odors, and to oxidize inorganic iron and manganese. Permanganate is not a substitute disinfectant for chlorine.

APPLICATION

Laboratory tests simulating plant conditions of time, addition of other treatment chemicals, etc., are conducted to determine the Permanganate Value (PV_t), where t is time. The procedure is described in Carus Form #3353. This is the raw water permanganate demand in a given period of time.

Permanganate is usually fed at the intake to allow the oxidant to react with the raw water before the addition of other treatment chemicals. A residual of 0.1 to 0.2 mg/L MnO₄⁻¹ should be maintained in the water entering the treatment plant. Control can be visual or monitored using residual permanganate analytical methods given in Standard Method 4500 - KMnO₄.

CHEMISTRY

Raw Water Organic Compounds + MnO₄⁻¹ → MnO₂ + No Trihalomethanes Formed
No Haloacetic Acids Formed

DOSAGE

Normal dosages will range between 0.5 and 2.5 mg/L MnO₄⁻¹ depending on the degree of raw water contamination. The average dosage is ~1.0 mg/L MnO₄⁻¹

FACILITY REQUIREMENTS

Proper feed equipment specially designed to handle permanganate is recommended. The product, an aqueous solution, is introduced into the system. Operators should be trained to monitor permanganate residuals and to exercise proper safety precautions when handling the oxidant.

BENEFITS

A cost-effective disinfectant by-product control program includes the application of permanganate in place of raw water chlorination. Permanganate does not form trihalomethanes or haloacetic acids, oxidizes taste and odor producing compounds, and aids in the coagulation process.

REFERENCES

1. Zawacki, J., KMnO₄ Contributes to Least Cost Treatment Solution, *Water Engineering & Management*, (May 1992). Form #3057
2. Myers, A.G., Evaluating Alternative Disinfectants for THM Control in Small Systems, *Journal AWWA*, (June 1990)
3. Ma, J. Graham, N., Controlling the Formation of Chloroform by Permanganate Preoxidation-Destruction of Precursors, *Jrnl Water SRT-Aqua*, Vol. 45, No. 6, (1996)
4. Ficek, K.J., Boll, J.E. Potassium Permanganate: An Alternative to Prechlorination, *Aqua*, No. 7 (1980). Carus Form #240
5. Standard Method 4500-KMnO₄ Potassium Permanganate, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (1998). Carus Form CX #3353

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

CARUS WATER



Pre-Oxidation for
Disinfection By-Product
Control

CAIROX® POTASSIUM PERMANGANATE
CARUSOL® LIQUID PERMANGANATE
TECHNICAL BRIEF

OTHER APPLICATIONS

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

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.

CARUS CORPORATION

During its more than 100-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.

Permanganate products are not registered as a pesticide under the Federal Insecticide, Fungicide and Rodenticide Act administered by U.S. EPA or similar state laws. Use as a pesticide is not government approved.

CARUS CORPORATION

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