



## OVERVIEW

This Product Safety Summary document is intended to provide the general public with an overview of product safety information and general uses of this chemical substance. It is not intended to provide emergency response, medical or treatment information, or to provide a discussion of all safety and health information. This document is not intended to replace the Safety Data Sheet (SDS).

## WHAT ARE PERMANGANATES?

The permanganate family consists of two unique chemicals, potassium permanganate, identified by the Chemical Abstracts Service as CAS Number 7722-64-7, and sodium permanganate, identified as CAS Number 10101-50-5.

Potassium permanganate products are pure granular products used in applications where less concentrated levels of permanganate are needed to oxidize specific contaminants. Sodium permanganate products are sold as water soluble solutions in varying concentrations where ease of handling is a criterion for use. While there is no significant difference between the chemical properties of sodium and potassium permanganate, there is a significant difference in the physical property between both permanganates, specifically their solubility in water. The potassium permanganate, although available as a 97% solid (or higher), can only be applied as a 3-4% solution because of the solubility limits. Sodium permanganate is soluble up to 40%, providing a solution that can be applied in much higher concentrations. Carus markets permanganates under the trade names: AQUOX<sup>®</sup>, CAIROX<sup>®</sup>, LIQUOX<sup>®</sup>, SucrOx<sup>®</sup>, CARUSOL<sup>®</sup>, and RemOx<sup>®</sup>.

Permanganates are primarily used as an integral part of processes used by municipal drinking water authorities to purify and improve the quality of drinking water before it is distributed to the public. Various low-level impurities that may be present in raw water, such as arsenic, are oxidized by permanganates to insoluble precipitates that can be removed from drinking water by clarification and filtration. Permanganates also remove impurities such as phenols and sulfides that may cause drinking water to have an objectionable taste and odor, and metals such as iron and manganese that may cause staining of plumbing fixtures.

Permanganates are added to the raw water during the treatment process and are completely consumed within the treatment plant. Under normal use conditions, there are no residual permanganates in the finished drinking water. Permanganates are not generally used directly in consumer products.

Permanganates are also used in wastewater treatment facilities and in soil and groundwater remediation processes.

Permanganates are also used in various industrial applications such as metal surface treatment and equipment cleaning, and in the production of other compounds/products.

Highly purified potassium permanganate, designated as BP, Pharma, or ACS Reagent grade, can be used as an oxidizer for chemical synthesis, pharmaceutical production, and food processing, where permitted by government regulations.





## CARUS RISK MANAGEMENT PRACTICES

The primary mechanism for providing advice on the handling of permanganates is through the Safety Data Sheet (SDS). Carus provides a SDS to all customers and others directly involved in handling the products, and to other stakeholders upon request through the company website. All of the pertinent handling information is reemphasized in Product Data (specification) Sheets and in Technical Bulletins or Briefs targeted to specific uses of permanganates. Carus also provides customers advice and assistance in the design and construction of equipment used to safely handle permanganates. For example, municipal water treatment authorities are offered a pre-engineered system using recyclable containers that is designed to safely and effectively feed permanganates into water treatment plants.

In addition, Carus provides PowerPoint safety and handling presentations given by the Technical Services Department or trained personnel. In many municipal bids this is written in as a requirement of the vendor.

## HEALTH EFFECTS

Permanganates can be present as both solid and liquid forms. Potassium permanganate is a distinctive dark purple inorganic solid that is soluble in water to form a dark purple solution. Sodium permanganate also has a distinctive dark purple color and is available as a solution (typically 20% or 40%). They are strong oxidizers, and can undergo self-sustaining decomposition if exposed to excessive heat (above 150°C) or if mixed with reducing agents.

Permanganates have been shown to be severely irritating or corrosive to the eyes, skin and digestive tract. Animal studies show that oral ingestion of permanganates causes toxicity. Because of this toxicity, permanganates are classified as "Harmful if Swallowed."

Aquatic toxicity of potassium permanganate to various species of fish has been studied. Based on these studies, potassium permanganate is classified as "Dangerous to the Environment." However, because permanganates are readily converted by oxidizable materials to insoluble manganese oxide, they are not expected to remain in the environment as "dangerous" for very long. Under normal storage and handling conditions, permanganates are stable. However, a strong chemical reaction can occur if they are subject to excessive heat (>150°C) or allowed to contact strong reducing agents such as organic fluids, metal powders, and hydrochloric acid.

## PUBLIC EXPOSURE

Routine public exposure to permanganates is not expected since products containing permanganates are generally intended for industrial and institutional use, and are not typically sold to the general public. It is possible that the public can be exposed to permanganates through accidents, spills, and inadvertent misuse of the products.

## WORKER EXPOSURE

Workers in the manufacture, transportation and use of permanganates have the potential to be exposed to these products. Normal industrial hygiene practices, which include use of protective equipment such as chemical goggles, gloves, and work clothing that covers arms and legs as needed, have been established to minimize the risk of any such exposure. Emergency responders such as firefighters could also be exposed to permanganates if they are present during an incident. Normal turnout protective gear for first responders such as positive pressure breathing units, chemical resistant suits, boots and gloves will minimize their risk.



## POTENTIAL ENVIRONMENTAL RELEASES

Intended industrial and institutional uses of permanganates normally result in these substances being consumed by a chemical reaction, thus routine environmental releases are not expected. Non-routine releases to the environment can occur from accidents, spills and inadvertent misuse of the products.

## STATE & FEDERAL REGULATIONS

Transportation authorities, such as U.S. Department of Transportation have reviewed and classified permanganates as oxidizers (Class 5.1).

U.S. Department of Homeland Security established the Chemical Facility Anti-Terrorism Standard (CFATS) in 2007. Potassium permanganate is a regulated compound for industrial applications when exceeding the 400 pounds threshold. Municipalities are exempt.

European Union authorities have reviewed and classified permanganates and required hazard labeling: May intensify fire, Cause serious eye damage (H318), Suspected of damaging the unborn child (H361d), May cause damage to organs through prolonged or repeated exposure (H373); Oxidizer (H272), Harmful if swallowed (H302), Causes severe skin burns and eye damage (H314) and Very toxic to aquatic life with long lasting effects (H410). The following precautionary statements have also been given: Keep away from heat/sparks/open flames/hot and other ignition sources-No smoking (P210), Keep/Store away from clothing/combustible materials (P220), Do not breathe dust (P260), Wear Protective gloves/protective clothing/eye protection/face protection (P280), In case of fire: use water for extinction (P370 + P378), Dispose of contents/containers to appropriate places (P501), Avoid release to the environment (P273), and Collect spillage (P391)

U.S. Food and Drug Administration has evaluated and approved potassium permanganate for direct addition at low levels to modified food starch (21CFR172.892) and as a component in indirect food additive sanitizing solutions for food processing equipment (21CFR178.1010).

The National Sanitation Foundation has reviewed and certified both sodium and potassium permanganate under the provisions of ANSI/NSF Standard 60 for Drinking Water Treatment Chemicals.

AQUOX potassium permanganate (free flowing grade only) and CARUSOL\* family of liquid permanganates have been certified by KIWA for Drinking Water Treatment.

The Controlled Substances Act, enforced by the U.S Drug Enforcement Agency, has listed potassium permanganate and sodium permanganate as List II regulated chemicals. Suppliers and manufacturers are subject to this regulation and control measures.

This summary was originally prepared on September 7, 2009 and revised on June 29, 2009, October 23, 2015, and November 26, 2019.

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.