



Used Oil Recycler Meets
Low Level Phenol
Discharge Limits

CAIROX® POTASSIUM PERMANGANATE
CARUSOL® LIQUID PERMANGANATE
CASE STUDY

THE APPLICATION

Mid-West Non-Hazardous Used Oil Recycling Company uses of permanganate oxidation chemistry to meet NPDES effluent goals for phenol. Before discharge, the phenol concentration must be below 1 mg/L.

BACKGROUND

Used oil recycling operations protect the environmental by reclaiming a waste product and turning it into a valuable resource. Every gallon that is collected and treated is a gallon that will not contaminate municipal wastewater or landfills.

Reclaiming used oil involves several separation steps and some chemical treatment to produce a clean product. The process separates the used oil into three components: oil, water, and solids. Each component is treated for eventual reuse or disposal.

PHENOL DESTRUCTION with CAIROX® POTASSIUM PERMANGANATE

Phenol products are present in the wastewater of many industries such as oil refining, petrochemicals, coking operations, plastics, and wood products. However, phenols are toxic compounds in parts-per-million levels and if discharged to surface waters without treatment they may adversely impact aquatic systems and human health. The U.S. EPA lists phenol as a Priority Pollutant.

Phenol is one component of the water in used oil and it must be removed before discharge. At this site the effluent water must meet a phenol residual concentration of less than 1 mg/L.

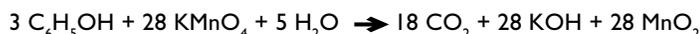
To remove phenol this recycling plant uses CAIROX® potassium permanganate, a strong oxidant and a proven treatment method for the oxidation of phenol.

HIGHLIGHTS

- The facility receives 4-5 truckloads of non-hazardous, solvent-free oily wastewater (20,000-25,000 gallons) daily.
- The phenol levels are variable in the range of 3-35 mg/L.
- Permanganate treatment effectively removes the phenol and other reactive dissolved organics that are present the water.
- Initially, 50 to 75 pounds of CAIROX potassium permanganate is added to the oxidation tank.
- The reaction mixture is agitated for 15 minutes at 90-100°F, then the treated phenol level is determined. If necessary, more permanganate may be added.
- Once the phenol level is below 1 ppm, the wastewater is treated with lime to raise the pH. This waste is sent to a decant tank for solids settling and the water is discharged to the local publicly owned treatment works (POTW).

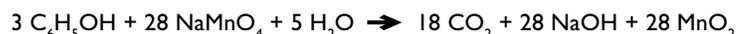
A COMPLETE OXIDATION REACTION

The permanganate reaction is capable of fully mineralizing the phenol molecule to carbon dioxide and water, according to the following equation:



This reaction proceeds quickly at neutral pH and in 15 minutes or less the phenol concentration can be reduced by 99%. If necessary, the reaction rate can be improved by raising the solution pH with the addition of a base, such as sodium hydroxide or by acidifying the solution with, for example, sulfuric acid. To achieve complete oxidation, 15.7 weight parts of KMnO_4 are required for every 1 part of phenol.

In the equation above, the permanganate ion was supplied in the form of potassium permanganate (KMnO_4). It is also available in the form of CARUSOL® liquid permanganate (NaMnO_4) which is just as effective. The sodium permanganate reaction is:



The weight ratio for this reaction is 14.1 parts of sodium permanganate to 1-part phenol.



THE TREATMENT PROCESS

Used oil, as it arrives at the site, has several components: hydrocarbons, solids, and water and separating these different phases is the first task. This facility receives 4-5 truckloads of non-hazardous waste oil (20,000-25,000 gallons) each day.

Quick laboratory tests are run when the waste delivery arrives. By using a separation funnel or a graduated cylinder, the volume of oil to water is measured. The water pH, clarity, solids and phenol levels are also determined. The phenol levels are variable in the range of 3-35 mg/L, depending on the source.

After testing, the waste is pumped into one of three 15,000-gallon equalization tanks. The tank is heated to 130°F and acid is added to break the oil-water bond. The oil is skimmed from the top and the water portion is sent to 5,000-gallon treatment tanks where phenol and metals are removed. The skimmed oil is sent off-site for further treatment at another plant.

In the treatment tanks, the wastewater is heated and treated with sulfuric acid, lowering the pH to 1.5-2.0. Ferric chloride is then added to coagulate and settle the waste solids. The dosage is determined by conducting a simple jar test.

THE ADDITION OF PERMANGANATE

To achieve a successful treatment program, the facility had to meet the phenol discharge requirements. It was decided that additional treatment using potassium permanganate should be included to remove the phenol. The permanganate system was easy to install and test, and it was immediately effective.

For this treatment step, 50 pounds to 75 pounds of CAIROX® potassium permanganate is added to the oxidation tank. The reaction mixture is agitated for 15 minutes at 90-100°F before the treated phenol level is determined. If necessary, more permanganate may be added.



CONCLUSION

This used oil recycling plant is a successful operation, meeting all environmental requirements for water discharge while recovering a valuable resource. CAIROX potassium permanganate is applied to remove residual phenol from the water. It is fast, reliably effective, and easy to use.

CAIROX potassium permanganate is manufactured by Carus LLC. in Peru, IL. With over 100-years of permanganate application experience, the Carus team can help answer your permanganate oxidation questions.