Case History
0-11

Phenol Destruction Using ChemTreat CL454 Organic Catalyst

Background

A mid-Atlantic organic synthesis plant was shipping its phenol-containing waste several hundred miles for waste processing. The cost for shipping and processing was very expensive.

Problem

Initially, chlorine dioxide was considered for on-site treatment. Chlorine dioxide was rejected because of the substantial initial capital investment and the requirement to store hazardous chemicals.

Because bulk hydrogen peroxide was available, the use of H_2O_2 and the organic catalyst, ChemTreat CL454, was considered. This treatment economically destroys difficult "refractory" organics, including but not limited to, phenol; benzene; a number of chlorinated organics including certain dioxins; furfural, and hydrogen sulfide. Please see the Product Data Sheet for CL454 on the next page for additional details.

A series of bench test were performed using the neutral organic-based peroxide catalyst CL454. The objective of the tests was to demonstrate the phenol could be lowered from several hundred ppm to less than 50 ppm to avoid the cost of shipping and processing phenol waste.

To assist in estimating the amount of catalyst and peroxide, the chemical oxygen demand (C.O.D.) was measured. The C.O.D. was measured at around 12,000 ppm. The initial pH of the waste was over 13.

Solution

The initial bench tests were performed by first lowering the pH to 7, and then adding the catalyst, followed by peroxide. Phenol was measured after a minimum of 4 hours. Because of the extremely high C.O.D., and after an extensive series of bench tests, it was concluded the recommended treatment would be:

1. Adjustment to pH 8.2 - 8.7 if required
2. Addition of 1.7% ChemTreat CL454
3. Followed by 4% of 35% hydrogen peroxide

After 4 hours, the phenol was measured. This treatment consistently lowered the phenol concentration to below 50 ppm. If necessary, an additional treatment using 35% peroxide would be added. The use of 50% peroxide could provide additional savings.

This application is now on-going and has provided the plant substantial savings. Other complex organic waste streams are now being evaluated for similar on-site treatment by this plant.

PRODUCT DATA
ChemTreat CL454
Hydrogen Peroxide Catalyst

GENERAL DESCRIPTION

CHEMTREAT CL454 is a highly effective organic catalyst that creates an extremely powerful "hydroxyl radical" oxidant when fed with hydrogen peroxide. The catalyst is not ferrous iron (Fenton's reagent) and is not a heavy metal; therefore, it is much more acceptable to the environment. The combination of hydrogen peroxide with the organic catalyst has been shown to be extremely effective for quickly oxidizing molecules that are difficult to oxidize, such as benzene, phenols, cyanide, MTBE, toluene, vinyl chloride, trichloroethylene, tetrachloroethylene, and virtually all chlorinated hydrocarbons (see table below), as well as hydrogen sulfide. This treatment program has several advantages compared to using the low pH reaction using Fenton's reagent (ferrous iron) catalyst. They are: no acid requirement, no sludge production, avoidance of costly special construction materials, less competing reactions, reduced peroxide demand, and significantly reduced handling and disposal concerns. CAUTION: Because CL454 is organic, the TOC and BOD will increase while the COD and contaminate will decrease.

TYPICAL PHYSICAL PROPERTIES

Appearance.....Dark Brown Liquid.
Odor..... .Slightly Acrid
pH..... 5.0-6.0
Specific Gravity.....1.06 +/- 0.1
Boiling Point.....106C (223oF)
Vapor Pressure.....40mmHg@35C

DOSAGE AND FEEDING

CHEMTREAT CL454 is a neutral pH catalyst but is effective within a pH range of 3.5 to 8.0. It is more typically used at a pH of approximately 7.0. Usually the amount of peroxide is added at 1.0 to 3.0 times the contaminant mass as measured by Chemical Oxygen Demand. CHEMTREAT CL454 is always added separately, but at a ratio of 1 part CHEMTREAT CL454 to 1 part 35% hydrogen peroxide by volume. CHEMTREAT CL454 catalyst should be added into the receiving wastewater stream first, followed by the addition of hydrogen peroxide into the same stream in an equal dosage. WARNING: ChemTreat CL454 catalyst *should never* be mixed with Hydrogen Peroxide in the container, (i.e. drum, tote, or tank), or line prior to addition in the receiving wastewater stream.

Typical results are as follows:

Contaminant	Concentration before treatment (ppb)	Concentration after treatment (ppb)
MTBE	85,000	<5
Benzene	294,875	<5
Phenol	13,200	10
Vinyl chloride	40	<5
Trichloropropane	502,000	<5
Toluene	153,678	<5
Trichloroethylene	502,000	<5
Tetrachloroethylene	31,000	<5

As general rule, the above results are always achieved in less than 3 hours; for benzene <1 hour, and MTBE <3 hours. For hydrogen sulfide, the time is less than 10 seconds. Normally, temperature is not a problem even down to 32°F.

SAFETY PRECAUTIONS

Do not mix directly with hydrogen peroxide.

For specific information on handling, safety and first aid, please review the product's Material Safety Data Sheet.

SHIPPING

CHEMTREAT CL-454 is available in 55-gallon drums, 275-gallon totes, and in bulk.