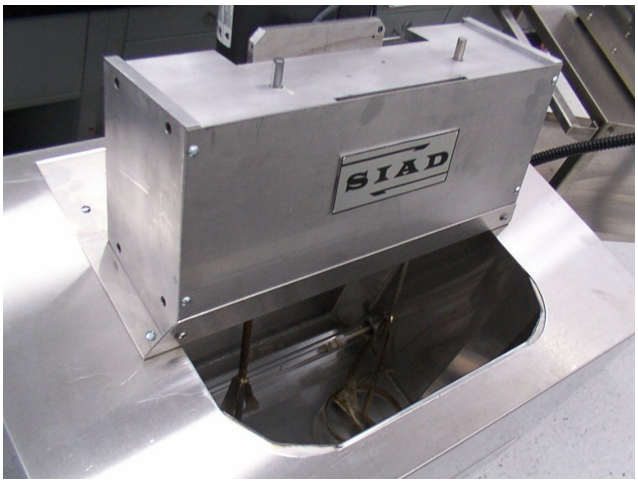
Report on the Reduction of the Chemical Phenol in Industrial Wastewater by SIAD Processing

September 10, 2003

Testing Facility:
SAFETY-KLEEN SYSTEM, Inc., Buffalo, NY

Data Report & Analysis:
SAFETY-KLEEN SYSTEM, Inc., Buffalo, NY
Sheridan Soft Water Co., Inc., Buffalo, NY
Synergena, Inc., East Aurora, NY

SIAD Process Equipment:
SIAD TGIR N-T Device (Batch processing)



Testing Medium:
7 gallons Untreated Industrial Wastewater per batch (contents unknown)

Phenol $C_{10}H_{18}NO_3$:

Industrial wastewater often contains phenols from industrial effluents. Undesirable phenol wastes are produced by many industries including the chemical, plastics and resins, coke, steel and petroleum industries.

Phenol is one of the EPA's Priority Pollutants. Under Section 313 of the Emergency Planning and Community Right to Know Act of 1986 (EPCRA), releases of more than one pound of phenol into the air, water and land must be

reported annually and entered into the Toxic Release Inventory (TRI). Phenol has a high oxygen demand and can readily deplete oxygen in the receiving water, with detrimental effects on those organisms that abstract dissolved oxygen for their metabolism. Phenol is persistent in the environment when released in large quantities, or if it is continuously released from a source.

Phenols may be treated by chemical oxidation, bio-oxidation, or adsorption. Chemical oxidation, such as with hydrogen peroxide or chlorine dioxide, has a low capital cost, but a high operating cost. Bio-oxidation has a high capital cost and a low operating cost. Adsorption has a high capital cost and a high operating cost. The appropriateness of any one of these methods depends on a combination of factors, the most important of which are the phenol concentration, and any other chemical pollutants that may be present in the wastewater. Depending on these variables, a single or a combination of treatments is be used. Currently, removal is accomplished with chemical oxidants, the most commonly used being chlorine dioxide, hydrogen peroxide and potassium permanganate.

Protocol:

The SIAD TGIR N-T Device tank was clean and empty prior to the start of the wastewater processing.

Seven gallons of fresh, untreated industrial wastewater was extracted by pail from a random batch at Safety-Kleen's initial holding tanks prior to any treatments. The seven gallons of untreated wastewater was poured into the SIAD TGIR N-T Device. A control sample of the untreated wastewater was taken at this time (0 minutes)

.

The SIAD process was started by igniting the SIAD 1500 watt photonic lamp and starting the twin mixers at 530 rpm. Water samples were taken from the SIAD tank at recorded time intervals and the phenol measured.

Following the first test, the processed wastewater was removed from the SIAD TGIR N-T Device tank and the tank was cleaned. A second seven gallon test was run from a different batch of fresh, untreated industrial wastewater, extracted by pail from a random batch at Safety-Kleen's initial holding tanks prior to any treatments. The second testing protocol was identical to the previously explained first test.

Results:

SIAD

Phenol Reduction Test Report
10-Sep-03

Phenol Test #1

Sample	Minutes	ppm
1	0	>15-20
2	5	15-20
3	15	15
4	30	12
5	45	11
6	60	8
7	75	5
8	90	<2
9	105	<2

Phenol Test #2

Sample	Minutes	ppm
1	0	>15-20
2	5	15
3	15	12
4	30	7
5	45	4
6	60	<2
7	75	<1

Conclusion:

The SIAD TGIR N-T device using photonics successfully reduced the chemical phenol, without the use of additional chemicals, to measurements below the regulatory requirements for clean and safe water disposal.