Industrial Pretreatment of Phenol in Wastewater Discharges Using the VTX Process

Introduction

The National Pretreatment Program was established to reduce the level of pollutants discharged by industry into municipal sewer systems. The objective of the program is to protect the Publicly Owned Treatment Works (POTW) from pollutants that may interfere with plant operation, prevent untreated pollutants from being introduced into the POTW, and to improve opportunities for the POTW to reuse wastewater and biosolids that are generated.

EPA has also developed national categorical pretreatment standards that apply numeric pollutant limits to industrial users in specific industrial categories. The General Pretreatment Regulations include reporting and other requirements necessary to implement these categorical standards.

Phenols are listed within several of the categorical standards. Destruction of phenols can be accomplished to some degree in the biological treatment systems at POTWs. However, biological destruction of phenols within most POTWs is often slow which can result in untreated phenols making it through the treatment works and into receiving streams and rivers.

Industrial treatment of phenols is typically accomplished through expensive UV oxidation systems or activated carbon. A technique which could reduce the cost of phenol treatment should be well received within industries which now have to control phenols in their effluents.

The VTX Oxidation Process

This **VTX** Catalytic Process is a very efficient treatment procedure for recalcitrant organic compounds. The process is based upon the finding that a certain catalyst and peroxide or similar reactant can be employed to degrade soil and/or water borne contaminants at normal pH levels. With this technique, wastewater, groundwater, or soil containing organic contaminants having at least one oxidizable aliphatic or aromatic functional group can be completely oxidized on contact. A broad list of treatable chemicals would include selected pesticides, petroleum hydrocarbons, and chlorinated solvents. Included in the list of readily treatable chemicals are such notable contaminants such as Phenols, MtBE, TCE, BTEX, and PCE.

The catalyst is safe, (i.e. does not add to the contamination of the water to be treated). The catalyst uses a common metal as its chief catalysis point within the **VTX** complex to generate a significant quantity of hydroxyl radicals. Importantly, the **VTX** complex allows the reaction to proceed at neutral pH. The non-metallic portion of the **VTX** complex is consumed in the process leaving only CO_2, a very small amount of metal ions, chloride ions and water as final products with complete oxidation. Importantly, the **VTX** process does not generate a noticeable sludge in water treatment applications.

The **VTX** Process can be employed in a variety of ways and is easily adaptable to existing treatment systems. The contact time for the oxidation process to occur is short, usually under 2 hours.

The **VTX** Process can replace existing oxidative wastewater treatment systems of any size. Importantly, **VTX** based treatment systems are often more efficient and provide for lower cost than competing oxidation treatment systems. A **VTX** system requires no materials of special construction and power requirements are absolutely minimal. The design is simple. Metered injection of the ingredients, rapid in-line mixing, and adequate retention time are the primary design criteria.

Phenol Treatability Study

Three phenol contaminated wastewater streams were tested using the **VTX** Process. The source of each waste stream was from the wash water associated with a metal molding operation. The characteristics of each wastewater stream was as follows:

Source	Phenol mg/L	COD mg/L	pH
1	**1.4**	**220**	**6.8**
2	**3.1**	**245**	**7.1**
3	**7.2**	**236**	**7.2**

One-liter samples of each wastewater stream were tested over a range of dosage of **VTX** catalyst and 35% hydrogen peroxide addition. A control sample received hydrogen peroxide alone for each test level. Dose volumes for catalyst and peroxide at each test level were the same. Dose rates for catalyst and hydrogen peroxide ranged from 0.2 mls, 0.4 mls, 0.6 mls 0.8 mls and 1.0 mls per liter of wastewater for each wastewater source.
The results of the study can be seen in the following table. The reaction time was approximately 3 hours.

Wastewater Source 1

Dosage	Phenol Remaining	
	Control	VTX Treated
0.2 mls	1.3	0.2
0.4 mls	1.2	ND
0.6 mls	1.2	ND
0.8mls	1.3	ND
1.0 mls	1.4	ND

Wastewater Source 2

Dosage	Phenol Remaining	
	Control	VTX Treated
0.2 mls	3.1	0.5
0.4 mls	3.0	0.1
0.6 mls	3.2	0.1
0.8mls	3.0	ND
1.0 mls	3.0	ND

Wastewater Source 3

Dosage	Phenol Remaining	
	Control	VTX Treated
0.2 mls	7.0	5.5
0.4 mls	7.1	3.7
0.6 mls	7.0	2.0
0.8mls	6.9	0.6
1.0 mls	7.2	ND

Results indicate that the **VTX** process is an efficient treatment process for the phenolic components of these three waste streams.