Shortcut To Success

A new streamlined treatment alternative for industrial wastewater delivers high quality effluent and generates nonhazardous waste

. . . . . Sultan I. Amer
Environmental protection, September 2000

Industrial wastewater generally contains contaminants such as suspended solids, dissolved organic matters, heavy metals, and cyanides at levels considered hazardous to the environment and could pose a risk to public health. Such contaminants must be removed or their level be reduced to legally acceptable levels prior to discharging the wastewater to the environment. Effluents are normally treated by chemical means and the quality of treated effluent must meet discharge standards required by the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA).

Conventional multi-step treatment

The type of water treatment program put in place by an industry is influenced by factors such as the nature and volume of the waste stream, discharge regulations, available space, and the nature of generated waste. The nature and volume of the waste stream and discharge regulations will influence the choice of equipment and treatment chemicals. The overall cost of treatment involves operational cost such as energy, labor, treatment chemicals, sludge processing and disposal, and maintenance. The classification of generated waste is very important as disposal of hazardous waste costs an average of three to four times that of nonhazardous waste.

Conventional techniques used in the treatment of industrial streams involve emulsion breaking, coagulation and scavenging of oil, precipitation of heavy metals as hydroxides or sulfides, flocculation and settling of the solids into a metal-laden floc, separation of floc from treated effluent, and finally discharge. Such techniques are generally multi-step, time consuming, and require extensive equipment and handling. The entire treatment is carried out sequentially and requires multi pH adjustments and the addition of hazardous chemical solutions, each with its own feed tank, pump, and feed line. Furthermore, both hydroxide and sulfide precipitation methods suffer great limitations in their use in metal removal and both generate hazardous waste that requires further treatment and stabilization at waste treatment plants. In cases where a significant amount, one percent or higher, of emulsion oil is present in the waste stream, use of an oil-water separator or dissolved air floatation (DAF) equipment becomes necessary for effective removal of oil.

Simpler is better

As the collective industrial discharge continues to grow and the CWA regulations governing the discharge of wastewater becomes more stringent, industrial facilities need new technology and products that enhance treatment efficiency and are protective of the environment and public health. A new alternative process for treating industrial wastewater streams is becoming popular as it eliminates the use of various dangerous treatment chemicals, is easy to implement and operate, requires less maintenance and generate non-hazardous waste.

The recently developed AQUASIL® treatment makes use of the concepts of synergy and favorable kinetics to react with the various contaminants simultaneously. This new technology employs proprietary advanced nonhazardous blend of natural and synthetic minerals that are

made to fit the chemistry of the particular waste stream. All products are manufactured from nonhazardous materials and supplied in solid form. They are highly hydrophilic and used in either the batch or continuous processes.

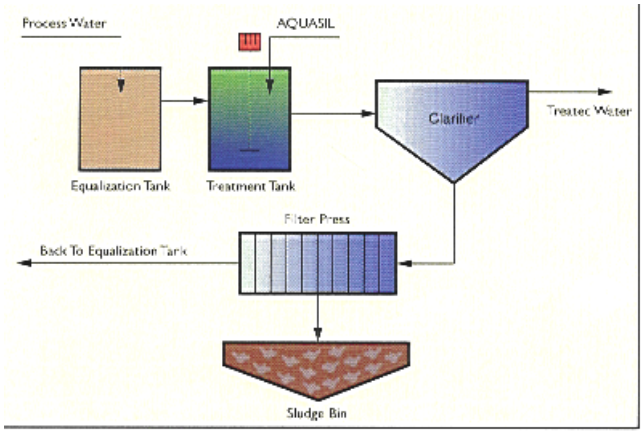
TABLE 1: Performance comparison between current and alternative treatments of effluent from an automotive manufacturing operation

Parameter	Limit, mg/L	Current Treatment	Alternative Treatment
Oil & Grease	50.0	1900	24.5
Suspended solids	NA	35.4	6.5
Total Phosphorus	NA	13.2	0.34
COD	NA	991	597
Phenol	0.20	0.19	0.09
Cadmium	0.37	0.005	ND
Chromium	1.47	0.083	ND
Copper	1.80	0.280	ND
Lead	0.37	0.040	ND
Nickel	2.12	0.150	ND
Silver	0.37	0.006	ND
Zinc	1.39	0.180	ND

In the new treatment, the particular product is added or metered into the agitated waste stream in a treatment tank. Within a few minutes a dense floc forms, settles quickly, and easily dewatered. Effluents are treated with products at either low, neutral, or moderately high pH. Use of such products eliminates problems inherent in the application of liquid chemicals in the conventional practice. The products have high capacity to take up or remove heavy metals, suspended solids, and oil and grease, simultaneously. In addition, they can lower the levels of hexavalent chromium, phenol, arsenic, selenium, phosphorus, fluoride, chemical oxygen demand (COD), and total dissolved solids (TDS). The products also overcome problems associated with hardness and the presence of complexing or chelating agents, surfactants , and detergents.

Figure 1 illustrates a conceptual setup of the new treatment; Table 1 shows the performance of the conventional treatment of an automotive manufacturer's wastewater, contrasted with the new method.

FIGURE 1: Conceptual setup for AQUASIL® treatment



The new treatment is applicable to effluents from a broad spectrum of industries. Applications include operations such as machining, anodizing, galvanizing, automobile manufacture, plating, surface coating, tannery, parts cleaning, laboratory waste, stamping, paint spay booth, wood treatment and circuit board manufacture.

Fewer steps equal more saving

The benefits of using the new treatment and products become evident if we consider the entire treatment process and its economics. For example, an automotive manufacturing operation has a wastewater treatment system that operates at 600 gallons per minute (gpm) daily. Waste streams from the various operations, which are combined in an equalization tank, are fairly concentrated in suspended solids, oil and dissolved solids. In the conventional treatment, pH is lowered, an emulsion breaker is added and DAF is applied to enhance the separation of oil from water. Oil is skimmed off the surface. Lime slurry id then added to raise the pH and precipitate heavy metals and a flocculant is added to facilitate settling of the formed floc in the clarifier. Sludge is withdrawn periodically to a sludge tank and treated with sludge thickener prior to dewatering in a filter press. Annual cost of the treatment, excluding labor, maintenance and energy is $ 1,630,000.

Laboratory tests, conducted over a period of several months, shoed that a dose of 350 milligram per liter (mg/L) of the new product produced much more favorable results (see Table 1). Cost analysis conducted at the automotive manufacturing plant indicates that the new wastewater treatment reduces the cost of waste disposal by 6 percent, sewer surcharges by 70 percent, and the overall cost by 40.4 percent. Furthermore, the DAF operation and all hazardous feed chemical are eliminated, and the cost of energy, maintenance and labor is substantially reduced. The high quality of treated effluent, generated by the new treatment, allows for water conservation through recycling.

Waste disposal: Acing the TCLP test

All techniques used in the treatment of waste streams produce large volumes of sludge/waste that is generally hazardous due the high concentrations of contaminants therein. Safe disposal of such waste is troublesome and the problem is aggravated by the increasing number of waste-water treatment systems. Currently, the waste is transported to treatment plants where it undergoes further treatment to render it suitable for long term disposal. Such a manipulation adds to the overall cost of treatment.

Waste created by the alternative treatment is already stabilized and does not require any further treatment to render it non-leaching. The waste passes the Toxicity Characteristics Leaching Procedure (TCLP) test and meets the Resource Conservation and Recovery Act (RCRA) requirements and can be landfilled as a nonhazardous material. Table 2 shows TCLP test results for a plating waste generated by the alternative treatment.

TABLE 2: Analytical results of contamination plating waste (filter cake)

Parameter	Total concentration[1] mg/kg	TCLP[2] limit mg/L	RCRA (TCLP[2]) limit mg/L
Cadmium	640	< 0.005	1
Chromium	240,000	< 0.01	5
Copper	3,500	0.04	100
Iron	13,000	< 100.00	NA*
Lead	670	0.15	5
Nickel	2,100	0.08	NA*
Zinc	340	0.06	500

1 Total concentration is obtained by total digestion of waste material in nitric acid and analyzing the digestate for metals.
2 A leachate is obtained according to leaching procedure given in reference 4.
* Not available or unregulated.

The new treatment is easy to implement, employs safe products and provides an economical alternative to current techniques. It lowers labor, energy and maintenance demands, delivers effluents that meet or exceed discharge and recycling standards and generates nonhazardous waste.

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MORE INFORMATION

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