Information Bulletin No. 16

The Use of Reverse Demulsifiers in BTEX Reduction

Introduction

The use of chemical demulsifiers in treating oily wastewaters has been around for a number of years. The introduction of unique chemical blends now shows promise in reducing the concentrations of other organic contaminants, not usually associated with oil & grease removal.

The increasing emphasis in recent years on the persistence of harmful effects of certain petroleum hydrocarbons (BTEX)** has focused attention on the need for secondary and tertiary processes in polishing oily wastewaters generated in a variety of applications.

In this research project, undertaken by a major environmental consulting and remediation company for an international oil company, treatment methods for tank bottom waters from gasoline and diesel fuel storage tanks were evaluated. The purpose of the study was to identify treatment processes that significantly reduce BTEX levels as well as the oil & grease content of the water.

Experiment

The samples represented water accumulated at the bottom of gasoline storage tanks. These water samples were analyzed for contaminant levels before and after the most successful chemical treatment. Typical results are summarized in Table 1.

Demulsifiers and coagulants were added to individual samples, followed, where necessary, by pH adjustment, and settling. Floc settling time and filterability were noted. Water clarity was noted before and after filtration. Treated water was analyzed for oil & grease content, as well as for benzene, toluene, ethylbenzene and xylene.

The last step in the treatment process was to remove the residual soluble hydrocarbons from the clarified aqueous phase. The effectiveness of various amounts of pulverized activated carbon was studied by mixing the water samples and carbon on a tumbler for approximately 14 hours.

Table 1

	Before Treatment	After Treatment With ECA* 1350
Color	Light brown, turbid	Pale yellow, clear
pH	7.7	7.1
Benzene (ppm)	33.30	3.40
Toluene (ppm)	43.00	2.33
Ethylbenzene (ppm)	2.29	0.10
Xylene (ppm)	14.40	0.137
Oil%Grease (ppm)	188	11.70
COD (ppm)	2035	1216

Results

Demulsifying agents tested were chemicals available from various suppliers. Optimum results were achieved using products from Emulsions Control Inc. The best candidate, ECA 1350, was compared with traditional inorganic coagulants, namely, acid/alum and ferric chloride at various concentrations. ECA 1350, at the recommended range of 500-1000 ppm, was added without pH adjustment, and the result was the formation of a brown floc that settled quickly from a pale yellow, but crystal clear water. ECA 1350 alone, although showing a significant reduction in BTEX levels, did not reduce benzene levels to below discharge specifications (0.5 ppm), and was followed by contact with activated carbon. Of the inorganic coagulants, alum gave the best results. Added at 2000 ppm, it reduced pH from 7.7 to 4.5. Following filtration, the pH was adjusted to 10, using both calcium hydroxide and sodium hydroxide. These results showed calcium hydroxide to be most effective, forming a tan precipitate, which required an anionic polymer to improve floc characteristics.

Carbon isotherm studies on the treated water showed that BTEX and oil & grease levels can be reduced to meet discharge criteria at reasonable carbon concentrations. Results are summarized in Table 2.

Table 2
Carbon Isotherm Results

Carbon	Benzene (ppb)	Total BTEX (ppb)	Oil & Grease (ppm)	COD (ppm)
0.0 g/l	333.0	442	11.7	1216
1.0 g/l	58.0	66	5.0	854
10.0 g/l	1.0	5	11.0	363

Conclusions

Results demonstrated the ability of ECA 1350, at relatively low levels, to significantly reduce BTEX concentrations as well as oil & grease residuals. Such reductions were achieved rapidly, generating a small volume of readily filterable floc and requiring no additional chemical conditioning. Sludge volumes and disposal costs were generally significantly lower than those associated with bulking, multi-step inorganic coagulants. Moreover, reducing benzene levels to below 10 ppm, made it possible to discharge such treated waters to POTW's.

By achieving this reduction in emulsified and soluble hydrocarbon residuals, ECA 1350 offers savings in the carbon polishing step, in terms of time and cost, and allows reductions in benzene levels to below detection limits (1 ppb). ECA 1350 is offered as an effective and reliable primary chemical treatment for process and ground waters that are contaminated with hydrocarbons, and where discharge limits on organic residuals are rigorously enforced.

- BTEX = B**enzene**, T**oluene**, E**thylbenzene**, X**ylene**

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