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TECHNICAL MEMORANDUM

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Demonstration of Pure-Tek Electronic Flocculation Oil-Water Separator

by

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INTRODUCTION

The Pure-Tek Company, Los Angeles, California, has developed a method of separating oil from water, called Electronic Flocculation. According to Pure-Tek, the operational cost would be approximately 25 cents per 1,000 gallons of oily water. A table-top model was demonstrated to Civil Engineering Laboratory (CEL) personnel 16 April 1976. This report describes the demonstration and the test results obtained.

DESCRIPTION OF DEMONSTRATION

In the demonstration model, a contaminated water mixture flowed by gravity from a burette into a cylindrical test cell containing iron electrodes. Electronic wave forms applied to the electrodes caused fine suspended particles of FeOH, floc, to be emitted from the sacrificial electrodes. Oil was absorbed on the floc. The mixture of floc and contaminated water was drained into a beaker and poured through ordinary coffee filter paper into another beaker. In one test, the effluent was filtered twice. For proprietary reasons, the Pure-Tek personnel would not disclose the nature of the wave forms applied to the electrodes. A sketch of the test set-up is presented in Figure 1.

The test oil was a 2:1:1 mixture of Navy Distillate Navy Special Fuel Oil, and 2190 lubrication oil (MIL-L-177331). Two contaminated water mixtures were prepared with tap water, and two contaminated water mixtures were prepared with seawater. Various combinations of the test oil, solvent, and ordinary liquid detergent were added to the tap water and seawater. The solvent was a synthetic resin enamel, Federal Specification TT-T-306B. Each contaminated water mixture was prepared in one-gallon buckets immediately preceding the test conducted on it. The contents were mixed with an electric mixer.

TEST RESULTS

The test results are presented in Table 1. If the contaminated water mixture had been homogeneously mixed, the oil concentration in the

influent sample would have been 1000 ppm. From Table 1, it is seen that the oil concentration in the influent samples varied from 274.9 ppm to 919.6 ppm. This shows that the contaminated water mixtures were not homogeneously mixed.

Because of the relatively large concentration of solvent in Test 2, the oil concentration, 137.5 ppm, after one filtration, was considerably higher than the oil concentrations obtained in the other three tests. After a second filtration, however, the oil concentration was reduced to 3.6 ppm, an oil concentration lower than those of the other three tests. The effluent in Test 2, after both filtrations, was turbid, whereas the effluents from the other three tests were clear.

The oil concentrations in the effluents for Tests 1, 3, and 4 were 22.9 ppm, 19.8 ppm, and 7.2 ppm respectively. The EPA requirement for discharge into harbors is 10 ppm.

The paper filters from Tests 2-4 were cleansed of the floc using solvent, and then dried. None of the filters was damaged by this process.

Apparently the power required for the seawater samples was approximately the same as for the tap water samples.

CONCLUSION

The principle of Electronic Flocculation was demonstrated on a small scale. However, further development would be required to reduce the oil concentration in the effluent to 10 ppm as required by EPA.

RECOMMENDATIONS

Modify the Electronic Flocculation oil-water separator so that the oil concentration in the effluent is reduced to at least 10 ppm.

Develop a larger scale experimental model, including a floc skimming device, to obtain more performance data and to determine operational cost more accurately.

Test No.	Contaminated Water Mixture					Oil Concentration of Influent Sample, ppm	Oil Concentration of Effluent After First Filtration, ppm	Oil Concentration of Effluent After Second Filtration, ppm	Weight of Floc on First Filter Paper mg
	Water	Volume of Water, gal	Volume of Test Oil, ml	Volume of Solvent, ml	Volume of Detergent ml				
1	Tap Water	1	3.8	0	0	509.5	22.9		
2	Tap Water	0.75	3.0	200	25	274.9	137.5	3.6	114.2
3	Sea Water	1	3.8	0	0	919.6	19.8		29.5
4	Sea Water	1	3.8	50	25	786.4	7.2		19.2

Notes:

(1) The test oil was a 2:1:1 mixture of Navy Distillate, Navy Special Fuel Oil, and 2190 lubrication oil (MIL-L-17331).

(2) The solvent was a synthetic resin enamel, Federal Specification TT-T-306B.

Table 1 Test Results, Pure-Tek Electronic Flocculation Oil-Water Separator

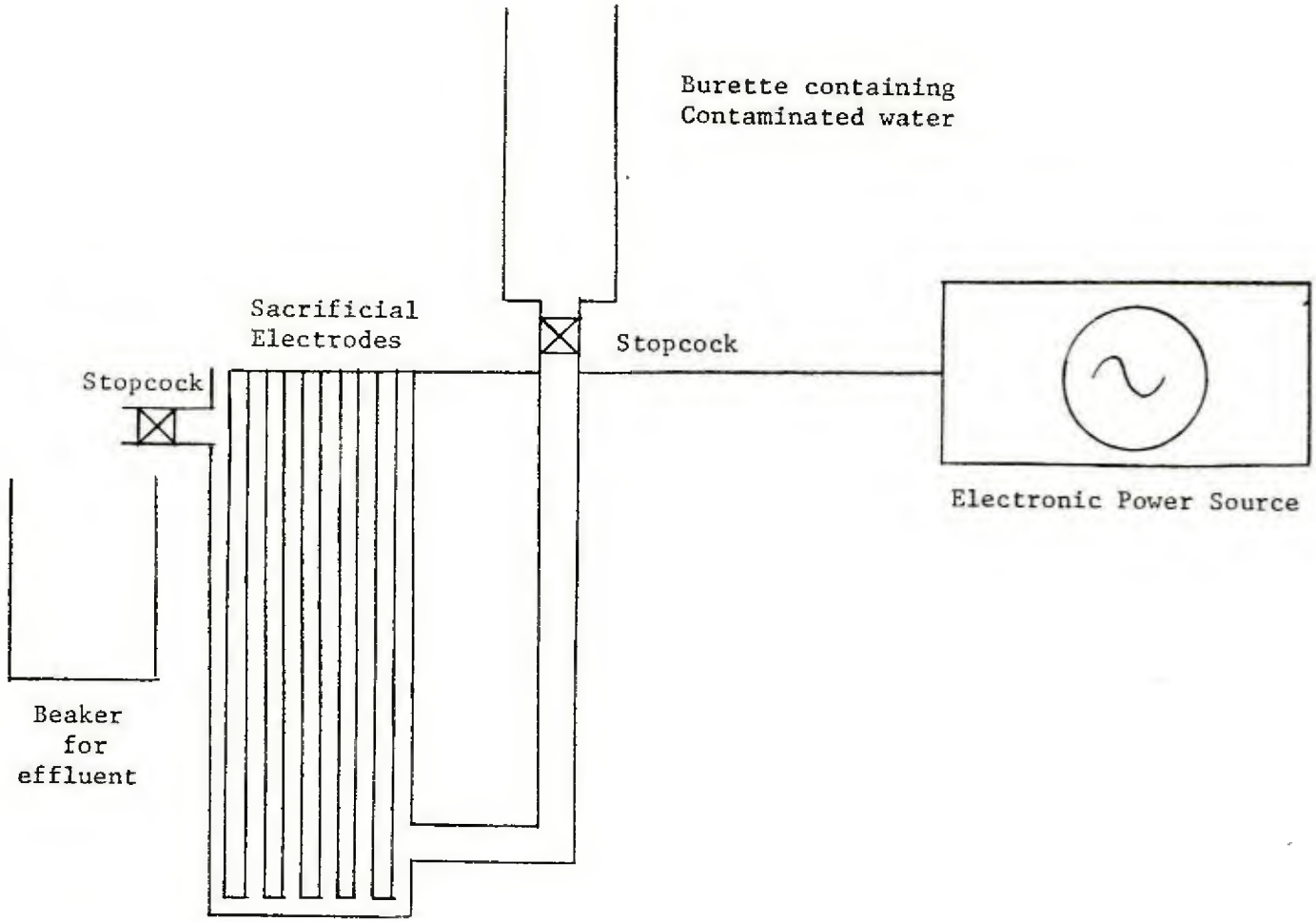

Figure 1. Schematic of Demonstration Model of
Electronic Flocculation Oil-Water Separator