ELECTROLYTIC TREATMENT OF OIL BASED EFFLUENT

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Service stations generate different types of pollutants which contaminate receiving waters. These pollutants include used motor oils, fuel oils, detergents, paint droplets, clay, silt, sand, tire particles etc. Discharging of untreated wastewater to natural waterways causes adverse effects on the aquatic life and quality of water. One of the main contaminants in wastewater is oil and grease. Oils exist in wastewater in two ways. One fraction exists as an emulsion and the other as in suspension. The nonseparable oil content of wastewater is due to the formation of an emulsion with water, clay and other suspended solids in wastewater. These clay particles do not settle down to the bottom as they are bound to droplets of oil. In Sri Lanka, chemical coagulation [addition of $Al_2(SO_4)_3.18H_2O$] is currently used as a treatment method though it is not very effective in removing suspended solids in wastewater.

The objective of the study was to design a low cost treatment plant to remove oils in wastewater. The proposed method of treatment consists of an application of direct current through electrodes (ferrite electrodes). A lower water pH tends to make colloids more positive or less negative and a higher water pH tends to make colloids negative. At an electrical field, such particles migrated towards the cathode or anode. The volume of sample taken for experiments was 500 ml and electrodes were placed horizontally in the sample (cathode in the top and anode in the bottom). The experiments were done at pH 6, 7 and 8. Concentrated Sulfuric acid was used to adjust pH values from initial pH (8.5) of the sample. A 0.01g salt (NaCl) was added as an electrolyte prior to the treatment. Addition of salt increased the efficiency of conducting electric current. Treatment was done at different voltages as 12, 24, 36, 48, 60, 72, 84, 96 and 108 V. Finally, turbidity of the samples was measured at 1hr, 2 hr, 3 hr, 4 hr and 5 hr durations of treatment.

The objective in reduction of oil and grease can be achieved by reduction of turbidity of the sample as most oils are adhered to the suspended solids. During the electrolysis O_2, SO_2 and Cl_2 evolved at the anode and H_2 is evolved at the cathode all in the form of gas bubbles. Coincidently formation of micro bubbles was found to help lifting particles to the top under the force of buoyancy. At pH 7 and 8, migration of colloids towards the anode was not done efficiently. The highest removal efficiency of turbidity of 74% (22.5 NTU) was recorded at pH 6, 108 V after 1hr duration. The current needed for this was 0.89 A (96.12 W) per 500 ml of sample. The lowest removal percentages were recorded at pH 8. If initial turbidity of the sample is low, the removal efficiency of the turbidity is high. At pH 8, 108 V has given a 68% (15 NTU) of removal during a 1hr period. The current taken for this was 0.44 A per 500 ml. The cost of treatment is Rs.1922.00/m^3 at Rs.10.00 per kWh. It is also proposed to make use of solar cells for this purpose, in the next research step.

The treatment at pH 6 and 108V has given the best performance by achieving the highest removal efficiency within a period of 1hour. Therefore, it was concluded that by electrolytic treatment as described in this report can bring automobile service station waste effluent to the standard prescribed by the Central Environmental Authority of Sri Lanka.