Performance Evaluation of Effluent Treatment Plant for Pigment industry and reuse of waste Aluminum Hydroxide as coagulant

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Abstract - *This paper discusses performance evaluation of the existing Effluent Treatment Plant ("ETP") in pigment industry. The main objective is to check the adequacy of the treatment units and efficiency of the individual treatment units. Along with above stated study, a separate laboratory study was carried out for use of waste Aluminum Hydroxide as coagulant. The pigment industry is among the most polluting industries. These industries are one of the major industries causing water pollution. Waste water from pigment industries contain high level of impurities such as colour, oil & grease, suspended solids, acids, alkalis, pH, Chemical Oxygen Demand ("COD") and Biochemical Oxygen Demand ("BOD"). Samples were collected from Oil & Grease Trap, Equalization and Neutralization Tank, Active Sludge Unit and Carbon Sand Filter to evaluate the performance of ETP. The results show that the treated effluent has achieved most of the parameters within permissible limit and use of waste Aluminum Hydroxide is most economical.*

Key Words: *Evaluate, efficiency, pH, COD, BOD, Alkalinity, Acidity, ETP, Pigment Industry*

1. INTRODUCTION

The process industries produce final products and intermediates by performing various processes on raw materials sourced from crust of the earth and using water and/or air. Inevitably, these industries generate waste products to be disposed of as they are of no use. Such disposal of waste should be carried out in such a way as to minimize any adverse effect to the environment.

A pigment is colored, black or white substance which is insoluble in the medium in which it is applied and imparts color and opacity to this medium. Pigments are of two types i.e. inorganic and organic. Inorganic pigments are an integral part of decorative, protective and functional coatings. It can retard corrosion. Inorganic pigments cover a wide spectrum of colors in addition to white and black.

Organic pigment was first produced from animal and/or vegetable extracts. These pigments are bright in shade but have poor light fastness. Pigments are insoluble in the medium while dye is soluble in the medium.

2. MATERIALS AND METHODS

The pigment industry selected for study manufactures Dioxazine (pigment violet 23). It is located at Ahmadabad, Gujarat, India. The selected industry has an effluent treatment plant of 2200 M2 area. The industry discharges 1.5 Lakh Litre of effluent per day. The duration of the study was for 7 month. The samples were collected at inlet and outlet of Oil & Grease Trap, Activated Sludge Unit, Carbon and Sand Filter. Schematic diagram of ETP is as shown in Fig. 1.

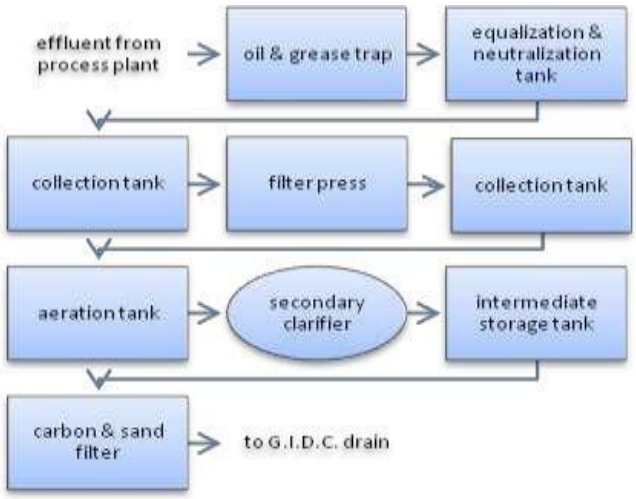

Fig. 1 Schematic diagram of Effluent Treatment Plant of pigment industry

Samples were analysed by comparing the concentrations as per I. S. method.

The composite samples were collected using wide mouth bottle having a diameter 35mm at mouth and capacity 120ml. Table 1 gives capacities of different units of ETP.

TABLE 1 Capacities of different units of ETP

Sr. No.	Treatment Unit	Capacity (m^3)
1	Oil & Grease Trap	13
2	Equalization & Neutralization Tank	20
3	Collection Tank	24
4	Primary Sedimentation Tank	17
5	Filter Press	36"x36" of 50 Chambers
6	Collection Tank	155
7	Aeration Tank	745
8	Clarifier	20
9	Intermediate Storage Tank	96
10	Carbon & Sand Filter	13
11	Sludge Drying Bed	3

In the Effluent Treatment Plant, treatment process includes primary treatment, secondary treatment and tertiary treatment. The industry recycles part of the effluent in preparation of solvent. By reuse of effluent the industry reduces quantity and quality of effluent and reduces the chemicals used in the process of effluent treatment.

In the pigment industry Alum is used as a coagulant. In this study, waste Aluminum Hydroxide was used instead of Alum. Waste Aluminum Hydroxide was generated by a neighboring industry, which also happens to be sister concern of the industry selected for this study. In this study, waste Aluminum Hydroxide was used as coagulant and carried out jar test to find out optimum dose.

TABLE 2 Monthly average values at inlet & outlet of Oil & Grease Trap of ETP.

Month	Oil and Grease at inlet and outlet of Oil and Grease Trap		
	Inlet (mg/L)	Outlet (mg/L)	% Removal Efficiency
July	7.20	4.80	33.33
August	4.90	3.20	34.69
September	5.60	1.20	78.57
October	15.60	10.20	34.62
November	39.20	12.00	69.39
December	5.20	1.10	78.85
January	42.40	20.20	52.36

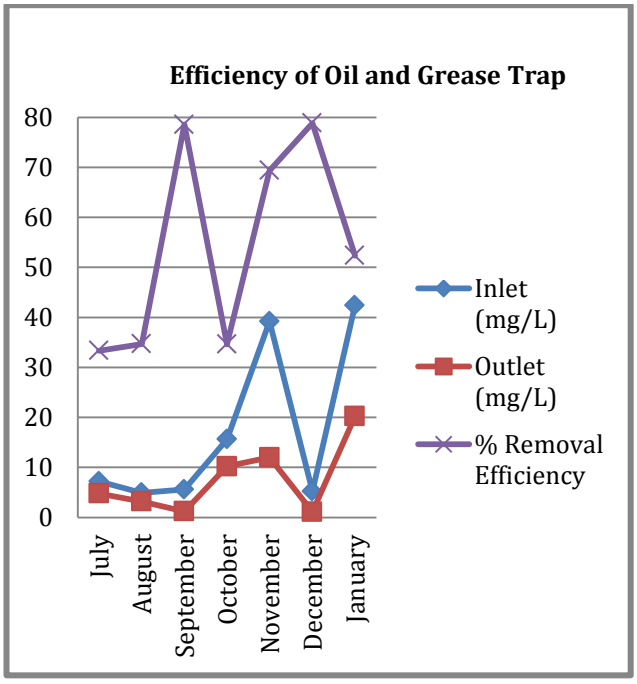

Fig. 2: Oil & Grease at inlet and outlet of Oil and Grease Tank & its removal efficiency

Month	COD at Equalization & Neutralization Tank		
	Inlet (mg/L)	Outlet (mg/L)	% Removal Efficiency
July	6374.00	5530.00	13.24
August	8480.00	6980.00	17.69
September	7400.00	6643.00	10.23
October	5170.00	4320.00	16.44
November	7485.00	6625.00	11.49
December	8679.00	6679.00	23.04
January	8010.00	6110.00	23.72

TABLE 3 COD at inlet & outlet of Equalization & Neutralization Tank

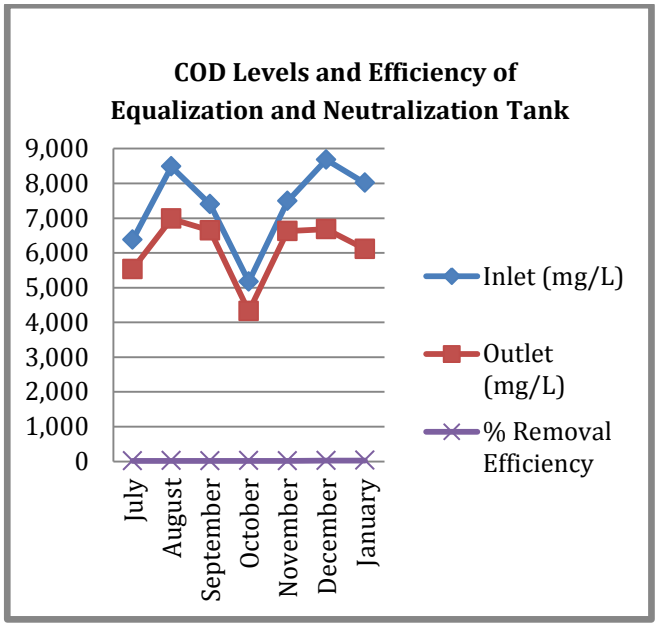

Fig. 3: COD at inlet & outlet of Equalization & Neutralization Tank and its removal efficiency

Month	COD at Activated Sludge Unit		
	Inlet (mg/L)	Outlet (mg/L)	% Removal Efficiency
July	5184.00	279.00	94.62
August	6680.00	550.00	91.77
September	6182.00	495.00	91.99
October	4320.00	400.00	90.74
November	6525.00	590.00	90.96
December	6520.00	560.00	91.41
January	8640.00	495.00	94.27

TABLE 4 COD at inlet & outlet of Activated Sludge Unit

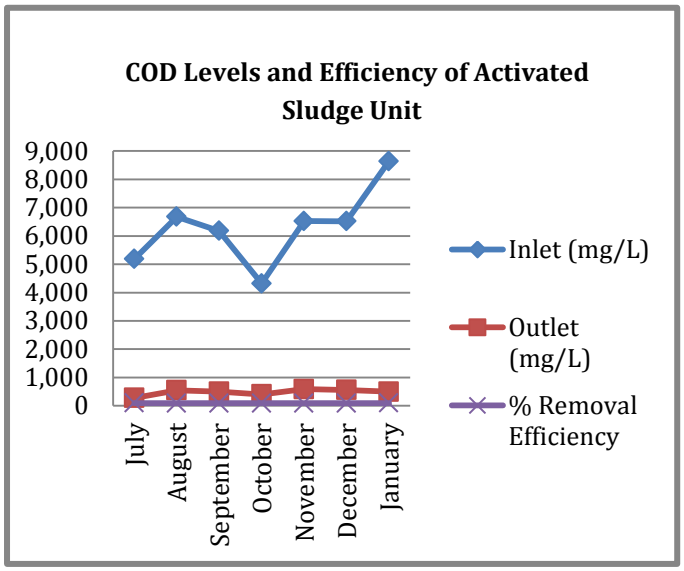

Fig. 4: COD at inlet & outlet of Activated Sludge Unit and its removal efficiency

TABLE 5 COD at inlet & outlet of Carbon & Sand Filter

Month	COD at Carbon & Sand Filter		
	Inlet (mg/L)	Outlet (mg/L)	% Removal Efficiency
July	280.00	193.00	31.07
August	300.00	192.00	36.00
September	410.00	212.00	48.29
October	340.00	171.00	49.71
November	295.00	210.00	28.81
December	490.00	246.00	49.80
January	283.00	200.00	29.33

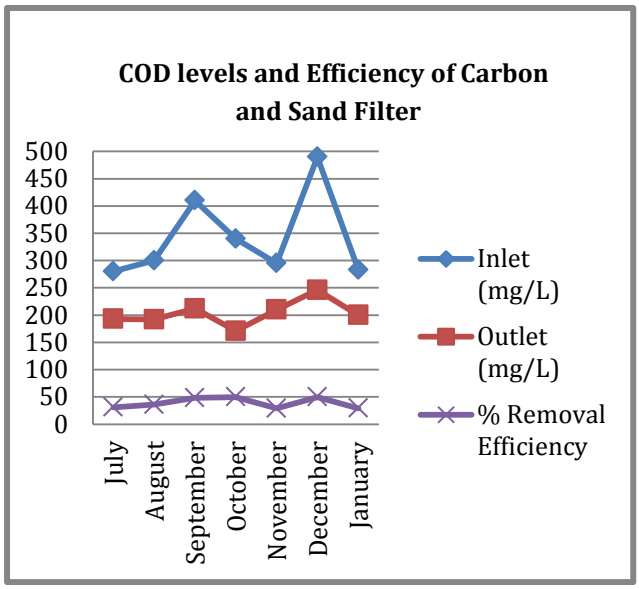

Fig.5: COD at inlet & outlet of Carbon and Sand Filter and its removal efficiency

3. RESULT AND DISCUSSION:

The results of analysis of the waste water samples collected from various sampling points are shown in Table-2 to Table-5 and Figure-2 to Figure-5.

The results of JAR test of raw waste effluent sample are shown in Table-6. Figure-6 shows graph of waste Aluminum Hydroxide dose (ml) Vs. Turbidity and one can easily work out optimum dose of waste Aluminum Hydroxide. From Figure-6 optimum dose of waste Aluminum Hydroxide is 40 mg/lit. For this optimum dose-COD of raw wastewater is 2026 mg/lit and COD of treated wastewater with waste Aluminum Hydroxide is 1013.33 mg/lit. COD reduction to the tune of 49.98% achieved by use of waste Aluminum Hydroxide.

TABLE 6 Results of turbidity at different levels of Waste Aluminum Hydroxide dose

Sr. No.	Waste Aluminum Hydroxide Dose (ml)	Turbidity (NTU)
1	1	5
2	2	4
3	3	3.5
4	4	3.5
5	5	4
6	6	5

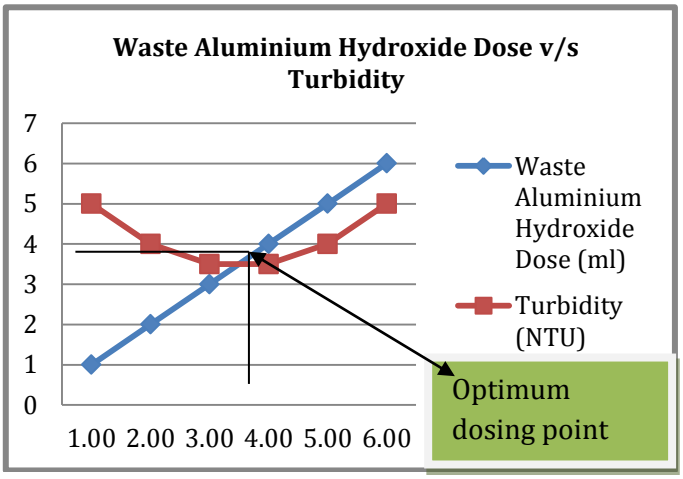

Fig.6: Turbidity at different doses of waste Aluminum Hydroxide and optimum dose of waste Aluminum Hydroxide

4. CONCLUSION:

Aluminum Hydroxide which is a by-product of neighboring industry, produced at the rate of 2.66 Tons/day is really a waste for industry and industries finds it difficult to dispose of this waste jelly. This waste Aluminum Hydroxide is tried as coagulant for removal of pigment violet 23 and results are encouraging. Optimum

dose of waste Aluminum Hydroxide is 40 mg/lit for waste treatment which means 6 kg of Aluminum Hydroxide per day without any cost. This can replace the use of 30 kg/day of Alum for waste treatment resulting into a good amount of saving including storage, transportation and disposal cost of waste Aluminum Hydroxide.

The waste water generated by pigment industry under study can be treated most effectively by existing wastewater treatment plant. The industry generates 150 m3/day of effluent from various processes. The existing wastewater treatment plant is able to cope with increased waste water loading up to 200m3/day.

5. ACKNOWLEDGMENT

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6. REFERENCES AND FOOTNOTES

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