Comparative Analysis of Electro Coagulation and Chemical Coagulation for the Treatment of Laundry Waste Water

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Abstract **-** The Commercial Laundry industry is one of the largest consumers of potable water and generator of huge quantities of polluted waste water. Effluent analysis shows that discharged waste water stream is high in COD, BOD, grease/oil, TSS, TDS, detergents and surfactants. Electrocoagulation is an extremely effective wastewater treatment system, removing pollutants and producing hydrogen gas simultaneously as revenue to compensate the operational cost. The aim of this paper is to compare the efficiency of electro- coagulation method with the conventional chemical coagulation. The Laundry named established in boys hostel in LPU campus (BH-7, lovely professional university) was selected for the research. By comparing the water quality parameters after treatment, best method was suggested to treat the laundry wastewater and to enhance its reuse and recycle potential.

Keywords **-** laundry waste water, electro-coagulation, chemical-coagulation, waste water treatment, re-use.

I. INTRODUCTION

Wastewater is not only one of the main causes of irreversible damages to the environmental balances but also contributing to the depletion of fresh water reserves at this planet, generating threats to the next generation [1]. The Commercial Laundry industry is one of the largest consumers of potable water and generator of huge quantities of polluted waste water. A typical laundry operation will consume on average 250m^3 /day of potable water and discharge approximately 200 m^3/day of polluted waste water [2]. Effluent analysis shows that discharged waste water stream is high in COD, BOD, grease/oil, TSS, TDS, detergents and surfactants as well as being at temperatures well above ambient potable water. Consequently, the recycling of laundry waste water has become a necessary requirement to reduce operational costs and meet regulatory standards.

Electrocoagulation is an extremely effective wastewater treatment system, removing pollutants and producing hydrogen gas simultaneously as revenue to compensate the operational cost [3]. The aim of this paper is to compare the efficiency of electro- coagulation method with the conventional chemical coagulation.

II. METHODOLOGY

***A. Selection of laundry site*:** The Laundry named MANGLA LAUNDRY which is established in boys hostel in LPU campus (BH-7, lovely professional university) was selected for the sample collection. The selection of area was done according to easy accessibility and feasibility because multiple time sampling is required for experimental work.

B. Collection of samples from laundry site: The samples were collected on 6, 13, 20, 27 October '2014; 3, 10, 17, 24 November '2014; 12, 19, 26 January' 2015; 2, 9, 16, 23 February' 2015 and 2 March'2015. Sampling was done three times in a day morning 9 a: m, 12 p: m and 5 p: m. Samples were collected in reusable plastic bottles and DO fixation was done at the time collection. The bottle was not filled up to the brim to provided sufficient space for shaking of sample.

C. ***Physical & chemical analysis of laundry raw water & waste water:*** Analysis of sample is very important because quality of water and application of treatment process is done on the basis of characteristic of water. The following parameters were analyzed pH, Turbidity, Alkalinity, Total Solids, Chloride, Hardness, Dissolved Oxygen, Biochemical Oxygen Demand and Chemical Oxygen Demand.

D. ***Treatment of laundry waste water by EC &CC****:* Two different methods were adopted for the treatment of laundry waste water namely electro coagulation and chemical coagulation.

Fig (1): Experimental Set Up for Electro-Coagulator

- The instillation of set up electro-coagulator by assembling the two electro of aluminum of size 1.5 cm and 12 cm length out of 8.5 cm is dipped in water. The electrodes were connected with DC power supply electric device in which application of applied voltage can by changed. The electrode and DC power supply machine were connected with wires. Fig 1 shows the experimental set- up for electro-coagulation.

Fig (2): Experimental Set Up for Chemical Coagulation

- For the experiment of chemical coagulation and adsorption, jar apparatus was used in which laundry waste water was poured in different beaker and desired amount of alum and activated charcoal was added. The standard beakers are placed beneath these stirrers with poured water and stirrers are start rotation by setting the button. The jar apparatus is set at desired rpm such that the impurities does not get settle down and remain in suspension to come in contact with adsorbent and chemical coagulating agent. Fig 2 shows the experimental set- up for chemical-coagulation.

E. ***Comparison of treatment method by analyzing the treated water quality*:** By comparing the water quality parameters after treatment, best method was suggested to treat the laundry wastewater and to enhance its reuse and recycle potential.

III. RESULT & DISCUSSION

A. ***Characteristic of influent water of laundry:*** The sample 1 indicates the samples which are collected at the time of morning, The Sample 2 indicates the samples which are collected at the time of noon and Sample 3 indicates the samples which are collected at the evening time.

B. ***Comparison****:* Sample treatment with Electro-coagulation (EC) was conducted at 15 volts and chemical coagulation (CC) was done with 2.5 mg/L of alum. Table (1) shows the characteristics of laundry waste water treated with electro-coagulation (EC) and Chemical Coagulation (CC)

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Table 1: Characteristic of influent and effluent of laundry

Parameters	Laundry Influent Sample			Laundry Effluent Sample		
	S- 1	S- 2	S- 3	S- 1	S- 2	S- 3
p^H	7.5	7.8	7.6	10.3	10.2	10.1
Turbidity	1	0	1	23	22	21
TSS	5.2	5.3	5.6	280.4	290.4	285.4
TDS	3.3	3.7	3.4	134	121	130
BOD	1.2	1.4	1.3	185	205	173
COD	2.1	2.0	2.8	315	340	288
Hardness	44.1	46.2	47.3	642	652	612
Alkalinity	22.4	22.1	21.5	224	221	215
Chloride	16.4	14.7	15.6	215	231.56	226.4
All Units in mg/L except Turbidity (NTU).						

Table 2: Characteristic of influent and effluent of laundry

Parameters	Characteristic of treated water by EC (15 volt)			Characteristic of treated water by CC (2.5gm/L alum)		
	S- 1	S- 2	S- 3	S- 1	S- 2	S- 3
p^H	7.4	7.8	7.7	7.7	7.8	7.7
Turbidity	3	2	3	7	9	8
TSS	35.1	32.7	38.7	46.8	45.6	47.7
TDS	14.5	13.1	14.7	27.4	22.8	23.7
BOD	5.5	6.8	5.5	51.2	52.0	51.6
COD	9.7	10.5	9.8	33.0	33.7	33.1
Hardness	46.9	44.2	45.8	47.9	46.8	48.5
Alkalinity	15.5	16.1	16.6	15.9	16.1	16.2
Chloride	16.8	16.0	14.5	38.4	37.4	35.4
All Units in mg/L except Turbidity (NTU).						

- The removal efficiency of BOD was found to be less in samples treated with CC(82.16%,83.565,80.86%) treatment process than the samples treated with EC(97.1%,96.87%,96.87%). Fig (3) shows the comparison of the two processes on the basis of BOD removal efficiency.

- The removal efficiency of COD was found to be less in samples treated with CC(84.16%,84.71,84.53%) treatment process than the samples treated with EC(97.70%,96.95%,97.15). %). Fig (4) shows the comparison of the two processes on the basis of COD removal efficiency.
- The removal efficiency of Chloride content was found to be less in samples treated with CC(84.49%,83.85,84.7%) treatment process than the samples treated with EC(97.78%,92.6%,93.16%). Fig (5) shows the comparison of the two processes on the basis of Chloride removal efficiency.
- The removal efficiency of Hardness and alkalinity was found to be less in samples treated with CC (92.53%,92.56%,92.35%; (92.9%, 92.72%, 92.23%) respectively) treatment process than the samples treated with EC(93.31%,93.06%,92.35%; 93.52.%,93.16%,92.6% respectively). Fig (6) and Fig (7) show the comparison of the two processes on the basis of Hardness and alkalinity removal efficiency. However CC process results better than EC, because the difference in removal efficiencies is only 1 percent and EC is costly.
- The removal efficiency of TSS was found to be less in samples treated with CC(83.3%,83.26%,83.11%) treatment process than the samples treated with EC(87.85.%,88.98 %,86.79%). Fig (8) shows the comparison of the two processes on the basis of TSS removal efficiency.
- The reduction in turbidity was found in the samples treated with CC (69.53%, 59..9%,6.42%) treatment process than the samples treated with EC (86.95%, 86.36%,78.26%). Fig (9) shows the comparison of the two processes on the basis of turbidity removal efficiency.

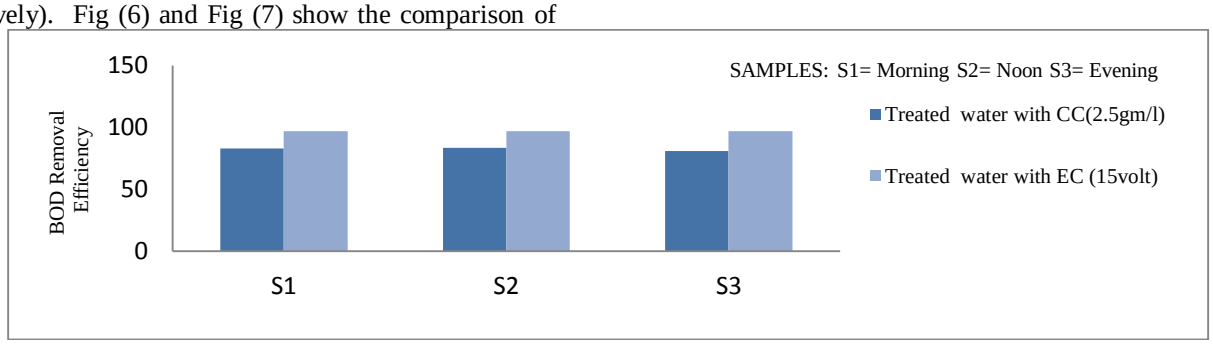

Fig (3) Shows the Comparison of the Two Processes on the Basis of BOD Removal Efficiency

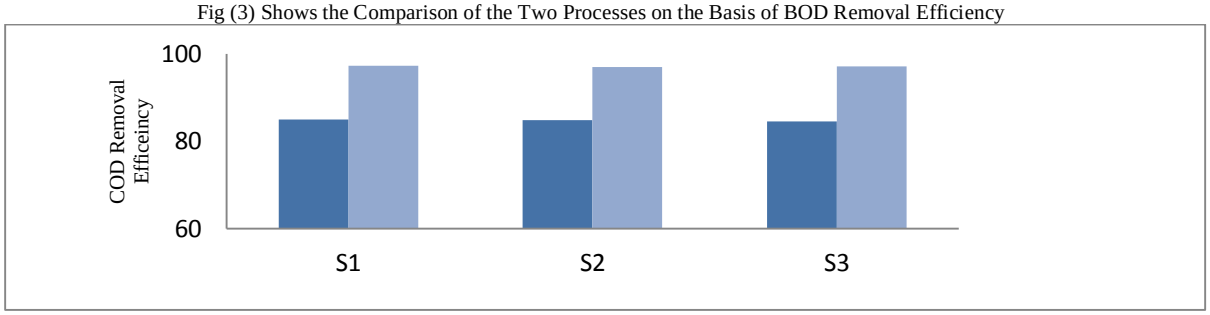

Fig (4) Shows the Comparison of the Two Processes on the Basis of COD Removal Efficiency

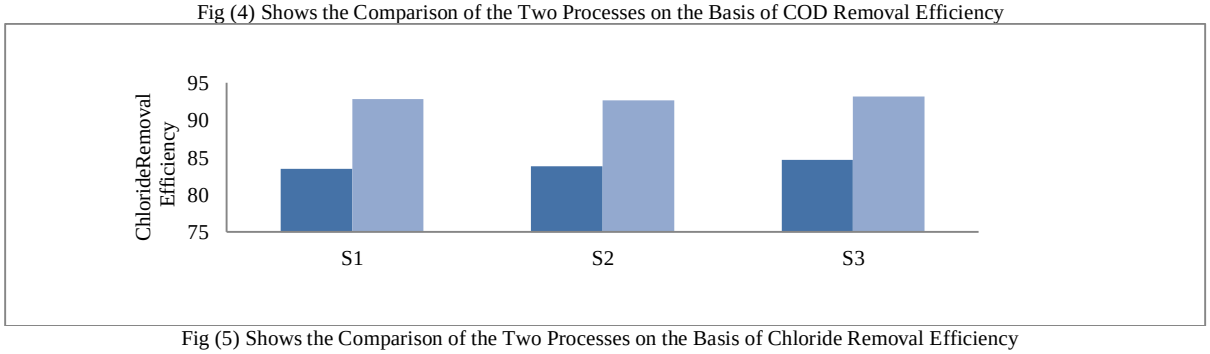

Fig (5) Shows the Comparison of the Two Processes on the Basis of Chloride Removal Efficiency

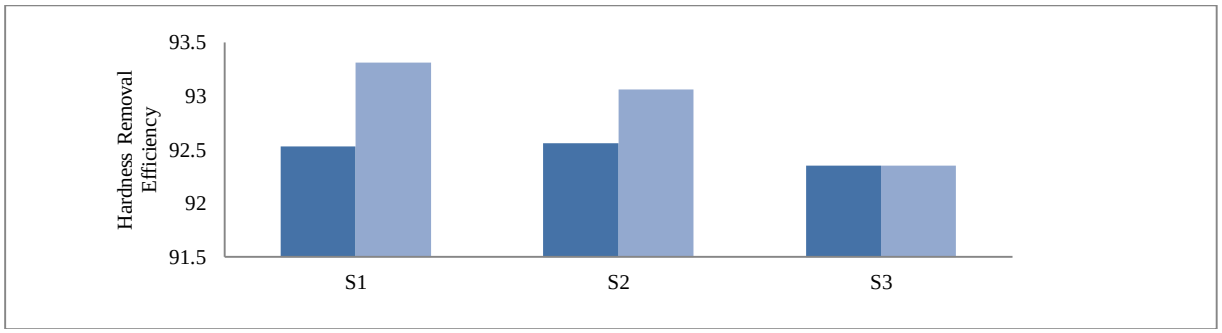

Fig (6) Shows the Comparison of the Two Processes on the Basis of Hardness Removal Efficiency

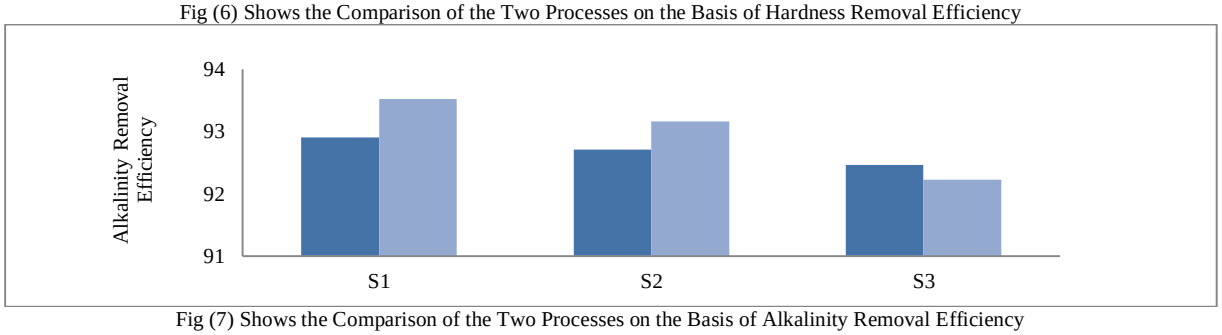

Fig (7) Shows the Comparison of the Two Processes on the Basis of Alkalinity Removal Efficiency

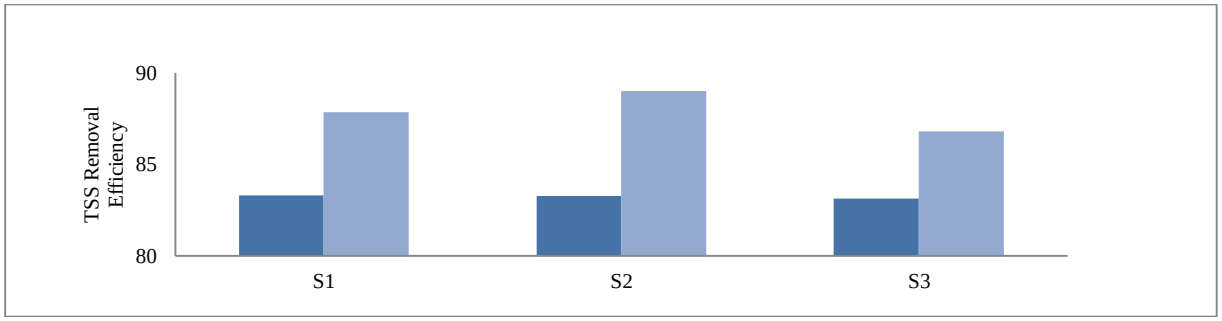

Fig (8) Shows the Comparison of the Two Processes on the Basis of TSS Removal Efficiency

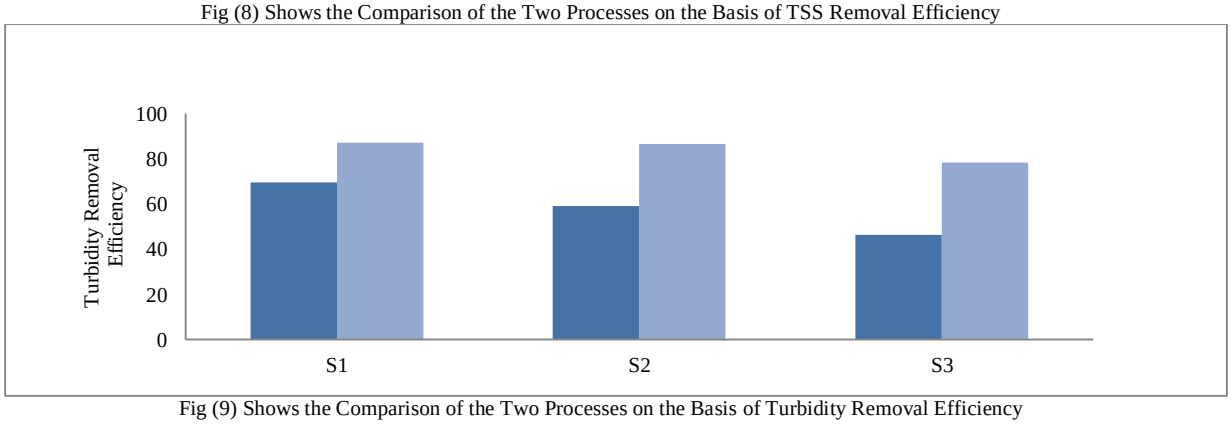

Fig (9) Shows the Comparison of the Two Processes on the Basis of Turbidity Removal Efficiency

IV. CONCLUSION

The treatment with electro-coagulation was found to be the optimum treatment out of the two methods. COD treated was about 95% through EC. After treatment all the quality parameters were found within the desirable limits prescribed by WHO, 1993. The treated water can be recycled again in laundry operation and can be reused in fire demands, irrigation, curing, gardening purpose. The treated water with EC can be disposed in reservoir for self purification.

V. REFERENCES

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