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ELECTROCOAGULATION TREATMENT FOR RAW EFFLUENT OF TEXTILE INDUSTRY

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ABSTRACT

Textile industries are major sources of Environmental pollution. Considering the problems of pollution, an attempt has been made in the present paper to evaluate electro-coagulation treatment effect on raw textile effluent. The purpose of this study was to investigate the treatment efficiency of the electro-coagulation process on removal of COD, colour and solids from textile industrial effluent samples. The study also brings out that electro-coagulation with Copper and Mild Steel electrodes were more effective.

Key words: *electro-coagulation, textile effluent, electrolytic cell, electrodes*

INTRODUCTION

Textile is one of the largest and oldest industries present globally. The textile industry continues to be the second largest employment generating sector in India. (Textile Industry in India, 2014).

Textile industries are major sources of Environmental pollution. As the textile industries consume large quantities of water and generates waste water in proportionate order. Moreover the dyes used in textile industry are important sources of environmental pollution. These effluents do not only contain high concentration of dyes, but also contain the chemicals used in the various processing stages. Some trace metals such as Cr, As, Cu and Zn are present in these effluent and are capable of causing several health problems including haemorrhage, ulceration of skin, nausea, severe irritation of skin and dermatitis. Textile effluents are also found to contain other organic and microbial impurities (S. A. PAUL, 2012).

The conventional treatments methods of textile wastewater are physico-chemical and biological methods. Most of these conventional methods are becoming inadequate and insufficient; because of the textile effluent contain mainly complex aromatic molecular structures. Compounds are often constructed to resist fading on exposure to sweat soap water, light or oxidant agents and this renders them more stable and less amenable to biodegradation. A simple and efficient treatment process for the textile wastewater is essentially necessary.

In the Electro-coagulation process, the coagulants are generated electrically and wastewater is treated in an electrochemical cell. When the system is connected to an external power source, sacrificial anodes are corrected due to oxidation in the solution and release coagulant cations in the cell. In the Electro-coagulation process the coagulating ions produced ‘in situ’ and it involves three successive stages:

1) Formation of coagulants by electrolytic oxidation of the sacrificial electrode.
2) Destabilization of the contaminants, particulate suspension, and breaking of emulsions.
3) Aggregation of the destabilized phases to form flocs.

When a potential is applied from an external power source, the anode material undergoes oxidation, while the cathode will be subjected to reduction or reductive deposition of elemental metals. The mechanism of Electro-coagulation is highly dependent on the chemistry of the aqueous medium, especially conductivity (Mohammad Y.A. Mollaha, 2004).

This study of Electro-coagulation treatment for raw effluent of textile effluent was tested at lab scale level. COD,colour and solid removal efficiency was determined.

EXPERIMENTAL SET-UP AND PROCEDURE

EC reactor with electrodes connected in parallel was used in the experiments. The reactor having a volume of 1 litre was used. Volume of sample taken for treatment is 500 ml. Different Electrodes (Aluminium, Mild Steel, Copper, Silver) were used for the experiments. A regulated direct current supply (0-30 V, 3 A) by Digital D.C. Power Supplier was used for the experiments. Current Density of 10 mA/cm^2 was tested at ambient temperature between 25 – 27^{o}C.

Analysis of COD,Analysis of colour and Analysis of solids were done as per(APHA & Clesceri, 1995) Standard Methods for Examination of water and wastewater.

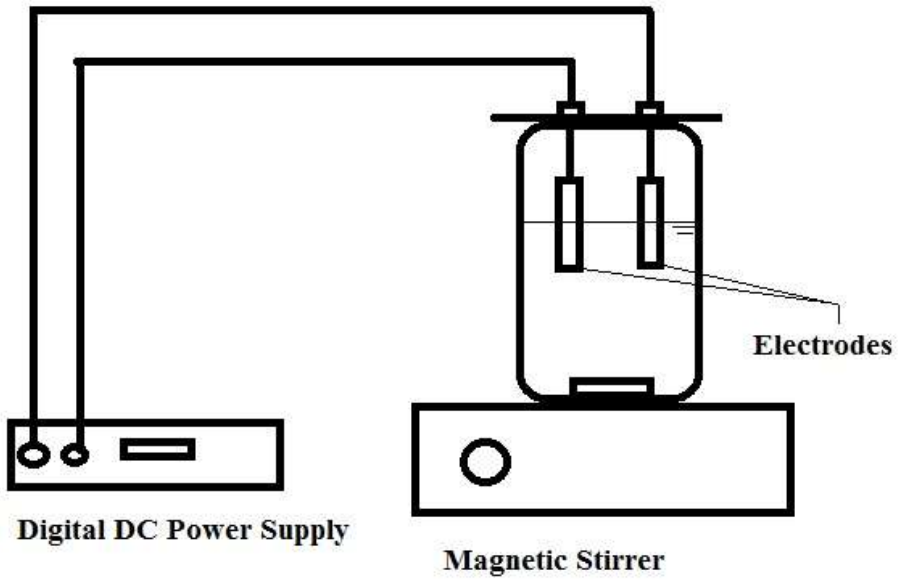

Figure 1 Lab Scale Electro-Coagulation Set-up

RESULT AND DISCUSSION

Effects of Different Electrode Material

Effects of different electrode materials i.e. Mild Steel, Copper, Aluminium, Silver is shown as follows;

- Sample Quantity : 500 ml
- Electrode size : 4 cm (width) × 4 cm (depth)
- Submerged Area of Electrode: 4 cm (width) × 3 cm (depth)
- Current Density: 10 mA/cm^2

Table 1 Effects of Different Electrode Material on Chemical Oxygen Demand

Sr. No.	Electrode Material		Analysis of COD						
	Anode	Cathode	Raw COD (mg/l)	After Treatment COD (mg/l)			% Removal of COD		
				30 min	60 min	90 min	30 min	60 min	90 min
1	Mild Steel	Aluminum	3200	2800	2000	1760	12.5	37.5	45
2	Mild Steel	Mild Steel	3040	2800	2400	2240	7.9	21	26.3
3	Mild Steel	Copper	2960	2400	2240	1600	18.9	24.3	45.9
4	**Copper**	**Mild Steel**	**2800**	**2000**	**1400**	**1200**	**28.6**	**50**	**57.1**
5	Mild Steel	Silver	2800	2000	1600	1400	28.6	42.8	50
6	Aluminum	Aluminum	2800	2640	2400	2000	5.7	14.2	28.6

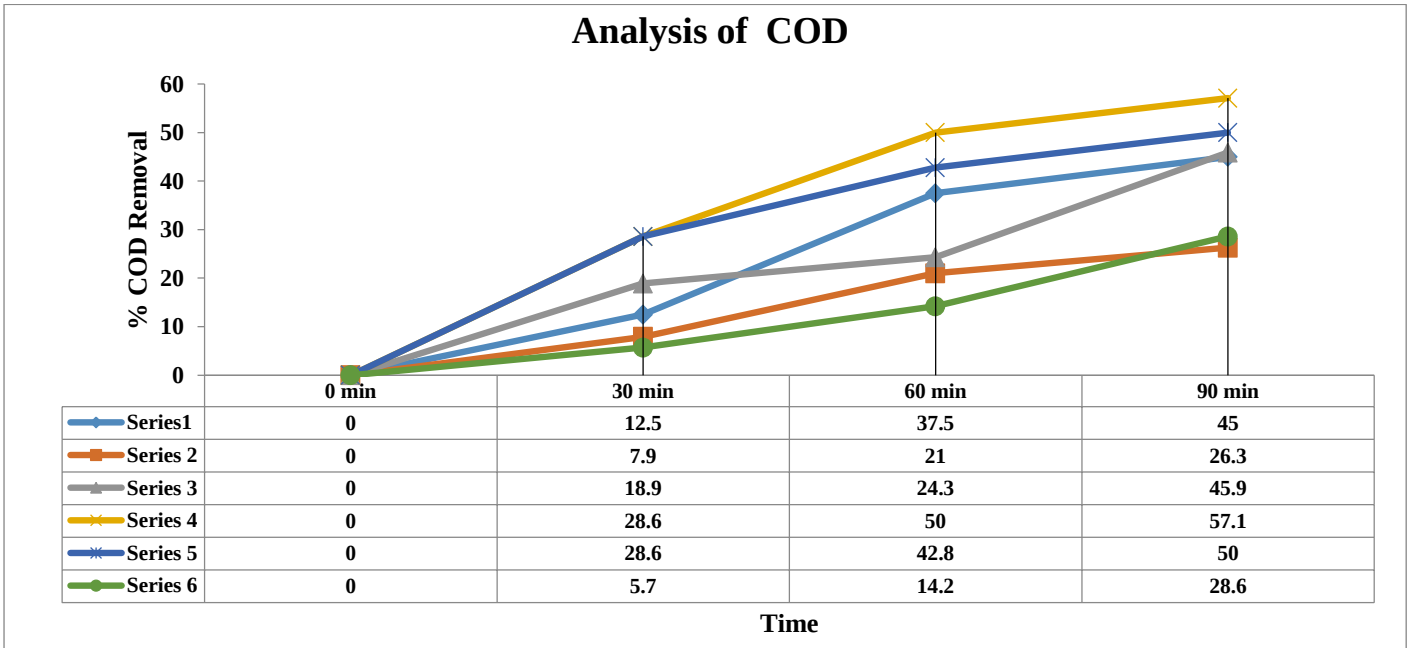

Figure 2 Effects of Different Electrode Material on Chemical Oxygen Demand

Table 2 Effects of Different Electrode Material on Solids

Sr. No.	Electrode Material		Analysis of Solids					
	Anode	Cathode	Total Suspended Solids (TSS) mg/l			Total Dissolved Solids (TDS) mg/l		
			Raw Effluent	Treated Effluent	% Removal of TSS	Raw Effluent	Treated Effluent	% Removal of TDS
1	Mild Steel	Aluminum	1800	1380	23.3	6000	4800	20
2	Mild Steel	Mild Steel	1700	1340	21.1	7500	6100	18.6
3	Mild Steel	Copper	1600	1120	30	7000	4500	35.7
4	**Copper**	**Mild Steel**	**1500**	**800**	**46.6**	**6900**	**3500**	**49.2**
5	Mild Steel	Silver	1500	900	40	7200	4000	44.4
6	Aluminum	Aluminum	1500	1200	20	6800	4900	27.9

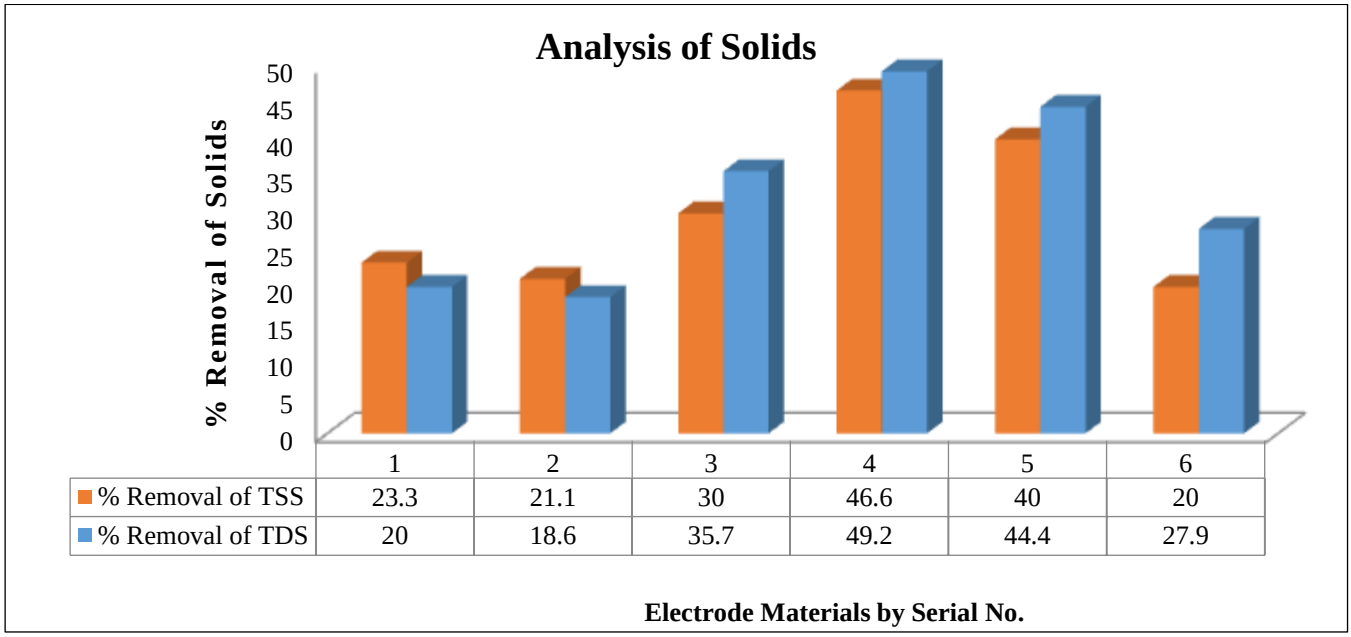

Figure 3 Effects of Different Electrode Material on Solids

Table 3 Effects of Different Electrode Material on Color

Sr. No.	Electrode Material		Analysis of Color		
	Anode	Cathode	Raw Effluent Color (Pt.Co)	Treated Effluent Color (Pt.Co)	% Removal of Color
1	Mild Steel	Aluminum	1200	1020	15
2	Mild Steel	Mild Steel	1180	880	25.4
3	Mild Steel	Copper	1240	690	44.3
4	**Copper**	**Mild Steel**	**1240**	**600**	**51.6**
5	Mild Steel	Silver	1200	900	25
6	Aluminum	Aluminum	1220	1000	18

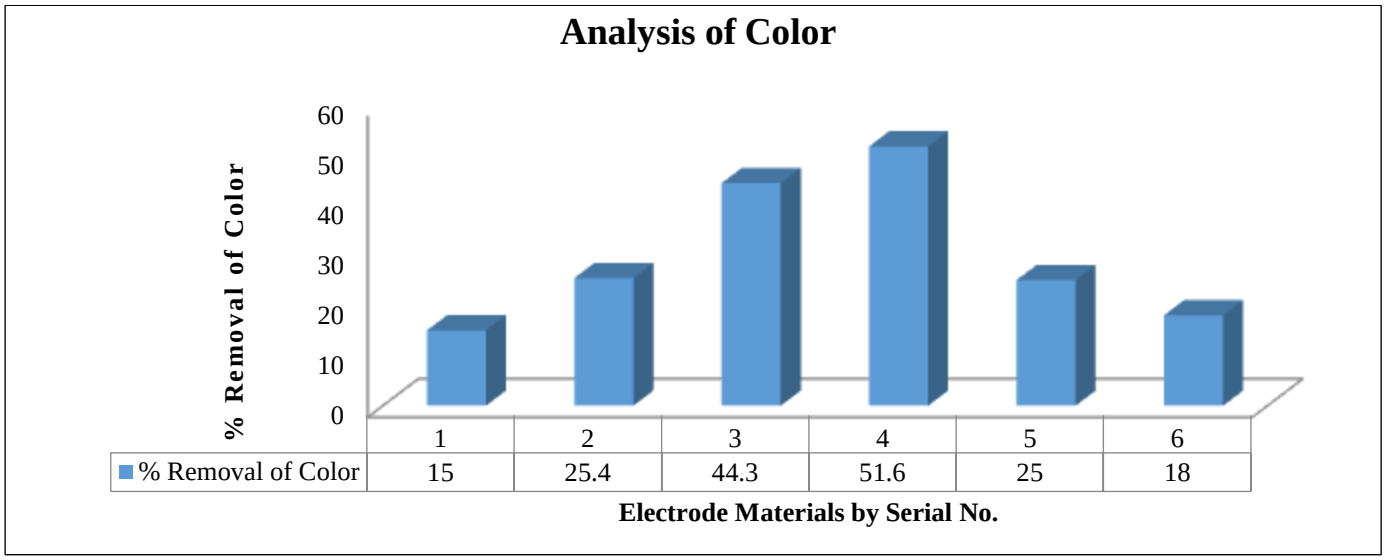

Figure 4 Effects of Different Electrode Material on Color

CONCLUSION

Based on the present Lab-Scale Electro-coagulation Treatment for Raw Effluent of Textile Industry, the following conclusions can be drawn:

- Maximum Removal of COD is obtaining Up to 57.1 % in 90 min of treatment by using Copper and Mild Steel as Electrode material.
- Maximum Removal of Solids is obtaining Up to 46.6 % for Total Suspended Solids and 49.2 % for Total Dissolved Solids in 90 min of treatment by using Copper and Mild Steel as Electrode material.
- Maximum Removal of Color is obtaining Up to 51.6 % in 90 min of treatment by using Copper and Mild Steel as Electrode material.

Results for Raw Effluent Treatment solely by electro-coagulation process exceed prescribed effluent standards for various quality parameters of Textile Industry by The Central Pollution Control Board (CPCB), Delhi. So, Electro-coagulation Treatment can be use after biological treatment for achieving highest efficiency for removal of pollutants.

REFERENCES

1. Ae Ghaly, R. A. (2014). Production, Characterization And Treatment Of Textile Effluents: A Critical Review. *J Chem Eng Process Technol 5: 182.*
2. Apha, A. A., & Clesceri, L. A. (1995). *Standard Methods For The Examination Of Water And Wastewater*. Apha.
3. Arceivala, J. A. (2006). *Wastewater Treatment For Pollution Control.* Mcgraw Hill Education (India) Pvt Ltd .
4. B. Ramesh Babu, A. P. (2007). Textile Technology Cotton Textile Processing: Waste Generation And Effluent Treatment. *The Journal Of Cotton Science 11* , 141-153.
5. Chaturvedi.S.I. (2013). Electrocoagulation: A Novel Waste Water Treatment Method. *International Journal Of Modern Engineering Research (Ijmer)* , 93-100.
6. Chen, G. (2004). Electrochemical Technologies In Wastewater Treatment. *Separation And Purification Technology 38* , 11–41.
7. Eckenfelder, W. J. (2000). *Industrial Water Pollution Control.* Boston: Mcgraw Hill.
8. EPA. (2002). *Wastewater Technology Fact Sheet: Aerated, Partial Mix Lagoons* (Vols. Epa 832-F-02-008). United States Environmental Protection Agency.
9. G. Bhaskar Raju, M. T. (2009). Electrochemical Pretreatment Of Textile Effluents And Effect Of Electrode Materials On The Removal Of Organics. *Desalination 249* , 167-174.
10. Government Of India. (1986). *The Environment (Protection) Rules.*
11. Mohammad Y.A. Mollaha, P. M. (2004). Fundamentals, Present And Future Perspectives Of Electrocoagulation. *Elsevier B.V.*
12. Nemerow, N. L. *Industrial Water Pollution Origins,Chracteristics And Treatment.* Addison Wesley Publishing Company.
13. S. A. Paul, S. K. (2012). Studies On Characterization Of Textile Industrial Waste Water In Solapur City. *Int. J. Chem. Sci.: 10(2)* , 635-642.
14. Shah V, N. P. (2014). Electrocoagulation Treatment For Dairy Effluent. *International Journal Of General Engineering And Technology (Ijget)* , 11-16.
15. Xujie Lu, L. L. (2010). Textile Wastewater Reuse As An Alternative Water Source For Dyeing And Finishing Processes: A Case Study. *Desalination 258* , 229-232.
16. *Textile Industry In India*. (2014, December 12). Retrieved From Wikipedia: Http://En.Wikipedia.Org/Wiki/Textile_Industry_In_India#Cite_Note-Cci-1