

Removal of Organic Waste From Pulp And Paper Industry By Electrochemical Process

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Abstract— Pulp and paper industry one of largest industry in India. These Industries disturbing the ecological balance of the environment by discharging a wide variety of wastewater. Depending upon the nature of raw material ,the wastewater is generated per metric tonne of paper produced . The paper-making process requires large amount of water for the production processes, hence it is a water-intensive process. The paper mill wastewater characteristically contains colour, very high level of Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), due to presence of lignin and its derivatives from the raw cellulosic materials, chlorinated compounds, suspended solids (mainly fibres), fatty acids, tannins, resin acids, sulphur and sulphur compounds etc. In this project with the development of electric field we are conducting the electrochemical Process which are innovative, more effective and inexpensive technologies for treatment of waste water. In this study we are mainly focusing on electrochemical process like Electrocoagulation and Electro-fenton and comparing the removal efficiency of organic wastes by these methods.

Keywords— Electrochemical process, Electro coagulation, Electro-fenton, Organic waste, Pulp and paper , Removal efficiency, Water parameter

1 INTRODUCTION

The Pulp and paper industry is one of the major water-intensive chemical processes. Paper industry generates a huge amount of wastewater and creates economical and environmental problems[1]. The effluent from pulp and paper industry contains high organic matter, suspended solids, strong color, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) [8]. Traditional methods for dealing with the wastewater consist of biological, physical, and chemical processes and various combinations of these [6]. The effluent from the biological treatment still contains significant amount of color compounds, microorganisms, recalcitrant organic compounds and suspended solids. Also, chemical oxygen demand (COD) cannot be removed effectively by biological treatment. Hence, advanced treatment is necessary to improve wastewater discharge quality and to reuse wastewater[5]. The method of electrochemical oxidation for treatment of the organic contaminants contained in wastewater has become a hot focus in recent years because of its convenience and effectiveness than traditional methods [7]

2 METHODOLOGY

2.1 Sample collection

Collected 10 liters of waste water from CSON paper mills private.ltd. The method of collection of water samples is of great importance and should be done carefully [3]. Otherwise



Fig. 1 waste water from CSON paper mills

serious errors are likely to occur in the results due to contamination during sampling. Bottles with stoppers which are thoroughly cleaned and sterilized should be used.

2.2 Testing of samples

The collected sample has been tested for various water parameters Turbidity ,Hardness,DO,Acidity,Alkalinity,Total dissolved solids,BOD,CO,Colour [4]. After the initial parameter test electrocoagulation and electro-fenton tests are con-

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ducted water parameters like Turbidity ,Hardness,Total dissolved solids ,Alkalinity ,Acidity,COD, BOD are tested after

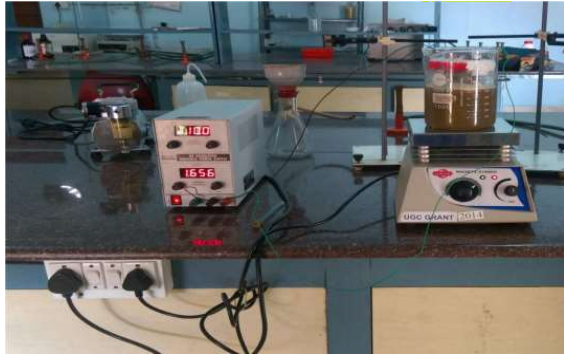


Fig. 2 Electrocoagulation apparatus

electrocoagulation and electron fenton process [2].The present study aims to examine the electro-Fenton/electrocoagulation (EF/EC) process for the treatment of wastewater generated from pulp and paper mills[1]

3 RESULTS AND DISCUSSION

The parameters were selected based on the influence of waste and other chemicals. The parameters included BOD, pH, Dissolved Oxygen, COD, solids, turbidity, hardness, colour. Table 1, shows the values of water parameters tested before the electrochemical process of the sample . Two most common plate materials are iron and aluminium are used here for the electrochemical process.

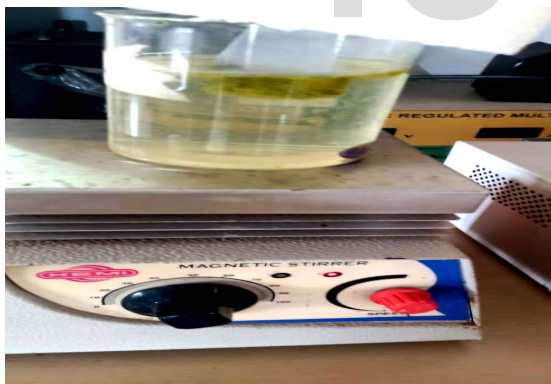


Fig. 3 Water sample after electrofenton

Electrocoagulation is a complicated process involving many chemical and physical phenomena that use consumable electrodes to supply ions into the waste water stream .Table 2 shows the values of water sample after electrocoagulation process.Here we are using two set of voltages and also having two Set of distance between the electrodes are used here for the electrochemical process. Table 3 shows the results after the electron fenton process.

Below table shows the value of water parameters after the initial test .These values are used for the comparison of remo

TABLE 1
INITIAL VALUES OF WATER PARAMETERS

Water parameters	Initialvalue
Ph	8.3
Turbidity(mg/l)	200
Hardness (ppm)	18220
Do(mg/l)	1.8
Acidity (mg/l)	0
Alkalinity(mg/l)	370
Totaldissolvedsolids(mg/l)	130
BOD(mg/l)	1672
COD(mg/l)	5200
Colour	Darkbrown

-val efficiency of the electrochemical process such as electrocoagulation and electrifenton.After the initialwater sample test

TABLE 2
VALUES OF WATER PARAMETERS AFTER ELECTROCOAGULATION

Parameters	Electro coagulation			
	4 cm		2 cm	
	10V	20V	10V	20V
pH	8.1	8.1	7.9	7.8
Turbidity (mg/l)	97	75	89	73
Hardness (ppm)	1972	1890	1903	1800
DO (mg/l)	1.9	2.1	2.1	2.3
Acidity(mg/l)	0	0	0	0
Alkalinity (mg/l)	305	265	260	210
Total dissolved solids(mg/l)	22.7	14.1	15.7	13
BOD (mg/l)	370	325	280	238
COD(mg/l)	872	834	810	790
Colour	slightly yellow			

electrocoagulation test conducted and after that water pa-

parameter test is conducted once again and the value of that test are given table 2.

TABLE 3
VALUES OF WATER PARAMETERS AFTER ELECTRON FENTON

Parameters	Electro-fenton			
	4 cm		2 cm	
	10V	20V	10V	20V
pH	7.9	7.1	7.8	7.9
Turbidity (mg/l)	75	52	73	50
Hardness (ppm)	1930	1862	162	1276
DO (mg/l)	2.1	2.8	2.3	3
Acidity(mg/l)	0	0	0	0
Alkalinity (mg/l)	300	240	260	180
Total dissolved solids(mg/l)	20.3	11.2	12.3	10
BOD (mg/l)	320	200	190	100
COD(mg/l)	890	370	540	290
Colour	Colourless			

Table 3 shows the values of water parameters after the electron fenton process and by compared these results with initial values removal efficiency was find out.

3.1 Efficiency comparison

The following table 4 shows the comparison between electrocoagulation and electro- fenton with irrigation standards .

TABLE 4
REMOVAL EFFICIENCY

Parameters	Electrocoagulation %	Electrofenton %
BOD	85.76	94.01
COD	84.80	94.42
Total dissolved solids	90	92.30
Hardness	90.12	92.99
Turbidity	63.5	75
Alkalinity	43.24	51.35

From the table it is clear that electro-fenton is most suitable method for treating industrial waste water. The electro-fenton

using 20 V and 2 cm distance is yielding good results .The below graph shows the removal efficiency comparison of electro fenton and electrocoagulation.

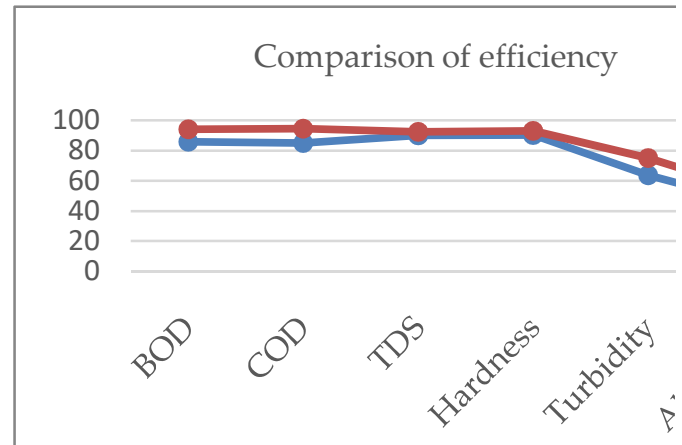


Fig. 4 shows the efficiency comparison

Electrofenton and electrocoagulation methods shows high removal efficiency compared to the convention removal methods

4 CONCLUSION

From the result obtained it can be concluded that; Various conventional methods for waste water treatment are present from ancient times, but most of them are complex and lengthy in nature. EF and EC process can minimize most of the disadvantages of conventional processes. Percentage removal of BOD, COD for EF process 94.18, 95.48 and for EC process 86,87.69 Percentage removal of Turbidity, Alkalinity for EF process 75,51.35 and for EC process 63.5,43.24 respectively. Removal efficiency is higher for EF process as compared to EC process. Costs of both processes are nearly equal. EF process is a promising technology for applications in waste water treatment

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