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Domestic wastewater Treatment by Electro-coagulation

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Abstract - T*he treatment of waste water has become an absolute necessity. An innovative cheap and effective method of purification and cleaning wastewater before discharging into any other water system is needed.*

The present study was to conduct to investigate the applicability of the electro coagulation technique for the treatment of domestic wastewater at S.T.J.I.T Ranebennur. Electro-coagulation is a surface reaction. In this experiment the sample are used at different voltage of current is passed in the sample (5V, 10V, 15V) and at distance of 3, 5, 7cm. The electrodes used are Aluminum and Iron. The combination effects pH, Turbidity, Acidity, and Alkalinity, from the domestic waste water showed that only current (c) have correlation with each other.

Key Words: Domestic wastewater, Electro-coagulation, Iron and Aluminium electrode, Voltage regulator.

1. INTRODUCTION

Electro-coagulation technology is a treatment process of applying electrical current to treatment and flocculate contaminants without having to add coagulations. We started that coagulation occurs with the current being applied, capable of removing small particles since direct current applied, setting them into motion. Also electrocoagulation could reduce residue for waste production.

Electro-coagulation consists of pairs of metal sheets called electrodes that are arranged in pair of two-anode and cathodes. Using the principles of electrochemistry, the cathodes is oxidized while the water is reduced, thereby making the waste water better treated. When the cathode electrode makes contact with waste water, the metal is emitted into the apparatus.

When this happens, the particles are neutralized by the formation of hydroxide complexes for the purpose of forming agglomerates. These agglomerates begin to form at the bottom of the tank and can be siphon out through filtration.

To consider how effective the Electro-coagulation reactor can be, one must consider the following inputs or variables- wastewater type pH, current density, type of metal electrodes (aluminum, iron), number of electrodes, and configuration of metal. This variable would affect the overall treatment time, and also the removal efficiency measured.

1.1 OBJECTIVE

1. Performance and evaluation of electro coagulation of Al-Fe electrodes with respect to pH, Voltage and Distance.
2. To study and understand the fundamental of coagulation process.
3. To influence the characteristics of domestic waste water.
4. Differentiate the domestic waste water properties before and after treatment.
5. To remove impurities present in the waste water.

1.2 Literature Review

1. **C. Sarala.**

   "Domestic waste water treatment by EC with Fe-Fe electrodes" The study was to conduct to investigate the applicability of the electro coagulation technique for the treatment of domestic waste water treatment at JNTU Hyderabad.it observed that the bath which is operated at 0.21A for 20min has mix removal efficiency of COD, TDS, pH, Colour, Chlorides at al..

2. **Amar Pratap Singh at al...**

   "Domestic waste water treatment by using EC process" The main aim of this paper presents the difference in treated water quality obtained from conventional sewage treatment plant and other obtained from EC method of treatment.

3. **Barun Kumar Nandi et al.(2016)..**

   "Treatment of domestic waste water by EC process" In this work , applicability of electro coagulation for treatment of domestic waste water has been studied using Aluminum electrodes. The finding in this study shows that an increase in the current density from 34.7 to 133.8 a/m2.

2. MATERIALS AND METHODOLOGY

2.1 Study area.

The collage is located at Ranebennur, Haveri District, a 52 acres site, about 5Km From the heart of the city. The climate of Ranebennur is very hot in summer and generally dry except during the southwest monsoon season the average rain fall is 8500 mm.

All the experiment was conducted in batches. In each experimental run a wastewater sample of 3 liters was collected and placed in electrolytic cells.

2.2 Equipment and Materials.

Electro-coagulation unit with dimension with height: length: width at 30:12:16 cm. on the inside of reactor a aluminum plate is placed as anode and a steel plate is used as cathode of size 10* 3*3 with 0.2 cm thickness the total plates used are 36. Rapid stirring 150 rpm and slowly stirring of 60 rpm during an hour.an regulated direct current supply (0-20V) was used for the experiment.

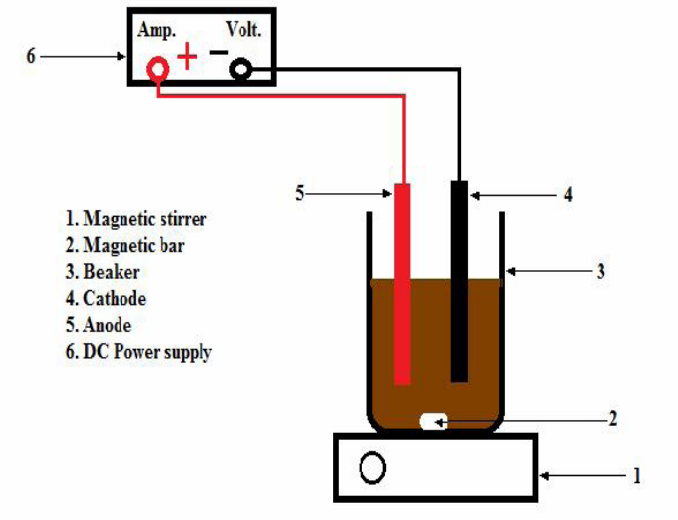

Fig : 1 Experimental set up.

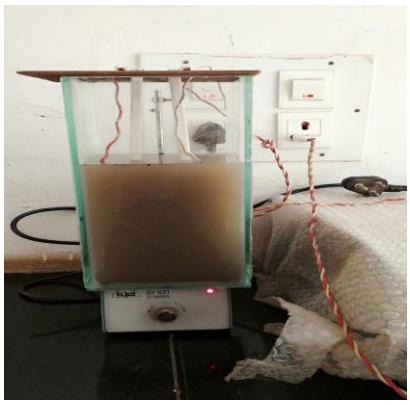

Fig : 1.1 The experimental set up of Electro-coagulation.

2.3 Methodology

The each batch experiment was conducted with a waste water sample of 3 liters. The sample was rigorously stirred by a stirrer. The iron electrodes were dipped in the solution up an active surface area. The following currents of 5, 10, 15V were passed for constant time of 30, 45 and 1 hour.

2.3.1 Determination of optimum Voltage.

To determine optimum voltage, the process was carried out at various voltages of 5V, 10V, 15V for electrodes, the distance and pH was fixed based on the previous experiments. During the end of experiment run, samples were collected and analyzed for different parameters.

2.3.2 Determination of Optimum pH.

To determine optimum pH efficient treatment of distillery spent wash, pH is varied for 5, 7, 9 and then the sample were analyzed for different parameters.

2.3.3 Determination of Optimum distance.

To determine optimum distance process was carried out at various distance of 3cm, 5cm, and 7cm for between the electrodes, the voltage and pH was fixed based on the previous experimental run, samples were collected and analyzed for different parameters.

3. RESULTS AND DISCUSSIONS

The removal efficiency of parameters with variation of pH, Voltage, Distance was compared and optimum conditions were obtained.

3.1 Considering pH 5 as constant.

Waste water sample was collected from S.T.J,I,T college ,Ranebennur, Karnataka. The sample was analyzed in environmental engineering laboratory, department of civil engineering.

Table 3.1: Initial characteristics of Domestic waste water

Sr. No	Parameters	units	Values
1	Acidity	mg/l	156
2	Alkalinity	mg/l	276
3	Turbidity	mg/l	92
4	TDS	mg/l	640

Constant distance of 3 cm:

Reduction of electrical conductivity by electro coagulation using Al-Fe electrode with constant distance 3 cm and pH 5 and variation of voltage 5V, 10V, 15V were analyzed and results were obtained as shown in Table 3.2

Table: 3.2 Constant distance 3 cm.

No		Before	After		
	Parameters		5 V	10 V	15 V
1	Acidity	156	56	52	54
2	Alkalinity	276	124	110	116
3	Turbidity	92	16	11	14
4	TDS	640	352	374	394

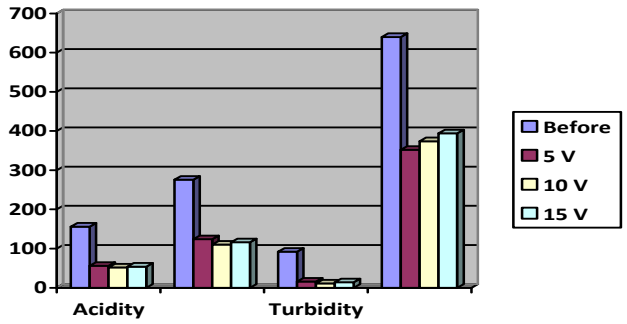

Fig 4.1: Reduction of parameters at constant distance 3 cm.

From the bar chart (Fig 4.1) it is observed that at pH 5,3cm constant ,the maximum removal efficiency of parameters are at 10 V of 65.3%.

Constant distance of 5 cm:

Reduction of electrical conductivity by electro coagulation using Al-Fe electrode with constant distance 5 cm and pH 5 with variations of voltage 5V, 10V, 15V and result were obtained in table 3.3.

Table: 3.3 Constant distance 5 cm.

No		Before	After		
	Parameter		5 V	10 V	15 V
1.	Acidity	156	46	38	42
2.	Alkalinity	276	108	92	102
3.	Turbidity	92	11	9	12
4.	TDS	640	332	314	336

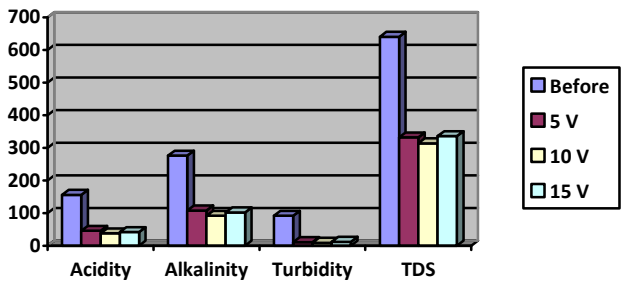

Fig: 4.2 Reduction of parameters at constant distance 5 cm.

From the bar chart (Fig 4.2) it is observed that at pH 5,3cm constant, the maximum removal efficiency of parameters are at 10 V of 69.6%.

Constant distance of 7 cm:

Reduction of electrical conductivity by electro coagulation using Al-Fe electrode with constant distance 7 cm and pH 5 with variation of voltage 5V, 10V, 15V and result were obtained in table 3.4.

Table 3.4 Constant distance 7 cm.

No		Before	After		
	Parameter		5 V	10 V	15 V
1	Acidity	156	42	41	45
2	Alkalinity	276	106	98	104
3	Turbidity	92	11	10	12
4	TDS	640	320	318	326

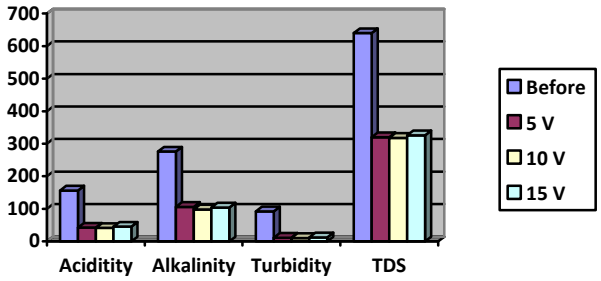

Fig 4.3 Reduction of parameters at constant distance 7 cm.

From the bar chart (Fig 4.3) it is observed that at pH 5, 7cm constant, the maximum removal efficiency of parameters are at 15 of 62.3%.

4. CONCLUSIONS

From the present study, it was concluded that the treatment process had shown feasible activity in removing the impurities present in the Wastewater.

- EC is the technology which can be instilled for the treatment of domestic waste water as it provides better result.
- Electro-coagulation method of treatment is very much beneficial as it provides water quality which can be reused for various applications.
- EC technology can also be employed along with conventional method.

Development of advanced materials and applications of different electrode types brings a new dimension to electrocoagulation. Different electrode materials can be used axis different coagulant types for specific pollution.

For pH 5, at constant 3 cm, the efficiency reduced is 65.3%. At constant 5 cm, the efficiency reduced is 69.6%. At constant 7 cm, the efficiency reduced is 62.3%.

So as we can conclude that the high removal efficiency is obtained at lesser distance between the electrodes.

Increasing the applied voltage cause the energy consumption to increase. Indeed, the highest voltage produces quickest treatment with effective reduction.

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