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TREATMENT OF HOSPITAL WASTEWATER BY USING ELECTROCOAGULATION

Kumara kaththemaradi[1], K.M. Sham Sundar[2], D.P Nagarajappa[3]

[1]PG Student, Department of civil Engineering UBDT College of engineering Davanagere Visvesvaraya Technology University Belagavi-590018 Karnataka, India
[2] Professor Department of civil Engineering UBDT College Engineering Davanagere Visvesvaraya Technology University Belagavi-590018 Karnataka, India
[3] Professor Department of civil Engineering UBDT College Engineering Davanagere Visvesvaraya Technology University Belagavi-590018 Karnataka, India

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Abstract *- The Hospital Wastewater came from diverse hospital activities, as in operation theatres, laundries, and laboratories, requires treatment. There are many conventional and modern methods utilized to treatment of wastewater, including the Electrocoagulation method. This method is preferred due to its ease of operation, lack of secondary pollutants, and cost- effectiveness. The Electrocoagulation method involves the usage of Aluminum and Iron Electrodes. The variables of electrolysis time (30M, 60M), electrode distance (2cm, 4cm), and voltage variation (10 V 20 V 30 V) are considered during the process. The most severe removal Effectiveness was noted when the voltage was 30, and time was 60 minutes, with an electrode distance of 2cm. The values of TS were 86%, TDS were 87.97%, SS were 70.83%, BOD was 85.27%, and COD were 70.28%. The outcomes were contrasted with the BIS standard of the wastewater.*

Key Words: **Hospital wastewater, electrocoagulation, Aluminium and Iron Electrodes**.

1.INTRODUCTION

The generation of wastewater effluent is increasing day by day due to the development in medical services and products. the main source of Hospitals wastewater, which includes surgical waste, drug treatments, radiology waste, laundry waste, operation room waste, biological and chemical laboratory waste etc. The Release of pollutants from hospital sewage discharged onto the environment can pose serious threats to environment protection and health care. The hospital wastewater (effluent) generated from the hospitals length of stay for treatment during the operation theatre laboratory testing of the blood samples urine samples and many other tests of the hospital generated derived from sewage from the different sources of the hospital units. Electrocoagulation technology is treatment of wastewater method that which utilizes electrical current without the inclusion of any coagulant. When electric flow is supplied in the reactor, electrocoagulation occurs. Ions metals from the off from the anode lose electrons and combine with in the wastewater there are ions. This reaction results in the emergence of flocs, with some settling at the base and others moving upward due to the create of hydrogen and oxygen bubbles at the cathode. The hydrogen gas aids in the upward movement of water containing pollutants. The response between ions and wastewater depends on the solutions conductivity, which determines the effectiveness of the therapy on the other. the within the cathode gains electrons and gets reduced, improving the degree of water treatment. The metal ions formed with the anode react with hydroxide ions (OH-) from the water to form highly charged coagulants that reduce the consistency of suspended particles. For example, ions of aluminum (Al3+) react with hydroxide ions to forming aluminum hydroxides (Al (OH)3), which are efficient coagulants.

1.1 OBJECTIVES

- To investigate the primary features of Hospital Wastewater.
- To investigate the impacts operating parameters such as Electrode Distance, Voltage, and Time and to determine the optimum condition for treatment using iron and aluminum as Electrode.

2.MATERIALS AND METHODOLOGY

2.1.MATERIALS ARE USED TO THE WORK

The experimental methods include the material and claim methods utilized the experimental process according to the objectives of the design work

- Glassware Used

Borosilicate glass materials stayed used in Laboratory and I can wash before using in the experiment commonly used for the beakers, reagent bottles, 1000ml beaker, and burette funnels.

- Instrument Used

Reactor, Electrodes, magnetic stirrer, DC power supply, pipette, pH meter, open reflex COD digester, TDS meter,

chain dish, HOT air oven, BOD bottle BOD Incubator are the mechanism used

- Chemicals Used

The chemicals used are Standard potassium dichromate, ferroin indicator, ferrous ammonium sulphate mercuric sulphate, phosphate buffer, manganese sulphate, ferric chloride, sodium thiosulphate solution. calcium chloride

2.2 Sample Collection

The Hospital sample of wastewater were grasp from taluk General Hospital huvin Hadagali Government Hospital. Hospital consumes huge quantum of water a day. While the value generally admitted for Hospital varies part such as hospitalization surgery room, laboratories administrative units, laundry, health services. The hospital wastewater was gathered in the polythene water flask and stored in the refrigerators at 4^{o} C in sequence to clog the microbial activity.

Figure 1: Government Hospital of huvin **Hadagali**

2.3 Study of Hospital Wastewater characteristics

The initial the hospital wastewater characteristics sample collected from General Hospital Huvinhadagali are analyses using quality laboratory methods. The typical the wastewater characteristic and the testing procedure for specific parameters are explainedbelow.

a) pH: The electrometric pH test carried out in lab setting with standard pH equipment. It measures the presence of hydrogen ions in water and waste samples, indicating their acidity or alkalinity. The pH scale ranges from 0 to 14, with values below 7 indicating acidity and values above 7 indicating alkalinity. For effluent prior discharge, the pH must be within the verity of 4-8 according to international standards

b) Total Suspended Solids (TSS): TSS relates to the quantifying of pollutants that have a density eminent than 1 or exceed 2 microns in dimensions. These solids can settle at the bottom by filtration using standard apparatus. The TSS test is conducted by filtering the sample through filter paper and drying it trendy an oven. TSS is expressed inmilligrams per liter (mg/l).

c) Total Solids (TS): TS measures both SS and DS present in the sample. It is findings by adding the TSS and dissolved solids together. TS is also expressed in milligrams per liter (mg/l).

d) BOD: BOD measures the quantity of DO require by bacteria for the consumption or decomposition of animate materials in wastewater. The BOD test involves the difference in dissolved oxygen levels between the starting day and after 5 days of storage in a BOD digester. BOD is reflected in milligrams per liter (mg/l).

e) COD: COD measures the mass of oxygen need by bacteria to consume both organic and inorganic matter and convert it into a stable form. COD is always more than BOD and measurable within 3 hours. The COD test is led using a standard chemical method involving a COD digester.

2.4 Experimentation

Testing of the Electrocoagulation process is performed out by using followingexperimental setup and course of action as mentioned below

2.4.1 Experimental Setup

The experiment for Electrocoagulation was completed in a 2000ml borosilicate beaker using Aluminum and Iron plates as anode and cathode electrodes. The dimensions of the electrodes had been 15cm x 5cm x 0.2cm, and the spandrel area of the electrodes was 20cm2. All told of 1000ml of Hospital wastewater model was included to the beaker, and the electrode space was kept at 2cm and 4cm the for proper mixing the container was setupon a electric stirrer and fish cistern aerator was employed for aeration in the vessel. Figure 3.3 shows the typical setup for leading the Electrocoagulation experiment, while the pictorial sight of Aluminum and Iron electrodes and the experimental arrangement used for Electrocoagulation process is shown in the Figure 3.4 Iron and Aluminum Electrode plates for Electrocoagulation.

Fig 2: Experimental set up by Electro Electrocoagulation

Figure 3: Iron and Aluminum Electrodes

2.4.2 Experimental Procedure

- The experiment started by adding 1000ml of Hospital Wastewater sample into a 2000ml Borosilicate beaker.
- The Aluminum and Iron electrodes were then underwater into the beaker stifle the waste sample with a spacing of 2cm and 4cm
- These anode and cathode Electrodes were linked to the (DC) Power Supply unit to dispense the desired current.
- According to the first run in the experimental and the electrolytic cell by a sample turning on the electric current.
- After turning on the electric current, the Ampere and voltage was adjusted, and the sample was stirred in the response duration as per the first run.
- Following that the specimen was then allowed to settle for certain period, and the supernatant was collected for wastewater quality scrutiny.

Comparison of Acceptable limit to Permissible limit from BIS Standard withActual Experimental Results

After all the runs of Electrocoagulation after which the actual experimental values are compared to the BIS Standard and established by graphical representation. The following action are taken followed for Comparing Actual Experimental and graphing in

- Then go to select the column charts.
- All the actual results are input the graphs data table in M S excel.
- Now in the below click
- on the graphs and differentiate of BIS standardthick line represent the BIS standard acceptable limit to permissible limit.
- For comparison of Experimental results with BIS standard acceptable andpermissible limit.
- For graphical representation of Trial results to BIS standard.

3. RESULTS AND DISSCUSSIONS

3.1 General

The analysis of hospital wastewater was achieved by electrocoagulation processby varying the voltage, distance, and elastolysis timings and compared with BIS standards was discussed as follows.

Initial Characteristics of Hospital Wastewater

The Preliminary Characteristic and Excellence of The Hospital Wastewater below Laboratory Conditions Are displayed in under the Table

Table1: Initial Characteristics of Hospital Wastewater

S l no	Parameters	Unit	Quantity
01	pH	-	9.3
02	Total Solids	mg/l	5006
03	Total Dissolved Solids	mg/l	4430
04	Suspended Solids	mg/l	576
05	BOD	mg/l	720
06	COD	mg/l	1565

30Voltage 30Minitues 4cm Distance

Table 2: Experimental Parameters at Different conditions with voltage

Sl no	Parameters	Effluent Quantity	Unit	% Removal
01	pH	8.3	-	-
02	Total solids	3354.02	mg/l	33%
03	Total Dissolved Solids	2973.98	mg/l	32.86%
04	Suspended Solids	380.04	mg/l	34.02%
05	BOD	439.2	mg/l	39%
06	COD	923.35	mg/l	41%

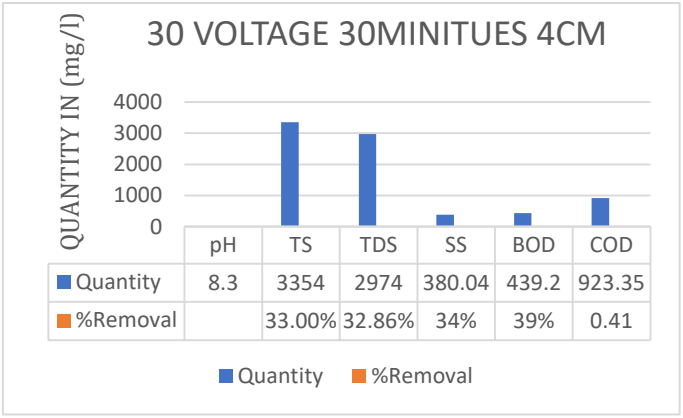

Figure 4: Effects Of 30Voltage, 30Minitues, 4 cm Distance.

The when removal efficiency was measured Voltage was30, Electrolysis Time 30 Minutes and Electrode distance was 4cm. The values of TS being 33%, TDS being 32.86%, SS being34.02%, BOD being 39%, COD being 41%, were recorded.

30 Voltage 30 Minutes 2cm Distance

Table 3: Experimental Parameters at Different Conditions with voltage

S l no	Parameters	Effluent Quantity	Unit	% Removal
01	pH	7.7	-	-
02	Total Solids	2052.46	mg/l	59%
03	Total Dissolved Solids	1833.58	mg/l	58.60%
04	Suspended Solids	218.88	mg/l	62%
05	BOD	280	mg/l	61%
06	COD	579.05	mg/l	63%

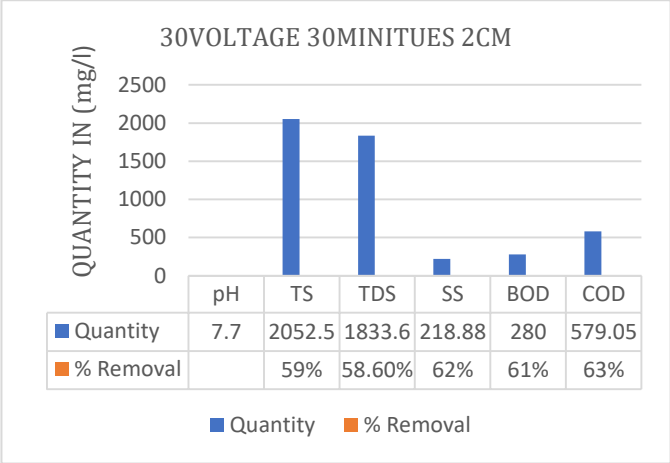

Figure 5: Effects of 30Voltage, 30minitues, 2cm Distance.

The when removal efficiency was measured Voltage was30, Electrolysis Time 30Minutes and Electrode distance was 2cm. The values of TS being 59%, TDS being 58.60%, SS being 62%, BOD being 61%, COD being 63%, were recorded.

30volage 60 Minutes 4cm Distance

Table 4: Experimental Parameters At Different Conditions With Voltage.

Sl no	Parameters	Effluent Quantity	Unit	% Removal
01	pH	8	-	-
02	Total solids	1852.22	mg/l	63%

03	Total Dissolved Solids	1557	mg/l	64.85%
04	Suspended Solids	295	mg/l	48.78%
05	BOD	244.656	mg/l	65.02%
06	COD	547.437	mg/l	66.02%

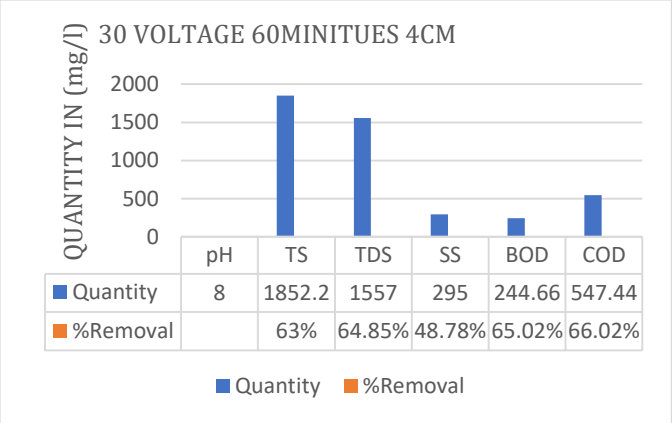

Figure 6: Effects of 30 Voltage, 60 Minutes, 4cm Distance.

The when removal efficiency was measured Voltage was30, Electrolysis Time 60 Minutes and Electrode distance was 4cm. The values of TS being 64.85%, TDS being 48.78%, SS being65.02%, BOD being 65.02%, COD being 66.02%, were recorded.

30volage 60 Minutes 4cm Distance

Table5: Experimental Parameters At Different Conditions With Voltage.

Sl no	Parameters	Effluent Quantity	Unit	% Removal
01	pH	7.7	-	-
02	Total solids	700.84	mg/l	86%
03	Total Dissolved Solids	532.84	mg/l	87.97%
04	Suspended Solids	168	mg/l	70.83%
05	BOD	230.4	mg/l	85.27%
06	COD	465	mg/l	70.28%

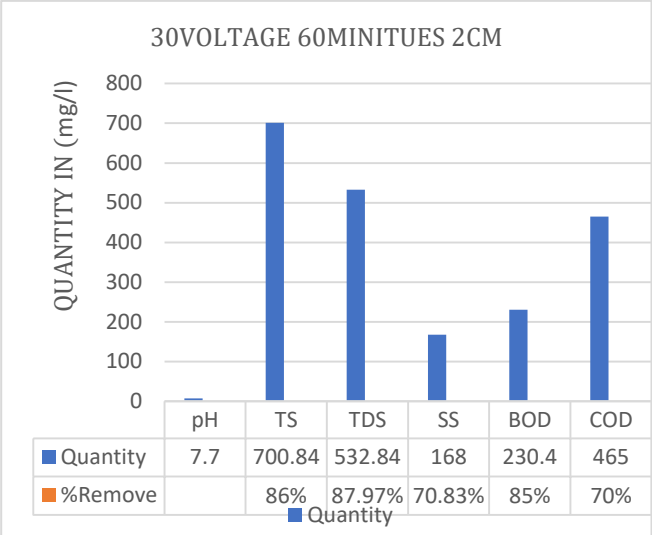

Figure 7: Effects of 30 Voltage, 60 minutes, 2cm Distance.

The when removal efficiency was measured Voltage was30, Electrolysis Time 60 Minutes and Electrode distance was 2cm. The values of TS being 86%, TDS being 87.97%, SS being70.83%, BOD being 85.27%, COD being 70.28%, were recorded

4. CONCLUSIONS

- In this present work the treatment of hospital wastewater by using electrocoagulation was done, conclusions were obtained as follow.
- The Independent variables like Electrode Distance, Electric Current, and Electrolysis time to the Treatment of Hospital wastewater which affects the Proficiency of TS, TDS,SS, BOD and COD removal.
- The ideal Conditions for greater removal Efficiency of TS, TDS, SS, BOD and COD was achieved at Electrode distance 2cm, Electric current of 30 Voltage, and Operating time of EC (60 min) for Al-Fe Electrode.
- The actual TS, TDS, SS, COD and BOD removals at optimized conditions are find to be 86% 87.97% 70.83% 85.27% and 70.28% respectively, which was nearer to values of BIS standard for wastewater characteristics.
- Comparisons of BIS standard with Experimental results to the graphical representationof pH, TS, TDS, SS, BOD, COD.

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BIOGRAPHIES

KUMARA KATHTHEMARADI PG STUDENT OF UBDT COLLEGE DAVANAGERE.