

AN EXPERIMENTAL STUDY ON THE TREATMENT OF WASTE WATER GENERATED FROM HOSPITAL USING ELECTRO COAGULATION METHOD

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Abstract

Hospitals consume significant amount of water. The water which is generated as waste by the hospitals includes pathogens such as bacteria, viruses and other medical wastes. In this paper an attempt has been made for treating hospital waste water containing harmful ingredients using electro coagulation. The same water can be reused after treatment. This method is effective for the treatment of hospital waste water, because of its low operation and maintenance cost, high efficiency, time saving, lower sludge production without any addition of chemicals. When the process of electro coagulation was done the pH was brought down from 8.14 to 7.4 and the concentration chloride ion was also reduced. The chemical and biological oxygen demand was too removed. The TDS, TSS and electrical conductivity of the water were also reduced by electro coagulation.

Keywords: Biological Oxygen Demand, Chemical Oxygen Demand, Electro coagulation, TDS, TSS.

1. Introduction

Wastewater originating from different sources like domestic, industrial, commercial, agriculture activity may create threat to human life. The waste water generated from hospital, along with Municipal wastewater is usually conveyed in combined sewer and treated

at wastewater treatment plant. This may creates heavy load to the wastewater treatment units. The wastewater which is generated from hospitals contain solids, toxic pollutants, metal oxides, hazardous liquid waste from various units, pharmaceuticals, radioactive waste,

bacteria, viruses, blood etc. It also contains high BOD and COD content in the water are due to solids and bacterial presence. Thus to prevent heavy load in treatment plants, the waste water generated from the hospitals can be treated onsite by creating a small treatment plant. The treated water can be reused for various purposes in the hospital. Some conventional methods which are available for the treatment of waste water like, ion exchange, adsorption, coagulation – flocculation, chemical oxidation, reverse osmosis, filtration, ultra filtration etc. are expensive. Electro coagulation is one of methods for treating waste water. This method is highly accepted for the treatment wastewater due to its low cost, easy in operation, low sludge production, low operational and maintenance cost. An attempt has been made in this project to treat the waste water generated in hospital by using electro coagulation method.

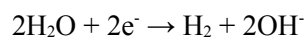
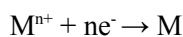
Electro coagulation process produces less TDS when compared with other chemical treatment process and also the maintenance cost will be less as it does not involve any moving parts for treatment of water. The removal efficiency can be improved by using AC instead of DC.

2. Electro Coagulation Mechanism

Electro coagulation technology makes use of electrical current for the treatment of wastewater without adding any coagulant. The electrodes used are mild steel and aluminium.

When electric current is supplied in the reactor, coagulation occurs. The metal ions from anode lose electrons and get combined with the ions present in waste water. The reaction between ions takes place, results in the formation of floc. Some settles at the bottom while some moves upward due to formation of hydrogen and oxygen bubbles at cathode. This hydrogen gas helps in the upward movement of water containing pollutants. The reaction between ions and the wastewater depends on the conductivity of the solution, which impart the efficiency of the treatment. On the other hand, the cathode gains electron and gets reduced. Thereby making water better treated. The metal ions which are released from the sacrificial anode, combines with hydroxide ions produced at the cathode.

This results in the formation of polymeric metal hydroxides, which are excellent coagulants. These coagulants trap and remove contaminants present in the water.

General reactions at anode:**General reactions at cathode:**

The Electro coagulation mechanism depends mainly on the chemistry of aqueous medium, especially conductivity and also on other characteristics such as pH, particle size, and chemical constituent concentrations.

3. Experimental Study

The experimental study consists of developing a prototype for treating the waste water collected from Sri Ramachandra Medical College and Hospital.

Properties of raw water sample:

The waste water has been collected and it was tested for the following properties.

Table 1: Properties of Raw water

S.No	Property	Value
1	pH	8.14

2	B.O.D (mg/l)	350
3	C.O.D (mg/l)	248
4	Chloride concentration (mg/l)	800
5	TDS (mg/l)	793
6	TSS (mg/l)	0.015
7	Electrical conductivity (μ S/cm)	1220

Prototype Specifications:

Diameter : 0.2m

Depth : 0.1m

Capacity : 2 L

Electrodes : Mild Steel and Aluminium

Electrode dimension: 8cm x 5cm

Input power : 0 to 30v (AC)



Fig 1: Prototype of EC unit

Stages of Treatment:

The sample water undergoes three stages of treatment, which depends on the power supply.

Primary Treatment:

During this process all the impurities like floated particles and small size unwanted particles were removed, by varying the voltage from 0 to 10v.

Secondary Treatment:

In this process the voltage supply was limited from 10v to 20v where the BOD, COD and chlorides present in the water were removed.

Tertiary Treatment:

It is the final stage in treatment where the power source of 20v to 30v was supplied. All the remaining impurities present in the water was removed.



Fig 2: Formation of Floc

4. Results and Discussion

The following table shows the various results obtained after the tertiary treatment of raw water using electrocoagulation method. From the results it is clearly found that the waste water is very much treated by using EC method. The pH value gets reduced from 8.14 to 7.40 which show a reduction in the basicity of the water. The B.O.D and C.O.D content gets reduced about 99% and 98%. The

chloride content gets reduced about 96% from 800 mg/l to 30 mg/l. The total dissolved solid (TDS) present in the raw water comes down from 730 mg/l to 65 mg/l, which shows a reduction of 91%. The total suspended solid (TSS) gets reduced from 0.015 mg/l to 0.008 mg/l and the electrical conductivity of the treated water is 200 $\mu\text{S}/\text{cm}$ which reduced from 1220 $\mu\text{S}/\text{cm}$ of raw water.

Table 2: Properties of Treated water

S.No	Property	Value
1	pH	7.40
2	B.O.D (mg/l)	3
3	C.O.D (mg/l)	5
4	Chloride concentration (mg/l)	30
5	TDS (mg/l)	65
6	TSS (mg/l)	0.008
7	Electrical conductivity (mg/l)	200

5. Conclusion

The study performed on the treatment of hospital waste water shows that Electro Coagulation is the most effective and

economic way of treating the water. The prototype can be developed into a treatment unit based on the waste water generated. The treated water can be reused for various purposes in the hospital itself like toilet flushing, floor cleaning, washing instruments etc.

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