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TO IDENTIFY THE HEAVY METALS AND REMOVAL OF MAJOR QUANTITY BY ELECTRO COAGULATION PROCESS IN THE TREATMENT OF SUGAR INDUSTRIAL WASTE WATER

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Abstract
The profitable treatment of waste water of sugar industry is a very stimulating task. In our experimental study, try to attempt was taken for the treating of waste water of sugar industry using a new technique namely electrocoagulation technique. Here few metals like lead (Pb), Zinc (Zi), Arsenic, Copper (Cu), manganese (Mn) and iron (Fe) are found as the major pollutant and here we also seen how metal can be removed. After the removal of conductivity and chloride the analysis waste water after treated and show that the maximum conductivity and chloride removal efficiency are found 93% and 92.5 % respectively at ideal conditions. And Chemical oxygen demand (COD), with or without addition of electrolytes i.e effect of electrolytes. Colour removal efficiency has also been seen along with chloride and conductivity COD has been removed up to 79.5% without mixing of polyelectrolytes and colour 95.8%.

Keywords: Electrocoagulation process, Electrode, Current, sugar industry wastewater.

I. Introduction

Electrocoagulation, this method has been seen that it is most valuable method for removal of different kind of pollutant from waste water. It is easily available, cheap, equipped, simple and environmentally friendly. Sugar has categorized in different graded system lime S-30, S-31, M-31, M-30and L-30. Here the S, M, L indicate the size and numbers 30 and 31 is indication the colour coding. Ion's exchange is also used as the valuable process to detect the heavy metal comes with industrial water along with sugar industry. Waste water as the industrial effluent is generally treated by this ions exchange process. High capacity of treatment and high kinetics efficiency is the main advantages. Resins are used in both ion in synthetic and natural form in ion exchange.

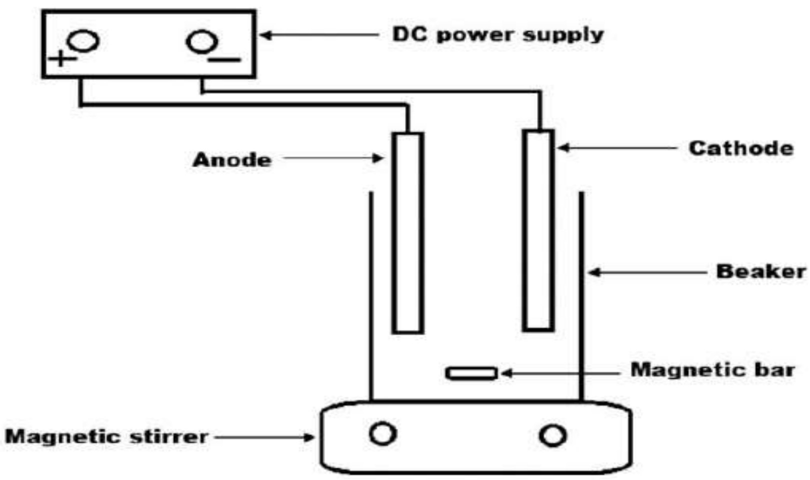

Figure 1: **Electrocoagulation process**

The activated carbon absorbents are very common absorbent used for the elimination of heavy metal ions as compare to other absorbents. It comprises huge volume of micropore and mesopore which create large area and this is the major benefit of this activated carbon absorbents. Researcher are found that, this is the best part to remove the toxic metal of activated carbon absorbent.

In the year 1991 a scientist lijima has discovered about CNT. He introduced about the features of CNT and elaborate the basis properties and idea of their various uses (applications). It has been found that it gives enormous result in the form removal of toxic metal present in the sugar waste water like nickel, chromium, lead by the process of absorption gives the outstanding result of removal of some common metal like Cd, Zn, Ni, etc. CNT are classified into two categories.

a. Sigle wall carbon nanotube absorbent (SWCNT) and
b. Multi wall carbon nanotube absorbent (MWCNT)

The steps of carbon nanotube absorbent is not very easy to performed so that the mechanism go through the absorption precipitation, electro-statics-attraction and chemical – interaction sandwiched between the surface of a group (functional) and from some heavy ion of CNT absorbed.

II. Literature

Sweta Chandra and Devendra Dohare (2020) The motive of this research is to explain the method of electrocoagulation in detail and how it works as the process of removal of heavy metal. They discuss about this method and mechanism by many affected ranges such the value of pH, electrode material, inter electrode, voltage, current density, time, initial concentrations that has been publish in their journals.
Amira Doggaz et, al. (2019) They investigate about the Electrocoagulation method over iron (divalent) and zinc (cation) from fresh water with the use of aluminium electrode in a discontinuous system. They have seen that all effects of hydro-carbonate by frequently use in liquid wastewater and also in groundwater on the particular electrocoagulation. Variation in pH through its buffering property & reduce the rate of aluminium dissolution by corrosions. To remove these cations, treatment time has increased and huge aluminium has dissolved in huge quantity.

Salman Hussein Abbas and wail Hussan Ali (2018) This review paper focuses on numerous studies that explore the effectiveness of the method of electrocoagulation in treating industrial waste water and removing a wide range of impurities, including colour, COD (Chemical Oxygen Demand) and BOD (Biochemical Oxygen Demand), turbidity, and metal ions. The paper examines various factors that can influence the Electrocoagulation process, These parameters, including pH, current density, applied voltage, agitation speed, type and size of electrodes, number of electrodes, inter-electrode distance, initial concentration of contaminants, and electrolysis time, were considered and optimized to assess their impact on the electrocoagulation process for heavy metal removal.

Mohammad Al-Shannag, et. Al. (2015) A study was conducted to examine the usefulness of the electrocoagulation (EC) process in removing heavy metals io, specifically Cu^{2+}, Cr^{3+}, Ni^{2+}, and Zn^{2+} from metals electroplating waste water. Remarkably, the EC treatment achieved an efficient removal rate of over 97% for heavy metals ion by operating at a current density (CD) of 5 mA/cm^2, a pH of 8.65, and a time of electrocoagulation is 45 minutes. Underneath these situations, the specified energy consumptions were approximately 6.25 kWh/m3, and the dissolved electrode mass was around 1.21 kg/m^3.

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III. Objective

The objectives of this thesis are-

- To identify and measure the quantity of heavy metal presents in the sugar industrial wastewater.
- To remove conductivity and chloride at different pH value
- The probability of this electrocoagulation method in removing heavy metal from waste water in sugar industry (Dwarikesh Puram Plants).
- The objective was to evaluate the influence of various parameter levels in electrocoagulation for the efficient removal of heavy metals and optimize the process accordingly.
- To understand the electrocoagulation process in details.

IV. Methodology

The electrocoagulation technique is extensively utilized for wastewater treatment, employing an electrochemical cell as the primary means of water treatment. An electrochemical cell typically comprises two electrodes, the anode and the cathode, which are submerged in a conductive solution called the electrolyte. These electrodes are connected by an electrical circuit containing a current source and a control device.

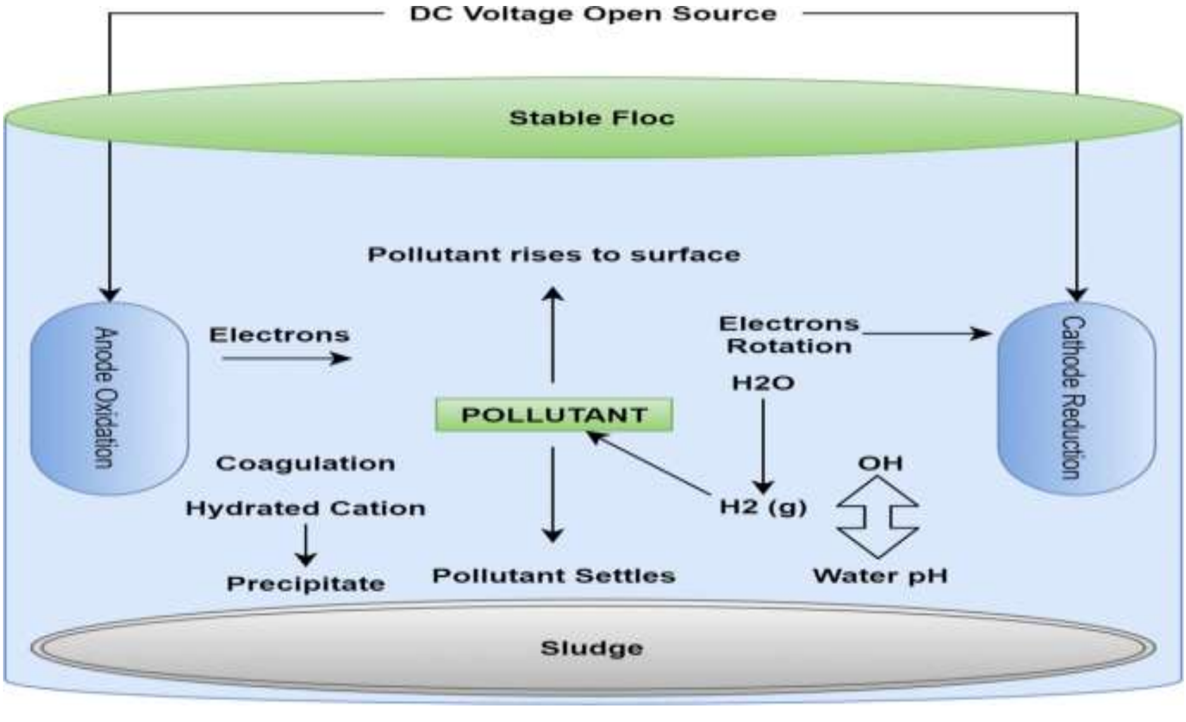


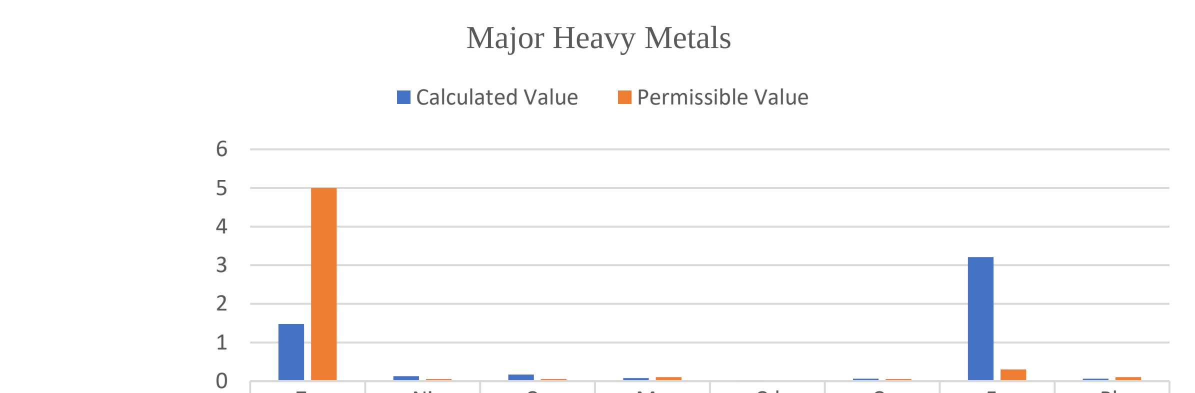
Figure 2: **Process of electrocoagulation in details**

The analysis of the Electrocoagulation system involves several steps:

1. The sacrificial electrode undergoes electrolytic oxidation, leading to the formation of coagulants.
2. At the surface of cathode, the formation of OH ions and H2 takes place.
3. Electrolytic reaction occurs at the surfaces of the electrodes.
4. Contaminants, particulate suspensions, and emulsions undergo destabilization.
5. The destabilized phases aggregate to form flocs.
6. Colloids are removed through either alluviation or flotation.

V. Results

In our study, we observed that the Nickle (Ni), Copper (Cu), lead(Pb), Iron (Fe), Cadmium(Cd), Manganese(Mn), Chromium (Cr) are found as heavy metal in sugar industrial waste water. From these major heavy metals, Zinc (Zn), and Iron (Fe) are present in excess quantity in sugar waste and heavy metals are very toxic for environment.



	Zn	Ni	Cu	Mn	Cd	Cr	Fe	Pb
Calculated Value	1.48	0.13	0.17	0.08	0.02	0.06	3.21	0.06
Permissible Value	5	0.05	0.05	0.1	0.01	0.05	0.3	0.1

Figure 3: **Concentrations of heavy metal in sugar waste water**

The current density has a significant impact on Electrocoagulation, particularly on the removal of COD and colour.

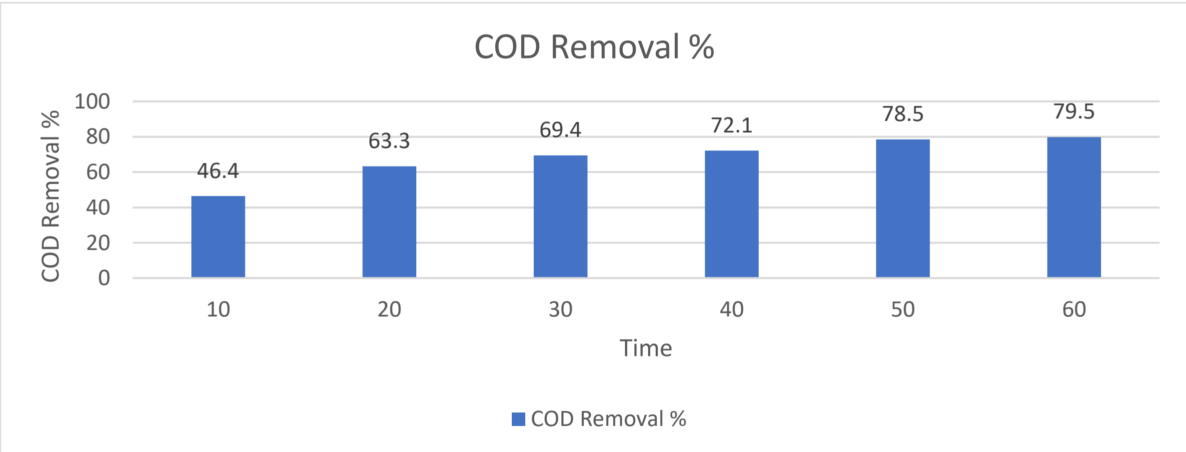


Figure 4: Effect of current density on COD Removal in % with time

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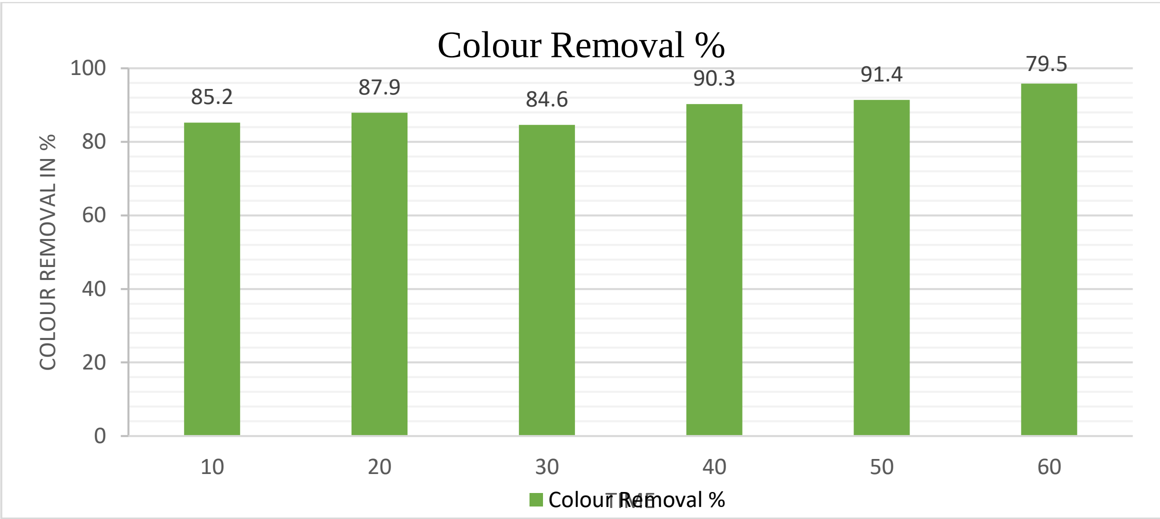

Figure 5: Effect of current density on Colour Removal in % with time

In order to enhance the performance of the aluminium reactor and achieve effluents that meet discharge standards, the utilization of polyelectrolyte as a coagulant was explored. The addition of polyelectrolyte aims to induce particle destabilization and increase particle size (up to 10 times), thereby facilitating the effective remove of organic substances present as COD. The results of this study, directed at a current density of 40 mA/cm^2 with the incorporation of polyelectrolyte, the COD removal efficiency improved from 79.5% to 81.2% after an operating duration of 60 minutes.

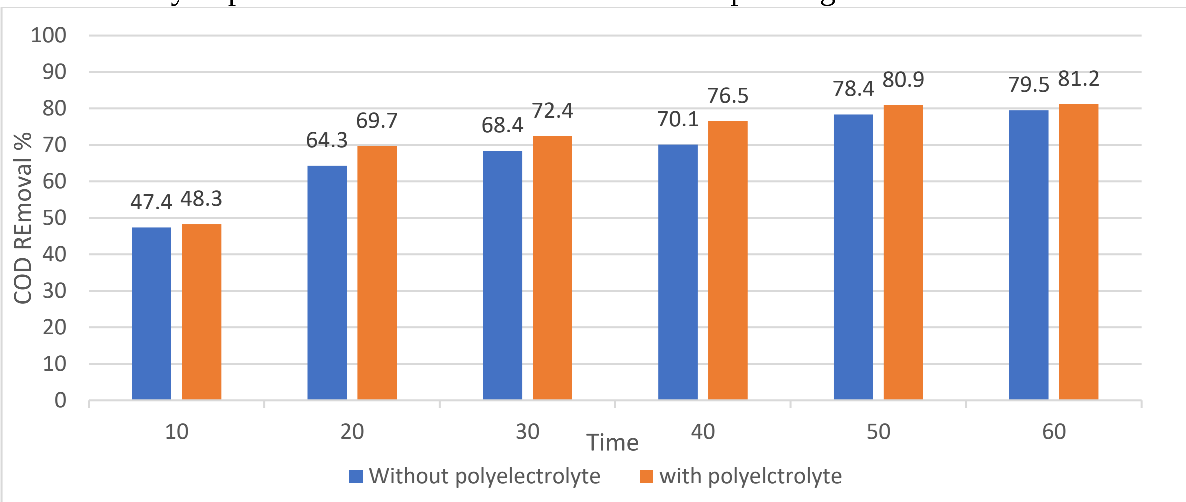

Figure 6: Effect of Polyelectrolyte on COD removal with time

VI. Conclusion

1. Based on our experimental study findings, the quantity of heavy metal like Zinc, Nickel, Copper, Manganese, Lead, Iron, Chromium and cadmium are present.
2. In this study it is very clear that only Fe (Iron) metal is present in waste water in excess (Fe 3.21mg/l) so we need to treated by compatible treatment processes.
3. The colour removal efficiency 95.8 % is the maximum efficiency at 60 minutes that can be removed by electrocoagulation process in sugar industrial waste water here.
4. Along this in our study we also seen the effect of electrolytes in finding of chemical Oxygen demand (COD) and have seen that the percentage of COD removal is increased after adding electrolytes as compare as comparison to with COD removal % without electrolytes.
5. After adding electrolytes, the COD removal is reached 81.2 as it was earlier 79.5.

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