

# Acceleration of Copper-Copper Electro Coagulation of Distillery Spent Wash Using Zinc Oxide As A Nanoparticles

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**Abstract-** The distillery industries contributing the lion's offer in the monetary development of the nation, for the ethanol generation. In distillery industry the liquid waste generated is known as spent wash. Characteristics of spent wash are high temperature, high BOD, COD, very low pH of about 4.2 to 4.5, dissolved organic and inorganic matter and ash content are at high range. Disposal of distillery effluent without proper treatment is regulated as it has negative impact on environment. Electrocoagulation is one of the commonly used technique for the treatment of distillery spent wash for removal of Color and COD. Electrocoagulation treatment using Copper-Copper electrodes result in the % removal efficiency of Color and COD of 96.81% and 93.31% respectively with optimum experimental conditions like pH 9, Voltage 15V, distance between electrodes is 3cm at constant time of 1.5hour. Acceleration of Copper-Copper electrocoagulation by addition of zinc oxide nanoparticle of dosage 2gm at optimized experimental condition the removal efficiency of Color and COD is 97.90% and 95.73% respectively. It is found that the Electrocoagulation method is efficient in treating distillery spent wash.

**Keywords-** Distillery industry, Distillery spent wash, Electrocoagulation treatment, Color, COD, Zinc oxide nanoparticles, Copper electrodes.

## I. INTRODUCTION

Water is the fundamental wellspring for survival of humankind, plants and including amphibian life. The water application for the most part consumable purposes ought to be free from unwanted contaminations or polluting influences. Release of wastewater is a noteworthy issue of human exercises from a decade ago is more. The best possible treatment of transfer required for squander water. Water cycle on earth surface types of condensation, transpiration, precipitation, evaporation and spillover. Transpiration and evaporation induces and increases the precipitation of surface land. Expansive amount of water joined with chemicals or

adsorbate minerals of hydrous. Industrial wastewater has been antagonistically influencing the individuals, plants and amphibian life to a specific moment since from numerous decades. Industrial wastewater is contained by different poisons released from the sources, for example, domestic, commercial, Industrial and Agricultural activities. Which experience extensive variety of toxins and with their high concentrations. The fundamentally pollution is from distillery ventures. By adopting treatment to the profulent from various polluting sources we can reuse and recover wastewater.

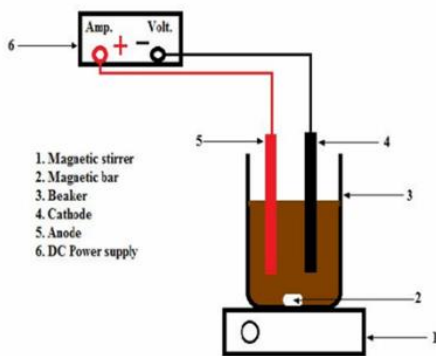
In India estimate fairly accurately 319 sugar organizations making ethanol 3.25 x 10<sup>9</sup> liters, creating 40.4 X 10<sup>9</sup> liters of expenditure each year. Most extreme distillery industries introduce on the planet are sugar base businesses. Ethanol generation in the refinery business is just around 5 to 12 percent by capacity that implies 88 to 95 percent squander water contained by capacity of liquor refined. About 10-15 liters of emanating are created for every liter of liquor. Refinery spent wash contains broke down polluting influences, supplements included amid the molasses maturation, by-results of aging and disintegration items. The suspended pollutions like tidy, cellulosic strands, and so forth are generally expelled primarily a grouping of juice.

In distillery spent wash is dim dark colored, exceptionally pH high, have more substance O<sub>2</sub> request and biochemical oxygen request. Spent wash contains Melanoidin which is sugary, colorless liquid aldehyde and have a more atomic weight. Melanoidin is profoundly foul and reduces penetration of daylight because of which dissolved oxygen introduce in aquatic life was adversely affected and in a roundabout way photosynthesis process is impeded henceforth creature and amphibian plants are can't live more, so a sheltered transfer strategy is requiring. Efficient and eco-accommodating the refinery spent treatment is an awesome test to earthy people and researchers. There are various techniques to deal refinery spent wash exceptionally color reduction and evaluating COD, for physical substance & organic strategies. Bio-methanation of refinery spent wash

took after by vigorous treatment is normally utilized treatment to deal refinery. The conventional physio chemical treatment utilized by the plant units for treatment of wastewater may be Chemical natural process, natural process, Adsorption, Oxidation, anaerobic lagooning, membrane filtration etc. however as these treatment having high cost, maintenance and needs a high detention time that ultimately will increase the treatment process time. To overcome the limitation and disadvantage of the traditional treatment methods Electro coagulation treatment is accustomed to archive most removal potency.

## II. BACKGROUND

Electrocoagulation technique for treatment of waste water works on the principle of electrochemistry, where the anode gains electrons or reduction takes place while at cathode losing of electrons that is oxidation occurs thereby forming the unwanted waste best for treating. It is simple and economic method for treating distillery spent wash.



Electro coagulation cell scheme

Electrocoagulation (EC) has been practicing as an advanced substitute to chemical coagulation in treating raw waters and wastewaters for removing pollutants. In this technology, metal cations are released into water or waste water through dissolving metal electrodes. Simultaneously, beneficial side reactions can remove flocculated material from the water or waste water. However, there are also adverse side reactions, such as deposition of salts on the electrode surface, which may cause deterioration of removal efficiency after long operation. Therefore before starting up each trials of experiment, Copper electrode surfaces are being cleaned by rubbing though sandpapers and washed by distilled water.

The electro coagulation of Copper-Copper Electrode is accelerated by Nanoparticle Zinc oxide. Many Trials are made by varying dosages of Zinc oxide with varying time at constant optimal pH, constant optimal voltage and constant

Optimal distance between electrodes to get maximum removal efficiency.

## III. STUDIES AND FINDINGS

Distillery spent wash was gathered by grab sampling Technique from Samsons Distilleries, situated close Duggavati, Davangere, Karnataka. The collected sample is investigated in Environmental Engineering laboratory, Department of Civil Engineering, UBDT, Davangere. The Wastewater was gathered after Bio-methanization handle.

In Electro coagulation technique, the electrochemical cell consists of two Copper electrodes (each having dimension 15cm x 5 cm x 0.3 cm) are immersed in a distillery spent wash, which is taken in a 2 L volume of a glass beaker which is kept on Mechanical stirrer. The cleaned and dried electrodes are connected to positive and negative terminals of DC power supply (0-30V). The electro coagulation was carried out by keeping time of 1.5 h constant with constant stirring of sample inside the beaker.

The present experimental work is carried out by keeping time of 1.5 hour constant, for varying pH of 3, 5, 7 and 9 and for varying distance between electrodes of 3cm, 4cm and 5cm and for varying voltages of 5v, 10v, and 15v. The electrolyte is kept on magnetic stirrer which helps in proper mixing of sample throughout the electrolysis time. The pH is adjusted by adding hydrochloric acid to decrease pH and NaOH to increase pH. After every reaction of electrolysis the treated sample is shifted to another beaker and kept undisturbed and allow the flocs to settle down which is formed during electro coagulation. Determine optimum pH, Voltage and distance between electrodes which gives maximum result.



Photographic view of Experimental set up

Copper Electrode is used in this experimental work. Copper is a Chemical element with image Cu and atomic wide variety 29. It is gentle, malleable, and ductile metal with very high thermal and electrical conductivity. A freshly exposed surface of pure copper has a reddish orange coloration. Copper is used as a good conductor of heat and power. Copper is one of the few metals will arise in nature in immediately usable

metal form in preference to wanting extraction from an ore. It became the primary metallic to be smelted from its ore. Within the Roman generation, Copper turned into mainly mined on Cyprus, the starting place of steel, from aesCyprium.

**IV. RESULTS AND DISCUSSION**

The results obtained for treating distillery spent wash using Electrocoagulation method using Copper electrodes and Zinc oxide nanoparticle are discussed below

Comparison of initial characteristics of distillery spent wash before treatment and Treated distillery spent wash with Electrocoagulation is showed below

The initial Characteristics obtained by examining the distillery spent wash methodically are mentioned in the below table. They are all above the discharging limit.

Initial Characteristics of distillery spent wash

Parameter	Value	Units
pH	3.67	-
Color	123600	Pt. Co
Turbidity	11300	NTU
Electrical Conductivity	20	µS/cm
TDS	10780	ppm
BOD	50190	mg/l
COD	122000	mg/l

Treating distillery spent wash by accelerating Copper-Copper Electrocoagulation method using Zinc oxide as a nanoparticle yields low COD, BOD, Turbidity, Electrical Conductivity, Total Dissolved Solids and reduction in Color. The effluent distillery spent wash after treatment with Electro Coagulation technique is in the range of discharge effluent quality into streams. In this Experiment the amount of Color removal is done in terms of Pt.Co. Which is also significantly removed. Even COD of the effluent is reduced to greater extent.

The below figures and the tables represents the comparison of initial characteristics of distillery spent wash before treatment and treated distillery spent wash with Electrocoagulation using Copper- Copper electrode with the

addition of Zinc oxide as a Nanoparticle and also there efficiency of removal are explained.

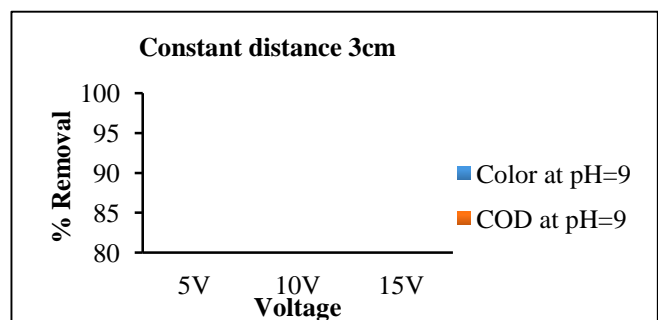
The results obtained in reduction of color and reduction of COD are discussed below



A Comparison of distillery spent wash before treatment, after Electro Coagulation treatment with Cu-Cu electrode and Electro Coagulation treatment using Cu-Cu electrode combined with Zinc oxide nanoparticle at optimum conditions.

The reduction of Color and COD by Copper – Copper Electro Coagulation at constant distance 3cm and pH 9 at varying voltages.

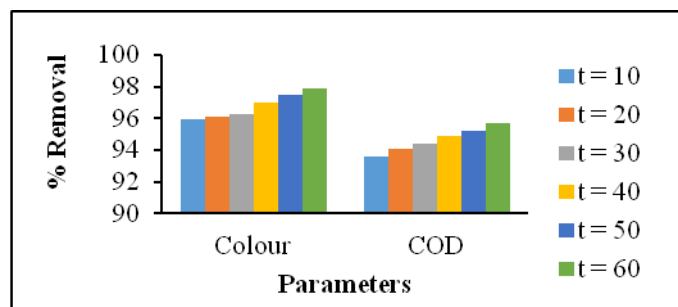
V	pH 9		pH 9	
	Colour	% removal efficiency	COD	% removal efficiency
5	15600	87.81	13700	88.77
10	14400	88.37	13000	89.34
15	3946	96.81	8100	93.36



The bar chart showing the maximum removal efficiency of Color and COD.

Table showing the reduction of Color and COD in Copper-Copper Electro Coagulation using Zinc Oxide nanoparticle at dosage 2gm.

pH	Distance (cm)	Voltage (V)	Time (min)	Color Pt. Co	% Removal efficiency of color	COD (mg/l)	% Removal efficiency of COD
9	3	15	10	5000	95.95	7800	93.60
9	3	15	20	4820	96.10	7200	94.09
9	3	15	30	4580	96.29	6800	94.42
9	3	15	40	3750	96.96	6200	94.91
9	3	15	50	3100	97.49	5800	95.24
9	3	15	60	2590	97.90	5200	95.73



The Bar chart showing variations of Color and COD with optimum distance between electrodes is 3cm, pH= 9, voltage=15V, and varying time with nanoparticle concentration of 2 gm of Zinc Oxide.

## V. SUMMARY AND CONCLUSIONS

### a. Summary

The following summary is concluded based on the objective of proposed project i.e. Acceleration of Copper-Copper electrocoagulation of distillery spent wash using Zinc oxide as nanoparticles. Electro coagulation process was carried out for varying pH of 3, 5, 7, and 9 and voltage of 5V, 10V and 15V by using Copper-Copper electrodes and optimized results were note down to meet the objective work. The characteristics of distillery spent wash such as COD and Color. The distillery spent wash has characteristics of pH=3.67, Colour-123600 pt.co and COD-122000 mg/L & other all the parameters are not within the range i.e. more than discharging limit.

Nanotechnology has gained much more important in recent year for its applications in various fields. Zinc oxide nanoparticles are used in this present work to accelerate

Copper-Copper electrodes performance in Electrocoagulation of distillery spent wash.

In present study 36 trails were carried out to get a optimized results of reduction of Color a COD by Copper-Copper electrodes. For this attained optimized conditions, by using varying dosages of Zinc oxide nanoparticle as 0.5gm, 1gm, 1.5gm, and 2gm for an varying electrolysis time 10min, 20min, 30min, 40min, 50min, and 60min, the maximum efficiency attained in batch reactor of electro coagulation is observed.

In Copper Copper Electro coagulation the maximum removal of COD and Color was found with pH=9, D=3cm and V=15v. Copper electrodes was found to be maximum removal efficiency of COD-93.36%, Colour-96.81%. By using Copper Copper Electro Coagulation using Zinc oxide nanoparticles the maximum removal efficiency found to be Color – 97.90% and COD-95.73% at 2gm dosage of nanoparticle.

### b. Conclusions

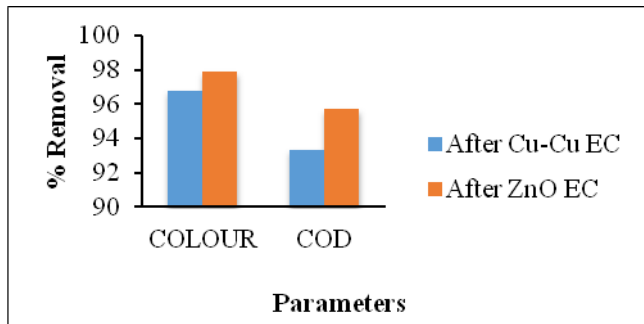
The work carried out in treating distillery spent wash using Electrocoagulation technique, which leads to the following conclusion.

By using Copper-Copper electrodes, it was found that maximum removal efficiency of Colour-96.81% and COD-93.31%, at a Distance (D) =3cm, pH=9, and V=15v and Time (t) =1.5h. Results obtained from using Copper- Copper electrodes concluded that lesser the distance between the electrodes more will be the increased removal efficiency.

Electrocoagulation treatment for distillery spent wash concluded that the maximum removal efficiency was found to be in higher pH value i.e. at alkaline condition.

Zinc oxide nanoparticle resulted in maximum removal efficiency of Color-97.90% and COD-95.73% than that of Copper-Copper electrodes electrocoagulation alone.

Electrocoagulation method for treatment of distillery spent wash is economical but only the problem is secondary sludge developed during Electrocoagulation process.



Graphical representation of Color and COD reduction by Cu-Cu electrodes electrocoagulation and with Zinc oxide nanoparticle electrocoagulation at Optimum Condition.

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