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"COD and Colour Removal from Distillery spent wash using metal oxide Electrode in Electrocoagulation process"

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Abstract - Distillery industries are one of the oldest and heavy polluting industries in India, Categorized into red category under MoEF. They produce highly categorized Total solids, COD, BOD, and Colour. Research work has been carryout by reviewing the various research papers by considering the electrocoagulation treatment process to study the removal efficiency of COD, Colour, using four different electrodes viz Al-Al, Fe-Fe, Gr-Gr and Zn-Zn with variable parameters like electrolysis time, voltage and maintain pH constant and electrode distance is 3cm. The comparative study between electrodes Al-Al is more effective in the removal efficiency of COD 95%, Colour 98% at pH9, Voltage 20V, electrolysis time 90 min, than Fe-Fe, Graphite, and Zinc electrodes. Correspondingly the comparative analysis between Al-Al and Anodized Aluminum, Anodized Aluminum is to be more effective in removal of COD 96% and Colour 94% at pH 7, Voltage 20V, Electrolysis time 150 min. and electrode distance 2cm. Distillery spent wash discharge leads serious impact on the environment, thus process has been proved the effective removal of Colour and COD.

Key Words: Electrocoagulation, Aluminium, Iron, Zinc, Graphite, Anodized Aluminium, etc

1. INTRODUCTION

Distillery spent wash is unwanted residual liquid waste produced during alcohol production. India is a larger manufacturer and also consumer of sugar in the world (4). The generation of spent wash is mostly due to the Molasses based distillery along with their product (alcohol). Distillery spent wash are one of the main industries which release huge quantities of more strength wastewater which has more potential towards causing water pollution India produce huge quantity of spent wash whose disposable into water bodies or land causes a number of environmental complications. Spent wash generally characterized with an unpleasant odor and recalcitrant dark brown colour (11).

The spent wash effluent sample was collected from Samson Distilleries and Chemicals Limited, located nearby the city of Davanagere, Karnataka, India. The collected effluent was immediately brought to the laboratory and stored in the refrigerator at 4 °C (4) until further use in order to avoid any deterioration in the physico-chemical properties of the spent wash. Distillery spent wash is containing greatly maximum COD, Suspended solids, Inorganic impurities, and other impurities.

1.1 ELECTROCOAGULATION

Electrocoagulation is a technique used for the treatment of wastewater, electro means application of electrical charge to water, and coagulation is the process which change the charge of surface particle by permitting the suspended matter to form agglomeration. The process is performed by application of an electric current across metal electrode that are submerged in water. It is an advanced and most economical water treatment technology. A simple method and most effective in removing various heavy metals, organic substances, metalloids, etc. The metal consumption from the anode with simultaneous establishment of hydroxyl ions and hydrogen gas taking place at the cathode (12).

Electrocoagulation experiments were conducted by batch reactor. The electrochemical cell consists of two plain electrodes (5cm *5cm*0.5cm) of Al-Al, Fe-Fe, Graphite, and Zinc electrodes were taken. Immersed in distillery spent wash taken in 1.5L volume of a beaker. The experiments were carried out by varying time, voltage, and kept constant pH, and electrode distance at 3cm.

1.2 ANODIZATION

Anodization is an electrolytic passivation evolution used to expand the thickness of common oxide coat on a superficial level metal slice. The process is called anodizing in light of the fact that the portion to be dealt with structures the anode terminal of an electrical circuit. Anodizing rises the corrosion resistance and wear obstacle, and gives improved bond to paint groundwork and pastes than exposes metal. Experimental equipment used to produce anodized Aluminum oxide shown in below Figure1

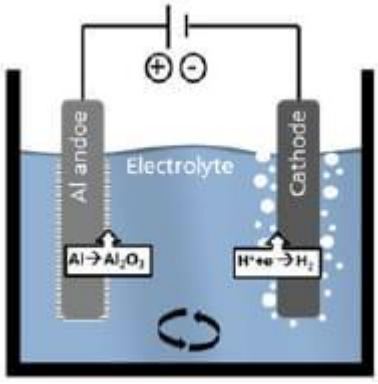

Figure1: Experimental equipment used to produce anodized Aluminum oxide (11).

Anodization of aluminum is formed by exothermic response on the fringe surface of aluminum or aluminum combinations with the early nuclear oxygen made by the electrolysis of a watery electrolyte. The electrolyte could be acidic arrangements like sulfuric acid, chromic acid, phosphoric acid and oxalic acid. The arrangement of Anodized Aluminium Oxide layer is subject to the electrolyte synthesis, anodization time, selected voltage, temperature and pre-treatment techniques and pore size is likewise constrained by treatments like dipping in acidic electrolyte after the anodization procedure. The commendable corrosion resistance of pure aluminum is mainly owing to its liking for oxygen. This outcomes in the creation of an extremely dainty however relentless oxide film which covers the surface when a recently cut bit of metal is presented to the environment (13).

1.2.1 PREPRATION OF ANODIZED ELECTRODE

The Nano pores Anodized Aluminium Oxide structures were electrochemically created from Al sheet substrates by utilizing a two-advance anodizing process. The electrochemical arrangement contained 0.2 to 1M H_2SO_4 corrosive, an anode (a pre-rewarded Al sheet of measurement 10cm x 5cm x 0.3cm) and a cathode (a Pb plate of measurement 10cm x 5cm x 1cm) most commonly.

2. RESULTS AND DISCUSSION

The qualities of Distillery Spent Wash were obtained and the experimental outcome on treatment of Distillery Spent Wash using Al-Al, Fe-Fe, Graphite, Zinc and Anodized electrodes by various researcher using previous research papers. The values given below are the predicted values and the various parameters monitored under electrocoagulation process are given below.

2.1 INITIAL CHARECHTERSTICS OF DSW

Table -1: Initial Characterization of DSW

SL NO	PARAMETERS	UNIT	VALUES
1	pH	-	3-4.8
2	TDS	mg/L	90,000-150,000
4	Turbidity	NTU	3,800
5	Conductivity	µs/cm	40,000
6	Colour	pt.co	3,26,000
7	EC	Ms/cm	23
8	Total hardness	mg/L	1000-1300
9	Total alkalinity	mg/L	1300-1800
10	Chlorides	mg/L	8000-8400
11	COD	mg/L	135000

2.2 COD AND COLOUR REDUCTION BY ELECTROCOAGULATION USING Al-Al, Fe-Fe, GRAPHITE, AND ZINC ELECTRODE

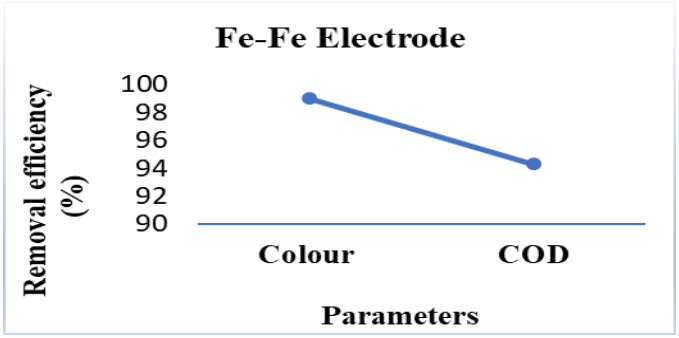

Figure 2: Maximum Removal efficiencies of Fe-Fe electrodes at pH 8, 3cm electrode distance, 15 volts and 150 min time interval

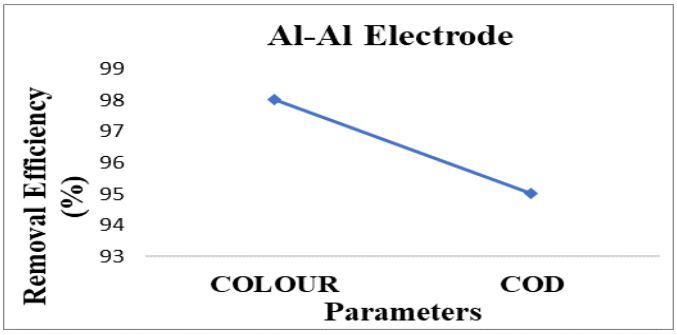

Figure 3: Maximum Removal efficiency of Al-Al electrodes at pH9, 3cm electrode distance, 20 volts and 90 min time interval

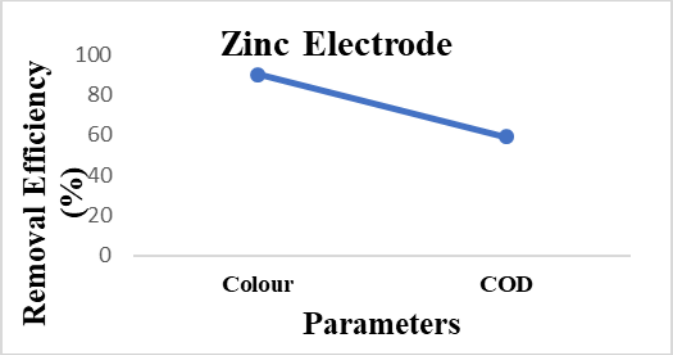

Figure 4: Maximum Removal efficiencies of zinc electrode at pH 8, 3cm electrode distance, 5 volts and 60 min time interval

The above graphs are taken from the review values by various researcher papers initially the graphs go on increasing at the maximum time 90min, further it may probably decrease, these are the predicted values. The colour removal efficiency was not found by using Graphite electrodes and maximum COD removal efficiency found to be 85 % at pH 7, voltage 8V, time interval 90min.

2.2 COMPARISON OF REMOVAL EFFICIENCY

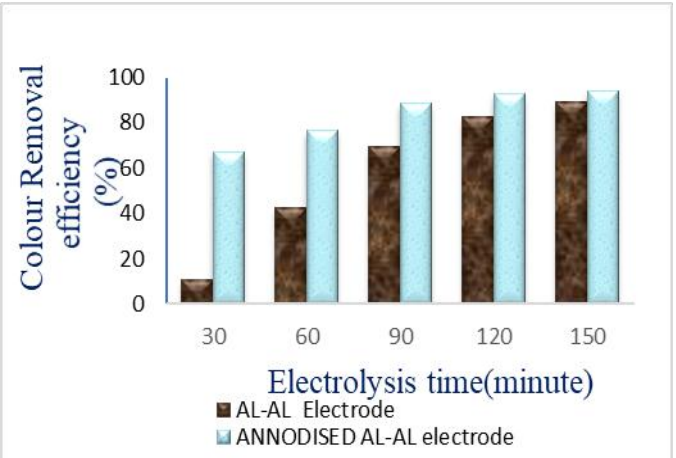

Figure 5: Graph depicting Comparative removal efficiency of colour employing plain Al-Al and Anodized Al-Al electrodes.

The variation in Colour removal efficiency were observed for plain Al-Al and Anodized Al-Al electrodes with different time interval are shows in the Figure 5. 89% of Colour was removed with plain Al-Al electrode and 94% of colour was removed with Anodized Aluminium at pH 7,150 minutes, 20V and distance 2cm. Results shows that the removal efficiency of Colour is more with Anodized Aluminium electrode compared to Aluminium electrode. At neutral pH there was maximum removal of colour removal efficiency were observed in Anodized electrode.

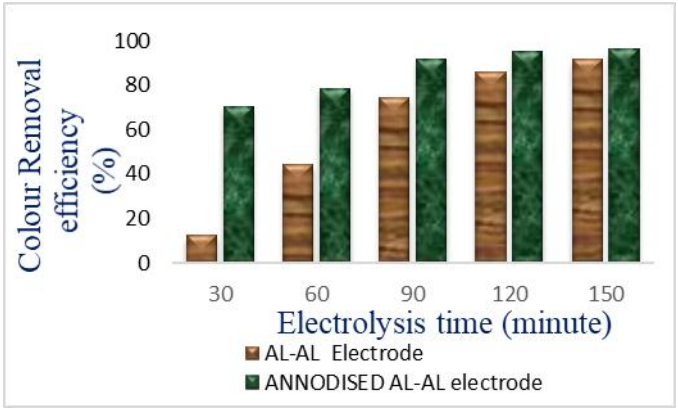

Figure 6: Graph depicting Comparative removal efficiency of COD employing plain Al-Al and Anodized Al-Al electrodes

The variation in COD removal efficiency were observed for plain Al-Al and Anodized Al-Al electrodes with different time interval are shows in the Figure 6. 91% and 96 % of COD was removed with plain Al-Al electrode and Anodized aluminium electrode respectively, at the condition of 150minutes, 20V, pH 7 and 2cm distance. The maximum removal efficiency of COD was observed in Anodized aluminium electrode at pH 7.

3. CONCLUSION

The comparative study between all four electrodes Al-Al is more effective in the removal efficiency of COD 95%, Colour 98% at pH9, Voltage 20V, electrolysis time 90 min, than Fe-Fe, Graphite, and Zinc electrodes. Anodised electrode used in Electrocoagulation can be adopted for the attainment of higher efficiency. The comparative analysis between Al-Al and Anodized Aluminium electrodes shows aluminum oxide to be more effective with removal efficiency of COD 96% and Color 94% at a constant pH7, Voltage 20V, Electrode distance of 2cm and at a 150 minutes electrolysis time.

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