Removal of COD And Color From Distillery Spent Wash By Electro Coagulation Using Aluminum And Iron As Electrodes

Nandini G D[1], Lokeshappa B[2] ,Shanmukha N T[3]
[1]Dept of Civil Engineering
[2]Associate Professor, Dept of Civil Engineering
[3]Assistant Professor, Dept of Civil Engineering
[1, 2] U.B.D.T. College of Engineering Davangere, Karnataka, India
[3]Government Engineering college, Ramanagara , ,Karnataka, India

Abstract- *Distillery effluent is characterized with with suspended solids, inorganic solids, high chemical oxygen,biochemical oxygen demand, color and low in pH. The main aim of the work is on removal of COD and Color from distillery spent wash by electro coagulation. The treatment of distillery wastewater is carried out by electro coagulation using electrodes of aluminium and iron as anode and cathode respectively. Experiment was carried in a batch operation and it consisting of electrodes, direct current supply system and a magnetic stirrer unit. Individual effect of pH, voltage and distance between the electrodes are determined. For every 90 minutes, samples were drawn and COD and color was measured. Optimum conditions were obtained at pH = 9, distance = 3 cm and voltage = 15 V. At optimum condition 97.1 % of COD is reduced and 96.46 % of color is reduced. Results shows that at lesser distance between the electrodes and at higher pH ,voltage maximum removal efficiency are found.*

Keywords- Distillery Spent Wash, Aluminium, Iron, COD and Color.

I. INTRODUCTION

In the economic growth of the country distillery industries contribute a maximum share. For the ethanol production maximum distillery industries present in the world are sugar base industries. Commonly used feed in distillery industries is molasses. Molasses is viscous liquid with dark brown color. During sugar production, sugarcane molasses is the byproduct of sugar industry. It contains 50 % fermentable sugar and about 4 to 10 kg of molasses which is required for 1 litre of alcohol production. Waste water generated in a large quantity during process of ethanol production known as spent wash. If spent wash is discharged without proper treatment it affects photosynthesis activity as it prevents sunlight penetration into rivers, streams and introduces various toxic substances which result in change in physicochemical characteristics of soil and water, also depletion of dissolved oxygen takes place .

a) Electro coagulation

The basic principle of electro coagulation process is generation of cations from anode resulting in coagulation of contaminants from waste water. The performance of the electro coagulation process is affected by various parameters such as pH,0agitation0speed, electrodes distance, concentration of pollutants and conductivity of the solution. There are mainly two processes involved in electro coagulation for reduction COD. Firstly generation of0Al(OH)3 and0Fe(OH)2 takes place which act as coagulants. Then Distillery spent wash contains chlorides and when the electric current is applied it increases chlorine and hypochlorite ions concentration, which helps in oxidation organic molecules.

b) Effects on Environment

Various effects on environment by the discharge of distillery spent wash are as follows.

- In case inappropriate land discharge of distillery spent wash it causes soil pollution and acidification .
- Aquatic flora and fauna have serious threat due to depletion of dissolved oxygen and immediate discoloration as soon as the waste water is discharged in water streams.
- It leads to obnoxious odour problem and sunlight penetration into aquatic system is prevented due to the presence of dark brown color pigment melanoidin in wastewater.
- Due to the prevention of sunlight into rivers and streams, it reduces oxygenation of the water as the normal photosynthetic activity is affected and it leads to death of aquatic life.

- The acidic nature of wastewater imparts corrosion to storage tanks, to the pipes in which waste water flows and reduces soil alkalinity.
- Soil leaching, pH of the soil is affected by acid waste and it makes recycling process expensive.
- Due to the land discharge of wastewater with high nutrients, it leads to decreases the yield of the production because of delay in seed germination, seeding growth and chlorophyll content in the plant.
- Turbidity of the receiving water body increases due to suspended solids in waste water and it affects biota of aquatic life.
- Large amounts of organic and inorganic content in wastewater leads to high0COD and0BOD and also imparts strong odour and color.
- The presence of excess nutrients like nitrogen, phosphorus, potassium causes eutrophication of lakes, rivers and development of algal blooms occurs.
- Long term disposal on land affect the physical, chemical properties of the soil and sometimes leads to problem of groundwater pollution.

II. MATERIALS AND METHODS

a) Materials

The distillery spent wash was collected from Samsons Distilleries located in Dugghvati, Davangere District, Karnataka. Experiments were conducted in a batch mode of operation. Aluminium and Iron plates were used as electrodes.All chemicals used were of analytical reagent (AR) grade from NICE Chemicals, Bangalore.The chemicals used are sodium thiosulphate, sulphuric acid, manganous sulphate, alkali iodide azide, ferrous ammonium sulphate, ferrion indicator, potassium dichromate, mercuric sulphate, silver sulphate, hydrochloric acid, sodium hydroxide, starch indicator were used to analyze the parameters of distillery spent wash.

b) Methods

Experiments were conducted in 2 litre glass beaker in a batch mode of operation. Aluminium and Iron plates with dimensions of 15 cm X 5 cm X 0.3 cm were used as electrodes. Aluminium is used as anode and iron is used as cathode. DC regulated power supply (instrument range 32 A/2A) is used as source of power supply. The contents in the beaker were agitated by a magnetic stirrer in order to avoid the concentration of gradients. Each experimental run was performed by using 1.5 litre of the sample in the glass beaker.

Individual effect of pH, voltage and distance are determined. For 3 cm, 4 cm and 5 cm distance between the electrodes, pH of waste water is varied from acidic level to alkaline as 3, 5, 7 and 9. Also during the experiment voltage is varied for 5V, 10V and 15V. The results were evaluated in terms of COD and Color removal efficiency. For every 90 minutes samples were drawn, COD and color was measured. At the end of each experiment run, the sample was transfered into another beaker and kept undisturbed for 30 minutes in order to allow the flocs that formed during electro coagulation to settle down.

Fig - 1 : Photographic representation of experimental setup

III. RESULTS AND DISCUSSIONS

a) Characteristics of Distillery Spent Wash

The initial characteristics such as pH, Turbidity, BOD, COD, TDS, and color of Distillery spent wash as shown in Table 1.

Table - 1: Initial Characteristics of Distillery Spent Wash

Sl no	Parameters	Unit	Values
1	pH	-	4.08
2	COD	mg/L	138000
3	BOD	mg/L	59111.8
4	TDS	mg/L	22280
5	Turbidity	NTU	12300
6	EC	mS /cm	22.47
7	Color	pt co	313600

b) Variation of Parameters at Optimum Condition

The removal efficiency of parameters with variation of pH, voltage, distance were compared and optimum conditions were obtained at distance 3 cm, pH 9,voltage 15V. The variation of parameters at optimum condition is shown in Table 2.

Table - 2 : Variation of parameters at Optimum Condition

Sl No	Parameters	Unit	Before EC	After EC	% Removal
1	COD	mg/L	138000	4000	97.1
2	BOD	mg/L	59112.8	3450	94.16
3	Color	pt co	313600	11100	96.77
4	TDS	mg/L	22280	1870	84.79
5	EC	mS/cm	22.47	3.643	83.78
6	Turbidity	NTU	12300	431	98.06

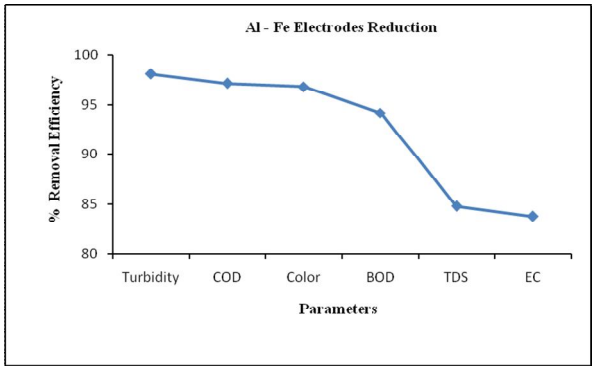

Fig - 2 : Variation of Parameters at Optimum Condition

From the graph (Fig 2) it is observed that at optimum conditions the removal efficiency of turbidity – 98.06%, COD – 97.1% , Color – 96.77%, BOD – 94.16%, TDS – 84.79% and EC – 83.78% were obtained.

For electro coagulation of distillery spent wash using iron and aluminium electrodes maximum COD removal efficiency is about 97.1 % and maximum color removal efficiency is about 96.77 % at optimum conditions pH = 9, D = 3cm, V =15V.The maximum removal efficiency of color and chemical oxygen demand from the distillery spent wash is obtained when the distance between the electrodes is less and at alkaline condition.

IV. CONCLUSIONS

Electro coagulation using aluminium and iron electrodes carried out for different pH, distances and voltages and maximum removal of COD and color was found at optimum conditions of pH = 9, D = 3cm, V = 15V. By using Al – Fe electrodes maximum COD removal efficiency is 97.1% is obtained and color removal of 96.77% is obtained. Results shows that high removal efficiency is obtained at lesser distance between the electrodes, pH of the solution is increases and at high voltage. Electro coagulation is the efficient method in treatment of distillery spent wash for removing Color and COD.

REFERENCES

[1] Charles D., Arivazhagan M. and Fazaludeen T.(2015), “Decolorization of distillery spent wash effluent by electro oxidation (EC and EF) and Fenton processes: A comparative study’’, *Eco toxicology and Environmental Safety*,121:142–148.

[2] Dayaca R.A., Flores J.D., Mohammed and Ulgasan J.C.(2015), “ An Optimization Process in the Reduction Of Chemical Oxygen Demand (Cod) From Distillery Spent Wash Using Electro coagulation ’’, Journal of Engineering Science and Technology, 9 – 16.

[3] Khandegar V. and Anil K.S.(2013), “ Electro coagulation Of Distillery Spent wash For Complete Organic Reduction ’’ International Journal of Chem Tech Research,5(2),712 – 718.

[4] Krishna B.M., Usha N.M., Manoj K. and Lokesh K.S.(2010), “ Study Of The Electrochemical Process For Distillery Wastewater Treatment ’’, Journal of Environmental Research And Development, 5(1):134 – 139.

[5] Roopa F., Priya S. and Saidutta M.B.(2013), “ Reduction of Color and COD of Anaerobically Treated Distillary Wastewater by Electrochemical Method’’,International Journal of Current Engineering and Technology,1:168 – 173.

[6] Shruthi M., Lokesh K.S., Krishna B.M. and Usha N.M.(2013), “Color Removal from Bio-Digester Effluent (BDE) by Electrochemical Treatment with and Without Fenton Reagent’’, International Journal of Current Engineering and Technology,115- 117.

[7] Shubham P.K., Vishwambhar R.K. and Krushna A.M.(2016), “Treatments to Distillery Spent wash by Electro coagulation [EC] and Adsorption: A Review’’, International Journal of Engineering Research and General Science, 4(3) : 165 – 172.

[8] Wagh M.P. and Nemade P.D.(2015), “Treatment Processes and Technologies for Decolourization and COD Removal of Distillery Spent Wash: A Review’’

International Journal of Innovative Research in Advanced Engineering , 2 (7),30 – 40.