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DEGRADATION OF DISTILLERY SPENT WASH USING ALUMINIUM ELECTRODES IN ELECTROCOAGULATION PROCESS

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Abstract - The distillery industry is one of the oldest industries that is very complex and characterized by high BOD, COD, Total Solids, Odor, and Color. Untreated distillery wastewater, when discharged directly into water bodies or into the field, causes irreversible damage to the environment. Electrocoagulation is one of the most significant electrochemical treatments utilized in modern wastewater treatment to diminish suspended and colloidal materials, Conductivity, Turbidity, TDS and COD in wastewater. During the last decade, Electrocoagulation in industrial wastewater treatment. Electrocoagulation is used as point-of-use technology in developing communities, since they are relatively more effective compared to chemical coagulants. In the Present Research work Electrocoagulation treatment has been adopted to study the removal efficiency of Color, COD, TDS, EC, and Turbidity with variable parameters viz., the Voltage, Electrode Distance and Electrolysis time. The experiments were carried out using Al-Al, Fe-Fe, and aluminium oxide as anodic and cathodic electrodes. The influence of various operating parameters on the COD removal of biomethanated distillery waste wash was investigated in this study utilising Anodized Aluminium electrodes. Operating parameters were optimized for Anodized aluminium electrodes by using previous researches and are predicted using regression analysis tool maximum Conductivity, Turbidity, TDS, and COD removal efficiency.

***Key Words*: Electrocoagulation, Distillery wastewater and Aluminum oxide**

1.INTRODUCTION *(Size 11 , cambria font)*

This is a revolutionary method of treating wastewater that uses electricity to create coagulants that can be controlled. Electrochemical methods are used for coagulation and particle flocculation. This employs the same fundamentals as chemically induced coagulation. The primary goal is to eliminate the bonds with repulsive properties that are causing the effluent to be in suspension. The pollution particles would become connected to one another, generating heavier masses that would fall by gravity once these connections were broken. Because no chemicals are used in this process, EC is economical. To create ions for coagulation, oxidation takes place. Consequently, less sludge will be produced. Figure 1.1 shows Electrocoagulation process, this method its help to remediate greasy water also. Electro coalescence of oil droplets can be aided by the presence of electric current. Electro coalescence has been shown to be useful in removing close-fitting emulsions with small drops.

1.1 *Industrial Wastewater*

Industries produce industrial wastewater as an annoying by-product. Treated industrial effluent (or effluent) may be reused or released to sewage or water sources in the environment after treatment. A major cause of water contamination is rapid industrialization. Pollution of waterways, ponds and ditches was caused by the discharge of untreated and partially treated effluent by divers such as chemicals, pesticides, fertilizers, pulp and paper, and sugar, among other things.

1.2 Distillery Wastewater

Breweries are one of the most polluting, and residues in the form of "spent wash" is among the greatest and most powerful contamination caused by the breweries. Molasses, a by-product of the sugar industry, is used as a raw resource by the majority of breweries in India. For each litre of alcoholic beverage produced, these produce 8.5–15.5 litres of effluent, which has a high BOD, a high COD, and a high concentration of liquid with a nuisance Color. The existence of melanoid brown polymers that have a complicated structure and are toxic to biological agents is responsible for this recalcitrance. During the commercial process of molasses fermentation with yeast, followed by the distillation of fermented wash and the recovery of alcohol, distillery wastewater, also known as spent wash, is created. The ecology is seriously threatened by the exceedingly harmful nature of the distilleries' spent wash. Without a question, one of the biggest problems for national sickness is distillery effluent. especially those who distil alcohol using sugar stick molasses that has been aged and refined afterward.

2. OBJECTIVES

The objectives of the present work are as follows:

- To Optimize the Operating Parameters viz, Electrolysis duration, Voltage and Electrode distance.
- To Evaluate the Removal efficiency of Pollution Parameters: COD, Conductivity, TDS, Turbidity.
- To Estimate the cost analysis.

Table -1: Characteristics of spent wash:

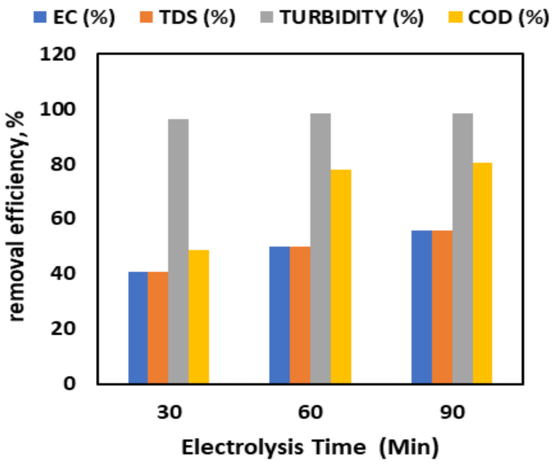
Effluent from distilleries is warm, Darkest Colored, acidic, and has strongest objectionable aromas, posing a considerable disposal or treatment challenge.

Table 1.1 Characteristics of Distillery Wastewater

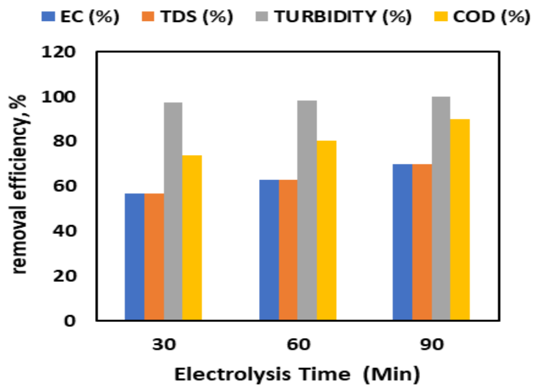
Parameter	Values
Color	Darkest brown
Odor	Disagreeable burn
pH	3.83
TDS (mg/L)	1281.5
COD (mg/L)	4325

Chart -1: Effect of Electrode distance on COD, Conductivity, TDS, and Turbidity removal efficiency (1 in 100 dilution)

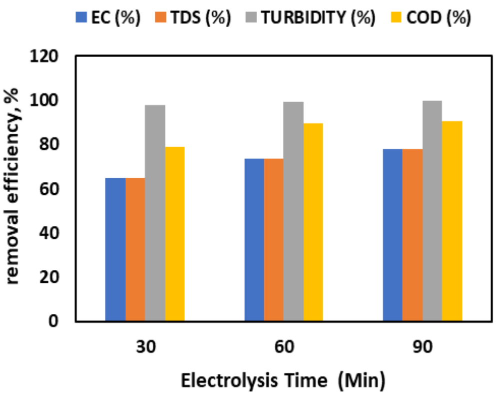
Constant Parameters			COD removal efficiency(mg/l)		
pH	**Voltage**	**Time (min)**	**4cm**	**3cm**	**2cm**
7	30	30	48.6	74	79
7	30	60	78	80.4	89.8
7	30	90	80.6	89.8	90.6
Constant Parameters			**Conductivity removal efficiency (m. mhos/cm)**		
pH	**Voltage**	**Time**	**4cm**	**3cm**	**2cm**
7	30	30	40.86	56.86	64.8
7	30	60	49.76	62.98	73.4
7	30	90	55.75	70.06	77.9
Constant Parameters			**TDS removal efficiency(mg/l)**		
pH	**Voltage**	**Time**	**4cm**	**3cm**	**2cm**
7	30	30	40.86	56.86	64.8
7	30	60	49.76	62.98	73.4
7	30	90	55.75	70.06	77.9
Constant Parameters			**Turbidity removal efficiency(mg/l)**		
pH	**Voltage**	**Time**	**4cm**	**3cm**	**2cm**
7	30	30	96.29	97.4	97.8
7	30	60	98.4	98.4	99.19
7	30	90	98.6	100	100



Electrode distance at 4cm, 30V



Electrode distance at 3cm, 30V



Electrode distance at 2cm, 30V

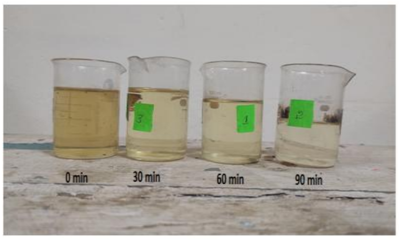


Figure 1: Untreated sample   Figure: Treated samples

3. CONCLUSIONS

- At 1.45 A, 2 cm spacing, pH 7, and 90-min duration, Aluminium electrode was proven to have the highest COD removal efficiency of 90.6 percent, Conductivity removal efficiency of 78 percent, TDS removal efficiency of 78 percent and Turbidity removal efficiency of 100 percent.
- The use of Aluminium-Aluminium electrode in the process showed that the efficiency of the removal process increased as the distance between the electrodes decreased. This is because as the distance between the electrodes increases, there is a decrease in the electrical attraction between the ions generated by the electrode, resulting in an increase in resistance between them. In contrast, when the electrode distance is shorter, the collision of ion generation occurs in a smaller space, which leads to increased floc creation.
- From Experimental Analysis Maximum COD, Conductivity, TDS and Turbidity removal efficiency found to be 90.6%, 78%, 78% and 100% respectively for optimized condition viz 30 Volts, 90-minute electrolysis time, 2 cm electrode distance, at neutral pH 7 and Constant agitation speed 500 rpm.
- The alkaline medium was shown the most operative for maximal removal efficiency by both the electrodes.

REFERENCES

[1] Al-Shannag, Mohammad, et al. "Reduction of COD and TSS from paper industries wastewater using electrocoagulation and chemical coagulation." Separation Science and Technology 47.5 (2012): 700-708.

[2] Barrera Díaz, Carlos E., and Nelly González-Rivas. "The use of Al, Cu, and Fe in an integrated electrocoagulation ozonation process." Journal of Chemistry 2015 (2015).

[3] Bayar, Serkan, et al. "Pre-treatment of pistachio processing industry wastewaters (PPIW) by electrocoagulation using Al plate electrode." Separation Science and Technology 49.7 (2014): 1008-1018.

[4] Bazrafshan, Edris, Kamal Aldin Ownagh, and Amir Hossein Mahvi. "Application of electrocoagulation process using iron and aluminum electrodes for fluoride removal from aqueous environment." E-Journal of Chemistry 9.4 (2012): 2297-2308.

[5] Butler, Erick, et al. "Electrocoagulation in wastewater treatment." Water 3.2 (2011): 495-525.

[6] Ghosh, D., C. R. Medhi, and M. K. Purkait. "Treatment of fluoride containing drinking water by electrocoagulation using monopolar and bipolar electrode connections." Chemosphere 73.9 (2008): 1393-1400.

[7] Jiménez, Carlos, et al. "Optimization of a combined electrocoagulation-electro flotation reactor." Environmental Science and Pollution Research 23.10 (2016): 9700-9711.

[8] Kallel, Amjad, Anis Attour, and Ismail Trabelsi. "Electrocoagulation treatment of raw and autoclaved landfill leachate with aluminum electrodes: case study of Djebel Chakir (Tunisia)." Arabian Journal of Geosciences 10.4 (2017): 1-8.

[9] Khandegar, V., and Anil K. Saroha. "Electrocoagulation of distillery spent wash for complete organic reduction." International Journal of Chemtech Research 5.2 (2013): 712-718.

[10] Khandegar, V., and Anil K. Saroh. "Treatment of distillery spent wash by electrocoagulation." Journal of Clean Energy Technologies 2.3 (2014): 244-247.

[11] Kobya, Mehmet, Orhan Taner Can, and Mahmut Bayramoglu. "Treatment of textile wastewaters by electrocoagulation using iron and aluminum electrodes." Journal of hazardous materials 100.1-3 (2003): 163-178.

[12] Mollah, M. Yousuf A., et al. "Electrocoagulation (EC)— science and applications." Journal of hazardous materials 84.1 (2001): 29-41.

[13] Moussa, Dina T., et al. "A comprehensive review of electrocoagulation for water treatment: Potentials and challenges." Journal of environmental management 186 (2017): 24-41.

[14] Qi, Zhenlian, et al. "Performance and mechanistic study on electrocoagulation process for municipal wastewater treatment based on horizontal bipolar electrodes." Frontiers of Environmental Science & Engineering 14.3 (2020): 1-10.

[15] Tibebe, Dessie, Yezbie Kassa, and Ashok N. Bhaskarwar. "Treatment and characterization of phosphorus from synthetic wastewater using aluminum plate electrodes in the electrocoagulation process." BMC chemistry 13.1 (2019): 1-14.

[16] Umadevi, Mohandas, et al. "Application of Electrochemical Oxidation for the Treatment of Reactive Red 195 using Graphite Electrode." Asian Journal of Biological and Life Sciences 10.3 (2022): 620-625.