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# Review on Electrocoagulation for Treatment of Wastewater

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**ABSTRACT:** In India, Huge amount of wastewater is generated, treatment of wastewater is necessary before discharging into water bodies and most of the treatment plants use conventional techniques which upon treated have limited usage. Viable and cost-effective treatment is a challenge for treating wastewater. Therefore, an innovative and effective technology is required to enhance the quality of water by using minimal chemicals. Electrocoagulation is versatile technique leads to treat large quantity of wastewater at low cost with less demerits makes it a potential method. This review paper provides an overview of electrocoagulation process of treating municipal wastewater and summarize the literatures regarding electrocoagulation.

**KEYWORDS:** Electrocoagulation, Aluminum electrodes, Wastewater

## I.INTRODUCTION

Wastewater is one of the main point-source pollutants on a huge scale leading to various pollutions. Almost 90% of water supply for domestic purpose gets converted to sewage. Wastewater is produced everywhere and due to lack of proper infrastructure in some parts of India, sewage is directly discharged to nearby water bodies and due to lack of funding and development conventional methods are opted for treatment of wastewater. The importance of identifying alternative methods for wastewater treatment has become a need as it is related to human health and sustainable environment. The chemical and biological composition of wastewater is high in BOD, COD, Suspended solids. The removal or breakdown of organic compounds from wastewater is an important and integral part of any wastewater treatment process (Madani K et al., 2011, Adin A et al., 2012). Therefore, it is necessary treat wastewaters prior discharging and bring down the concentration levels to a standard acceptable limit before discharging to waterbodies.

Electrocoagulation is an alternative method for wastewater treatment in addition to conventional treatments though it is an old technology for treating domestic sewage but far better than some traditional methods as the water quality is upgraded (Sadeghi S et al., 2015). This process generates less amount of sludge compared to chemical coagulation (Fernandez F J et al., 2011). Electrocoagulation process has a greater ability in removal of COD. However, there is no technology to meet all the requirements this process play a predominant role in treating wastewater. Electrocoagulation seems to be promising technology due to cost-effectiveness, less labor work, less amount of sludge is generated and ecofriendly with rapid results (S. Benammar et al., 2008; Espinoza C et al., 2017).

## II. INVESTIGATION CONDUCTED FOR THE TREATMENT OF WASTEWATER BY ELECTROCOAGULATION PROCESS

Tanner Ryan Delvin et al. Conducted an electrocoagulation process on municipal wastewater using Iron, Aluminum, Magnesium electrodes. It is observed that Aluminum and Iron electrodes removed 68% of COD, 13% of total Nitrogen, 93% of total Phosphorous. On the other hand, Magnesium electrodes has removed 49% of COD, 21% of Nitrogen and removed orthophosphate 8-9 times slower than Aluminum and Iron electrodes.

A study investigation is carried out on treating of oily wastewater generated in port by various activities. Oil and greaseremoval in conventional treatment was done by heating of wastewater to break the oil emulsions followed by chemical treatment with gravity separation (Trembalay, 2008; Benito et al., 2007). Varank G et al. performed an

investigation on treating of oily wastewater by electrocoagulation using Aluminum electrodes in batch reactor. The initial parameters of wastewater were SS – 660mg/L, COD – 2783mg/L and oil & grease – 736mg/L. Y Asselin et al. (2008) studied the treatment of oily bilge water using an Electrocoagulation process. Under the optimal conditions the results of removal were higher than 90% for BOD, Oil and Grease, hydrocarbons, TSS, and turbidity. Also, the removal rates for COD were determined as 61.3 and 78.1%, respectively. Here Suspended solids, COD, oil, and grease are effectively removed by EC process. The optimum time and current density of COD and SS removal are 12mA/cm<sup>2</sup>@20min and 16mA/cm<sup>2</sup>@5min, respectively. Results of oil and grease removal was recorded 80% at 10min at the current densities. Alaadin A et al. performed Electrocoagulation treatment on raw municipal wastewater mainly for the removal of turbidity, TSS, BOD by using stainless steel electrodes. Various current densities such as 0.05A, 0.1A, 0.2A, 0.4A, 0.8A were applied to the sample and results were recorded accordingly. The highest removal of TSS was 95.4% at 0.8A with a contact time of 5min and the BOD removal was dependent on Total Suspended Solids removal efficiency.

Jean-Francois et al. studied and investigated the treatment of oily bilgewater using electrocoagulation technique for the removal of oil and grease. Electrocoagulation process was established on a laboratory scale using Iron and Aluminum electrodes. Turbidity, COD, TSS, BOD were removed under optimum conditions. The electrodes are arranged in monopolar configuration and is seen that BOD and COD removal was 93% and 61.3% along with 99.8%, 98.4% and 95.5% of TSS, turbidity, oil and grease respectively. The optimum current density and contact time recorded was 1.5A @90min. The EC process under optimal conditions involved a total cost of 0.46US per cubic meter to treat oily bilge water.

Electrocoagulation was carried out to treat grey water from Indian middle-class single household. Here the grey water is collected from single household which constitutes at most 40% of kitchen wastewater of the total (Akanksha Bhatia et al). Electrocoagulation technique involves applying a current to sacrificial electrodes (mostly iron and aluminum) which are immersed in the electrolyte solution where the current generates a coagulating agent and gas bubbles are created near the electrodes (Fatchizadeh A, 2011). The investigation is conducted on laboratory basis using aluminum electrodes in an electrochemical reactor with varied voltage and current densities. The results revealed that 70% of COD removal and 99.9% of pathogens removal with an energy consumption of 0.3kW h/m<sup>3</sup>.

Electrocoagulation and Electrochemical coagulation are the methods which gained attention among conventional techniques due to its cost effectiveness and simplicity. M Malakootian et al. (2009) conducted a laboratory experiment to remove hardness through electrocoagulation process using aluminum electrodes. The sample used in this process was potable water collected from distribution network from Kerman, Iran. The experiment was conducted with a series of six Aluminum electrodes connected in pilot arrangement through monopolar configuration and performed under different conditions. The process was performed under 10.0, 7.0, 3.0pH with contact time of 10, 20, 30min using 24v, 12v and 6volts. The Hardness was determined by EDTA titration method. The maximum hardness removal efficiency shown at pH 10.1 @ 20v with 60min detention time was 97.4%.

### III. CONCLUSION

The main point of this review article was based on the treatment on municipal wastewater by the process of electrocoagulation. This study investigation states the electrocoagulation was found effective in removal of organic pollutants, color, heavy metals. It has been noted that electrocoagulation has good results in high removal efficiencies when compared to other conventional technologies. Electrocoagulation is an attractive and environmentally friendly method for the treatment of various kinds of wastewater which can be characterized by simple equipment, easy operation, less operating time, and decreased amount of sludge which sediments rapidly. There is a need to opt eco-friendly and cost-effective techniques on industrial scale. This treatment technique needs a wide exposure in large scale industrial applications via pilot plant studies.

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