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# Sustainable Electrocoagulation Treatment for the Efficient Removal of Terasil Red Dye using Recycled Aluminum Electrodes

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## ABSTRACT

The contamination of natural water reservoirs by dye compounds poses a significant threat to water quality and human health, necessitating comprehensive studies to explore effective removal methods. This research focuses on the elimination of Terasil Red (TR), a synthetic dye extensively using in the textile industry, applying the Electrocoagulation (EC) technique. Notably, this investigation uses two specially selected aluminum electrodes derived from reclaimed metalworking materials wastes in their pristine state. The key parameters investigated in this study included the added NaCl concentration, pH levels, applied current intensity, electrode spacing, and the submerged surface area. The analyses for TR dye concentration and the removal mechanism were studied by ultraviolet-visible spectroscopy at λ max of 527nm turbidity and COT analyses. The findings showed exceptional efficacy in dye removal, surpassing the 95%, particularly under optimal EC conditions. Including a neutral pH solution at 7.35, an electrolysis time of 20 minutes, a current intensity of 0.15 A, an electrode separation of 1 cm, a submerged surface area of 56 cm 2, and a sodium chloride concentration set at 1 g/L. The study suggests that the adoption of recycled aluminum electrodes within the EC framework not only environmental sustainability but also presents an economically viable strategy for mitigating dye pollution.

**Keywords:** Recycled Aluminum, Electrocoagulation, Electrodes, Dye removal

## 1 Introduction

The textile industry's extensive use of synthetic dyes has led to the contamination of water reservoirs, poses a significant threat to water quality and human health, necessitating the development of effective removal methods. [1] [2] Electrocoagulation (EC) has emerged as a promising technique for dye removal, offering environmentally sustainable alternatives. [3] In this study, we focus on the efficient removal of Terasil Red (TR) using recycled aluminum electrodes derived from metalworking materials wastes in their pristine state, without any preliminary treatment. emphasizing both environmental sustainability and economic viability.

## 2 Experimental

The experiments were conducted in a 1L batch reactor under controlled conditions with continuous stirring to maintain uniformity. The synthetic wastewater introduced was prepared with the specified TR dye with an initial concentration of 20 mg/L, serving as the testing medium for the EC process. A systematic approach was adopted to evaluate the impact of key parameters in Tab.1 on the treatment efficiency.

**Table1:** *Different studied parameters*

| Current Density (A) | Electrode spacing (cm) | pH | Submerged surface area (cm2) | Electrolyte (mg/L) |
|---|---|---|---|---|
| 0.10 | 1 | 3 | 34 | 0.5 |
| 0.20 | 1.5 | 7 Original | 45 | 1 |
| 0.23 | 2 | 8 | 56 | 1.5 |
| 0.26 | -- | 10 | 78 | 2 |

## 3 Results and Discussion



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The findings of the experiments demonstrated exceptional efficacy in Terasil Red dye removal, reached the 98.24% threshold, particularly under optimal EC conditions. These included a neutral pH of 7.35, an electrolysis duration of 20 minutes, a current intensity of 0.15 A, an electrode separation of 1 cm, a submerged surface area of 56 cm2, and a sodium chloride (NaCl) concentration of 1 g/L. with a removal of turbidity of 92% and COT of 82%.

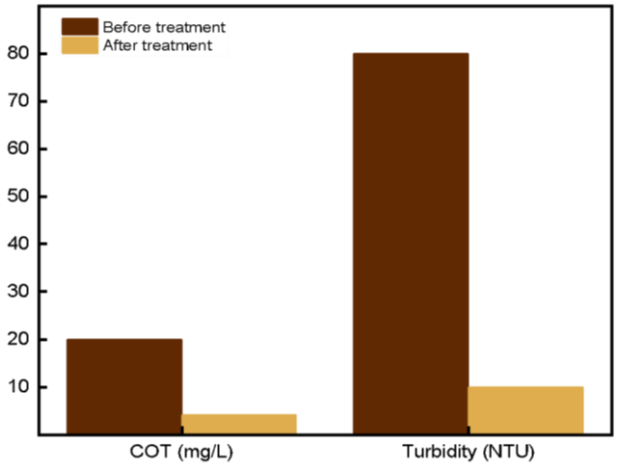


**Figure1:** The turbidity and COT removal.

## 4 Conclusions

The adoption of recycled aluminum electrodes within the EC framework not only underscores the method's environmental sustainability but also presents an economically viable strategy for mitigating dye pollution within wastewater systems through the reuse of waste materials. The success of this approach points towards a promising avenue for sustainable water treatment technologies

## 5 Acknowledgements

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