Tanta University

Faculty of Engineering
Public works Department

Assessment of continuous flow electrocoagulation process for industrial wastewater treatment from edible oil factories

By

Abdel Aleem Magdy El wakil
Public Works Engineering Department
Faculty of Engineering, Tanta University, Tanta, Egypt
B.Sc. in Civil Engineering, 2018, Pharos University, Alexandria

A thesis

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
In
ENGINEERING (PUBLIC WORKS ENGINEERING)

Under supervision of

Assoc. Prof. Dr/ Ahmed El-Morsy Ahmed
Associate Professor, Public Works Engineering Department,
Faculty of Engineering, Tanta University

Assoc. Prof. Dr/ Mohamed Abd Elsalam Ayoub
Associate Professor, Public Works Engineering Department,
Faculty of Engineering, Tanta University

Dr/ Abd Elaziz Elsayed Abd Elaziz
Lecturer, Public Works Engineering Department,
Faculty of Engineering, Tanta University

2025

Acknowledgement

Praise and thanks be to Allah for giving me the potential to do this work. I praise him for his favors and ask him to increase his grace and generosity.

Foremost, I would like to extend a sincere thanks to ***Assoc. Prof. Dr/ Ahmed El-Morsy Ahmed***, Associate Professor, Public Works Engineering Department, Faculty of Engineering, Tanta University, for his guidance, advice, and support in throughout this work.

I can hardly express my gratitude to ***Assoc. Prof. Dr/ Mohamed Abd Elsalam Ayoub,*** Associate Professor, Public Works Engineering Department, Faculty of Engineering, Tanta University, for his help and unlimited support since the first day. I was very lucky to work under his supervision. I appreciate his support and help along the way. I could not have supposed having a better advisor for my Master of Science.

I would like to present my special gratitude to ***Dr/ Abd Elaziz Elsayed Abd Elaziz,*** Lecturer, Public Works Engineering Department, Faculty of Engineering, Tanta University, *for his kind help.*

Special thanks and gratitude go to ***my mother, my father, my sisters, and my wife*** for their love, support, effort, patience, and encouragement throughout my study and my entire life, may God bless them all.

Abdel Aleem El wakil

Abstract

Wastewater generated by edible oil industries is characterized by elevated levels of chemical oxygen demand (COD), oils and grease (O&G), which poses significant challenges for treatment to comply with environmental standards. This study aims to assess the effectiveness of continuous flow electrocoagulation in treating such wastewater and optimizing water quality to meet these standards. A response surface methodology (RSM) approach is employed to evaluate the influence of critical operational parameters, including pH, electrode spacing, electric current, and reaction time, on the removal efficiencies of COD and O&G. Numerous experiments are conducted under various conditions to identify the optimal conditions. The results revealed that under optimal conditions of pH 3.81, electrode spacing of 1.5 cm, an electric current of 5 A, and a contact time of 51.42 minutes, removal efficiencies of 91.2% for COD and 93.7% for O&G are achieved. Additionally, the maximum processing efficiency is reached during the second operational cycle, where the residual concentrations of COD and O&G are found to be 36.6 mg/L and 14.2 mg/L, resulting in removal efficiencies of 99.26% and 99.25%, respectively. These findings underscore that the proposed optimized electrocoagulation method can attain higher removal efficiencies for COD and O&G than those previously noted in comparable studies. Consequently, this method could be adopted by industries aiming to comply with stringent environmental regulations. The novel operational parameters in wastewater treatment address a gap in research, offering sustainable solutions for oily contaminants management, but further research is needed for long-term stability and cost-effectiveness.

Key words:

Electrocoagulation, oily wastewater treatment, response surface methodology (RSM), sustainability