

REMOVAL OF TOTAL SUSPENDED SOLID
(TSS) AND CHEMICAL OXYGEN DEMAND
(COD) IN OLEOCHEMICAL WASTEWATER
USING ELECTROCOAGULATION
TREATMENT

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MASTER OF SCIENCE

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Air sisa daripada industri oleokimia mengandungi gliserin yang terlalu tinggi, keperluan oksigen kimia (COD) dan juga larutan pepejal (TSS) yang boleh menyebabkan pencemaran alam sekitar jika dibuang tanpa melalui rawatan yang sewajarnya. Kebanyakan sekarang industri oleokimia menggunakan membrane osmosis terbalik dan menggunakan kaedah reaktor biofilm untuk merawat air sisanya. Selain dari rawatan tersebut, kaedah lain untuk merawat air sisa iaitu melalui kaedah sistem elektrokoagulasi yang mampu mengurangkan warna yang tinggi, COD, keperluan oksigen biologi (BOD) di dalam air sisa industri. Sistem elektrokoagulasi telah digunakan dalam pelbagai sektor industri untuk rawatan air sisa sebelum ia di buang ke dalam sungai dan sebagainya. Selain itu, sistem electrocoagulation telah berjaya dalam merawat pelbagai jenis air buangan dari pelbagai industri seperti air sisa di bandar, industri tekstil, kedai dobi, restoran, industri penyaduran bahan elektrik, industri kimia, industri mekanikal, industri penggilap, industri pengeluar buah zaitun, industri pengeluar tenusu dan industri penyamakan kulit, industri pulpa dan kilang kertas, industri pembuat roti dan industri penyembelihan. Kaedah Surface Response (RSM) digunakan untuk mengoptimumkan parameter operasi untuk proses tersebut. RSM dijalankan dengan menggunakan perisian dengan reka bentuk komposit pusat (CCD) dua faktor tiga peringkat. Selain itu, ia juga digunakan untuk mengenal pasti interaksi antara setiap parameter dan untuk mendapatkan nilai yang optimum bagi setiap parameter. Kajian pengoptimuman telah dijalankan menggunakan reka bentuk pakar versi 7.0. Objektif- objektif untuk kajian ini adalah untuk mengkaji ciri-ciri kualiti air sisa dari industri oleokimia dan mengkaji beberapa faktor – faktor parameter yang mempengaruhi sistem elektrokoagulasi iaitu pH (6-9), jenis elektrod (aluminium & stainless steel), arus yang digunakan (4.0-8.0A) , masa (10-40min) dan susunan elektrod (bipolar & monopolar) untuk merawat air sisa menggunakan sistem elektrokoagulasi untuk mengurangkan permintaan oksigen kimia (COD) dan jumlah pepejal terampai (TSS) dalam air sisa dari industri oleokimia. Keputusan daripada kajian tersebut menunjukkan sistem elektrokoagulasi menunjukkan dapat mengurangkan kandungan COD dan TSS dalam air sisa yang memperolehi nilai pengurangan sebanyak 62.64% dan 66.12%. Selain itu, keputusan menunjukkan faktor – faktor pengoptimum di pH 7.5, arus yang di gunakan iaitu 6.0A dan masa yang digunakan untuk merawat ialah 30 mins. Merawat air sisa oleokimia menggunakan reaktor elektrokoagulasi di parameter optimum dapat mengurangkan nilai – nilai COD daripada 87,000ppm kepada 38,700ppm kira-kira 55.52% selepas 35 min. Kesemua dapatan kajian mendedahkan bahawa rawatan air sisa oleokimia melalui proses elektrokoagulasi pada keadaan optimum boleh digunakan sebagai rawatan alternatif.

ABSTRACT

Wastewater from oleochemical industry contains high concentration glycerin, chemical oxygen demand (COD) and total suspended solids (TSS) that can cause environmental pollution if discharged without proper treatment method. Currently, oleochemical industry uses reverse osmosis membrane and submerged bed biofilm reactor to treat their wastewater. In this work, other method namely electrocoagulation treatment that capable to achieve a high removal of color, COD, biological oxygen demand (BOD) is employed. Electrocoagulation have been used in many industrial sectors to treat wastewater before discharged and success in treating different types of wastewaters such as urban wastewaters, textile industries, laundry wastewater, restaurant wastewater, electroplating wastewater, chemical, mechanical, polishing wastewater, olive mill wastewater, dairy and tannery wastewater, pulp and paper mill industry wastewater, baker's yeast wastewater and slaughterhouse wastewater. Response surface methodology (RSM) is used to optimize the operating parameters for the process. RSM is conducted by using software with two-factor, three-level central composite design (CCD). Besides, it is also used to identify the interaction between each parameters and to get the optimum values of the parameter that affect the process. The optimization study has been conducted using design of expert version 7.0. The objective of the study was to determine the characteristics of oleochemical wastewater quality from oleochemical industry and to evaluate the effect of parameter whereas pH (6-9), type of electrode (aluminium & stainless steel), applied current (4.0-8.0A), retention time (10-40min) and arrangement of electrode (bipolar & monopolar) in electrocoagulation performance in treating wastewater to reduce chemical oxygen demand (COD) and total suspended solid (TSS) in wastewater from an oleochemical industry using this process. The experimental results showed that the pollutant removal efficiencies of COD and TSS can be achieved at 62.64% and 66.12%, respectively, of the initial concentration of parameters using aluminium electrode at the optimum conditions of pH 7.5, applied current 6A and reaction time of 30 min. Treating oleochemical wastewater using electrocoagulation reactor at the optimum parameter reduced COD from 87,000ppm to 38,700ppm about 55.52% after 35 min. All the findings of the study revealed that the treatment of oleochemical wastewater by electrocoagulation process at the optimum conditions can be applied as an alternative treatment.

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