MODELLING AND OPTIMIZATION STUDY OF ELECTROCOAGULATION PROCESS FOR FLUORIDE REMOVAL USING ALUMINIUM ELECTRODE

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AUTHOR'S DECLARATION

I declare that the work in the thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the results of my own, unless otherwise indicated or acknowledge as reference work.

I, hereby acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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We declared that we read this thesis and in our point of view this thesis is qualified in terms of scope and quality for the purpose of awarding the Bachelor of Chemical Engineering (Environment) with Honours.

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ABSTRACT

Electrocoagulation (EC) has been recognized as one of the most popular and widely used process in water and wastewater treatment throughout the world. This research is focusing on the modelling optimization of electrocoagulation for fluoride removal. The objective of this study are to develop mathematical model of the electrocoagulation process for fluoride removal, study the effect of voltage and electrolysis time towards removal efficiency and to obtain the optimum conditions of the electrocoagulation process that lead to maximum fluoride removal using the dynamic optimization technique. A mathematical model was developed and validated with the experimental data. The sensitivity analysis of the proposed model was performed to check the significance parameter towards removal efficiency, which can determine the parameter to be optimized. In the dynamic optimization study, an orthogonal collocation of the finite elements was implemented in the MATLAB® environment using a dynopt code package. The proposed model from the first principle can be considered validated since the average value R^2 is 0.99. The result show the percentage removal of fluoride increases as the voltage increase due to the amount of Al^{3+}ions produced. For optimum condition, it is shown that 92.53% percent removal can be achieved with the range of voltage from 11.2 V to 11.9 V at 30 minutes of process time. In a nutshell, the result showed that this EC process can be considered as potential alternative technology for fluoride removal in wastewater.