SIIC083

PRODUCTION OF BIODIESEL FROM PALM FATTY ACID DISTILLATE: KINETIC STUDY

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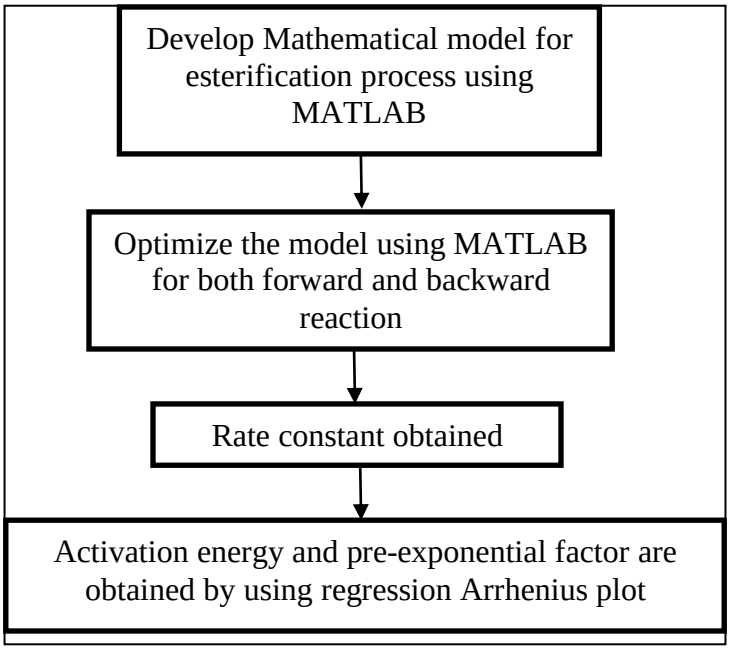
Abstract:
As the fossil fuels are depleting and eventually will be gone forever, the studies and research have been conducted to find the alternative for the fossil fuels. The most suitable alternative for fossil fuels are biodiesel. Biodiesel or known as fatty acid methyl esters (FAME) usually obtained from green resources such as plant oil, animal fats or even waste cooking oils. Next, Palm Fatty Acid Distillate (PFAD) which is by-product of Palm Oil will be used as the main material as it contains high concentration of free fatty acid (FFA). In this study, a mathematical kinetic model of esterification will develop by using a software named MATLAB. Rate constant will also be determined by the end of this study by using rate law. Rate of reaction or known as rate constant (k) is vital in process because it will determine the time taken for the process to complete. From the rate constant for both forward and backward reaction obtained, values of activation energy and the pre-exponential factor values for both reactions at can be determined with plotting Arrhenius plot. A general kinetic model and parametric study of the kinetics of the reaction involved in the production of biodiesel developed in this project through use of MATLAB Sequential Quadratic Programming and ODE45 have shown promising results. The objective of this project is achieved

***Keywords*:**
PFAD, rate constant, esterification, kinetic modelling, biodiesel.

Objectives:

- To develop kinetic model for production of biodiesel via esterification of PFAD using MATLAB simulation.
- To determine reaction constant of the forward and backward reaction for esterification process.
- To determine the activation energy and Pre-exponential factor for both reactions.

Methodology:



Results:

Rate constant for each temperature

Temperature ^{0}C	Forward reaction (k_1) (min^{-1})	Backward reaction(k_2) (min^{-1})
160	0.00070	0.00020
170	0.00087	0.00035
180	0.00100	0.00043

Activation energy and pre-exponential factor of both reactions

Parameter	Forward reaction	Backward reaction
Activation energy (E_a) (J/mol)	419.98	899.675
Pre-exponential factor (A)	3.191×10^{-7}	1.423×10^{-11}

Conclusion:

Biodiesel from PFAD showing a promising future in biodiesel production. The kinetic model obeyed the pseudo-first order reaction for both forward and backward reaction which resulting relatively low error compared to experimental values. The activation energy obtained from the Arrhenius plot is 419.98 J/mol for forward reaction and 899.675 J/mol for backward reaction whereas the Pre-exponential factor is 3.191×10^{-7} for forward and 1.423×10^{-11} for backward reaction.