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PRODUCTION OF EPOXIDIZED PALM OIL DERIVED OLEIC ACID BY USING PERACID MECHANISM

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Abstract:

Epoxidation study has changed a lot in world consumption of raw material where the cost-effective and eco-friendly product is much safer for consumer to used. This practice is very reliable to achieve the increasing demand in every consumer especially in vegetable oil. Epoxidation of oleic acid was carried out by in situ performic acid to produce epoxidized oleic acid with enzymatic reaction. Since epoxide ring is highly reactive where the degradation of the oxirane was tested by using hydrogen peroxide, formic acid and water. The degradation of the epoxide is mainly focus on the rate of reaction between molar ratio of chemical. Thus, the study on degradation of the epoxide is lacking. With the initial concentration of formic acid at 1.4714 mol/L, while hydrogen peroxide and oleic acid are 2.948 mol/L respectively. Then, the kinetic rate, k parameters obtained k_{11}= 6.6642, k_{12}= 11.0185, k_{21}= 0.1047, for epoxidation palm oleic acid, and k_{31}= 0.0538 in epoxidation process. The minimum error of the simulation is 0.0967. Besides, optimizing molar ration between the chemical was done through epoxidation and the optimum condition obtained are H_2O_2/OA unsaturation molar ratio and FA/OA molar ratio with the temperature of 35°C (level 1), agitation speed at 100 rpm (level 1) specifically.

***Keywords*:**
Epoxidation,Kinetic Rate, Matlab, Molar Ratio

Objectives:

- To develop kinetic model of epoxidation of palm oil by Genetic Algorithm through MATLAB simulation.
- To study the effect of rate constant to molar ratio of hydrogen peroxide and formic acid based on kinetic data.

Methodology:

The flow of methodology based on the objective. From this experiment, all method is using through comparative study by MATLAB software and data is used from the previous study. The parameter is chosen by number of molar ratio between hydrogen peroxide, oleic acid and formic acid. The parameteris chosen by number of molar ratio between hydrogen peroxide, oleic acid and formic acid. The value of kinetic, *k* will be varies between molar ratio of this chemical into number of epoxy obtained with minimum error will selected. All the value will be discuss based on plotted graph between molar ratio and value of *k.*

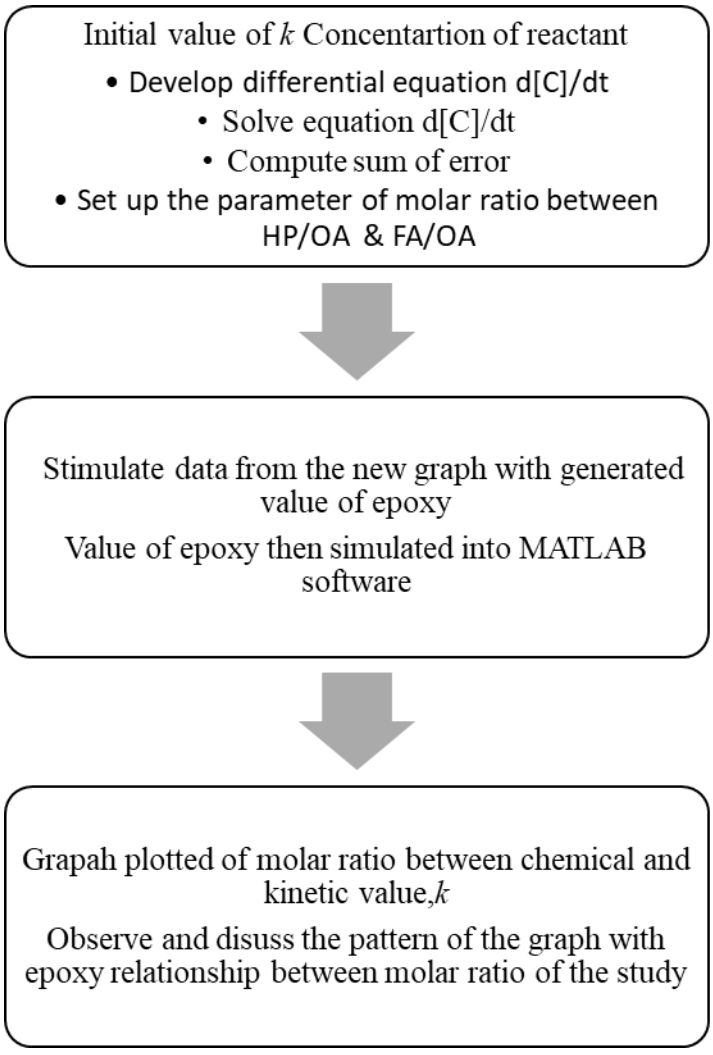


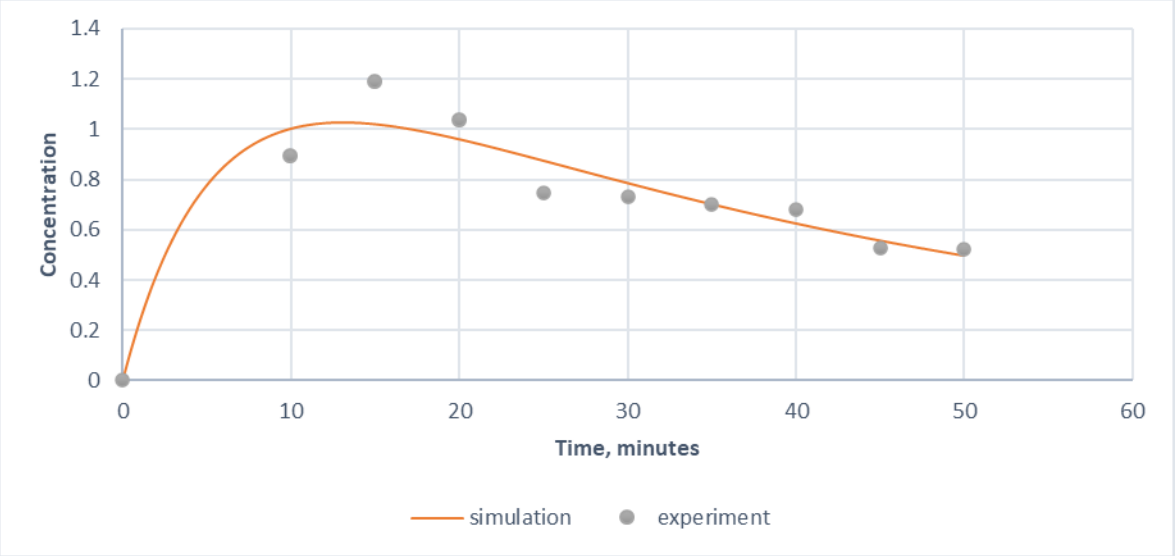
Figure 1 illustrate the process flow of epoxidation process of kinetic study and molar ratio of Hydrogen Peroxide and Formic Acid to Oleic Acid Concetration.

	Parameters	Levels		
		1	2	3
A	H_2O_2/OA unsaturation molar ratio	0.5	1	1.5
B	FA/OA unsaturation molar ratio	0.5	1	1.5

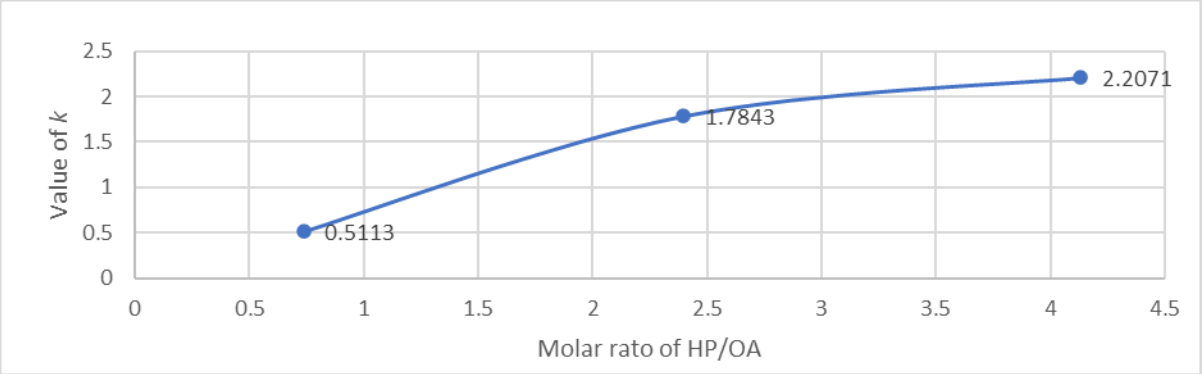
Figure 2 illustrates the molar ratio of the between Hydrogen Peroxide and Formic Acid to Oleic Acid

Results:

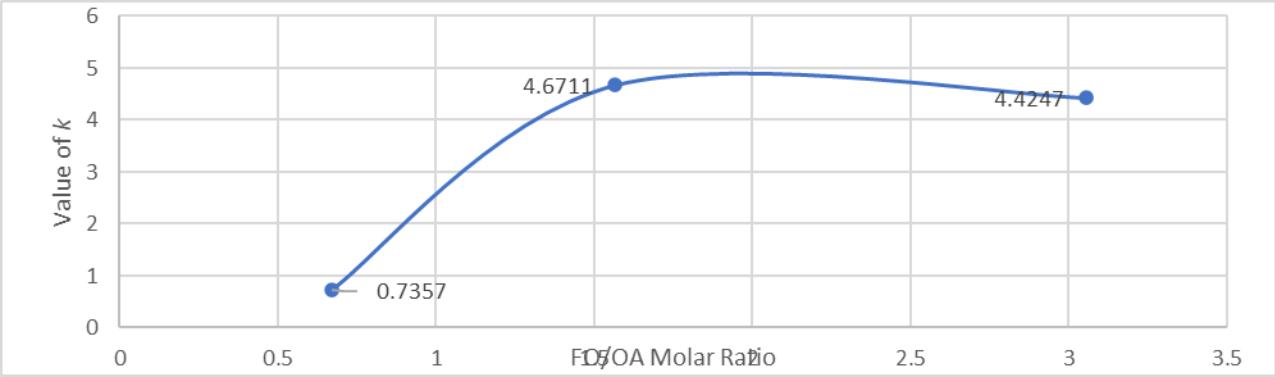
Graph 1: Comparison between simulation and experimental data.



Graph 2 : Parameter of Hydrogen Peroxide to Oleic Acid Molar Ratio



Graph 3: Parameter of Formic Acid to Oleic Acid Molar Ratio



Conclusion:

This study had shown that the formation of epoxidized oleic acid palm oil successfully represents the experimental data. In addition, the kinetic model of palm oil with molar ratio of the chemical represented with value of k_{11}= = 6.6642 mol/L.min k12 = 11.0185 mol/ L. min, k21 = 0.1047 mol/ L. min and k31 = 0.0538 mol/ L. min of epoxidation process. Besides that, all the process involved epoxidation and degradation with each reaction and were successfully simulated by using MATLAB simulation. The minimum error of simulation for this study is

0.0967% which consider good and all the generated simulation from relation of molar ratio obtained successfully formulated from the equation. As from the equation, all the reactants will be used up and the product will have increase value of concentration. Thus, the kinetic model is valid, and the objective might vary from the previous study. It also can be concluded also that the finding of this study is comparable with the result of previous study.

In addition, the number of molar ratios optimized by using MATLAB software help to precise the minimum error of the experiment. The kinetic modelling successfully represents epoxidation and epoxidation process. The factors that have been decided which were H_2O_2/OA unsaturation molar ratio of 1:1 (level 2), FA/OA unsaturation molar ratio 0.5:1 (level 1), temperature of 35°C (level 1), agitation speed at 100 rpm (level 1) specifically. From these values, the relation of molar ratio between all chemicals can be achieved.