SIIC078

EPOXIDATION OF PALM OLEIC ACID BY USING PERACID MECHANISM AND KINETIC STUDY

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Abstract:
Elaeis guineensis is a scientific name for palm oil (PO) tree is a wild plant grow that has been introduced for planting commercial plant in 1917 for economy purpose. PO consumption has been increased rapidly in the past several years as this type of oil has higher amount of saturated fat compared to other vegetable oil. The extraction of palm fruit produce epoxidized palm oil (EPO) through the chemical reaction called epoxidation. EPO has been widely used as intermediate product such stabilizer and plasticizer of polyvinylchloride, while also used as solvent to replace volatile organic solvent in paint and EPO can be classes as biodegradable as it obtained from fruit. This study is conducted since there only a few researches related to the kinetic study on organic catalyst toward palm oleic acid as palm oil exist redundantly in Malaysia. The study also can be compared to existing research to make a better result. This research paper was conducted to determine the effect of hydrogen peroxide (H2O2) which is 30%, 35% and 50% toward epoxidation palm oleic acid by organic catalyst, to determine the physico-chemical properties of epoxidation palm oleic acid and to determine reaction kinetic epoxidation palm oleic acid based on different molar ratio of hydrogen peroxide (H2O2) and temperature by organic catalyst. Experiment is conducted in FKK laboratory, molar ratio selected is 1:1:1 for FA:H2O2:OA. Performic acid is prepared in situ at fixed temperature and reaction time which is 60oC and 35 minutes. Analitycal data need to be concern is the relative conversion to oxirane (RCO). Product chafourracterization conducted by using pycnometer to determine densities, while Fourier-Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD) and Nuclear Magnetic Resonance (NMR) spectroscopy to determine functional group. All the spectroscopy spectrum result verified and proved that samples contain epoxy functional group which is the important properties in the product sample. The kinetic modelling conducted using MATLAB to determine reaction rate, k the optimum condition for reaction. Overall, sample of 30% H2O2 shows the highest RCO and other characterization shows positive outcome. Further study need to be conducted in future to expand the research.

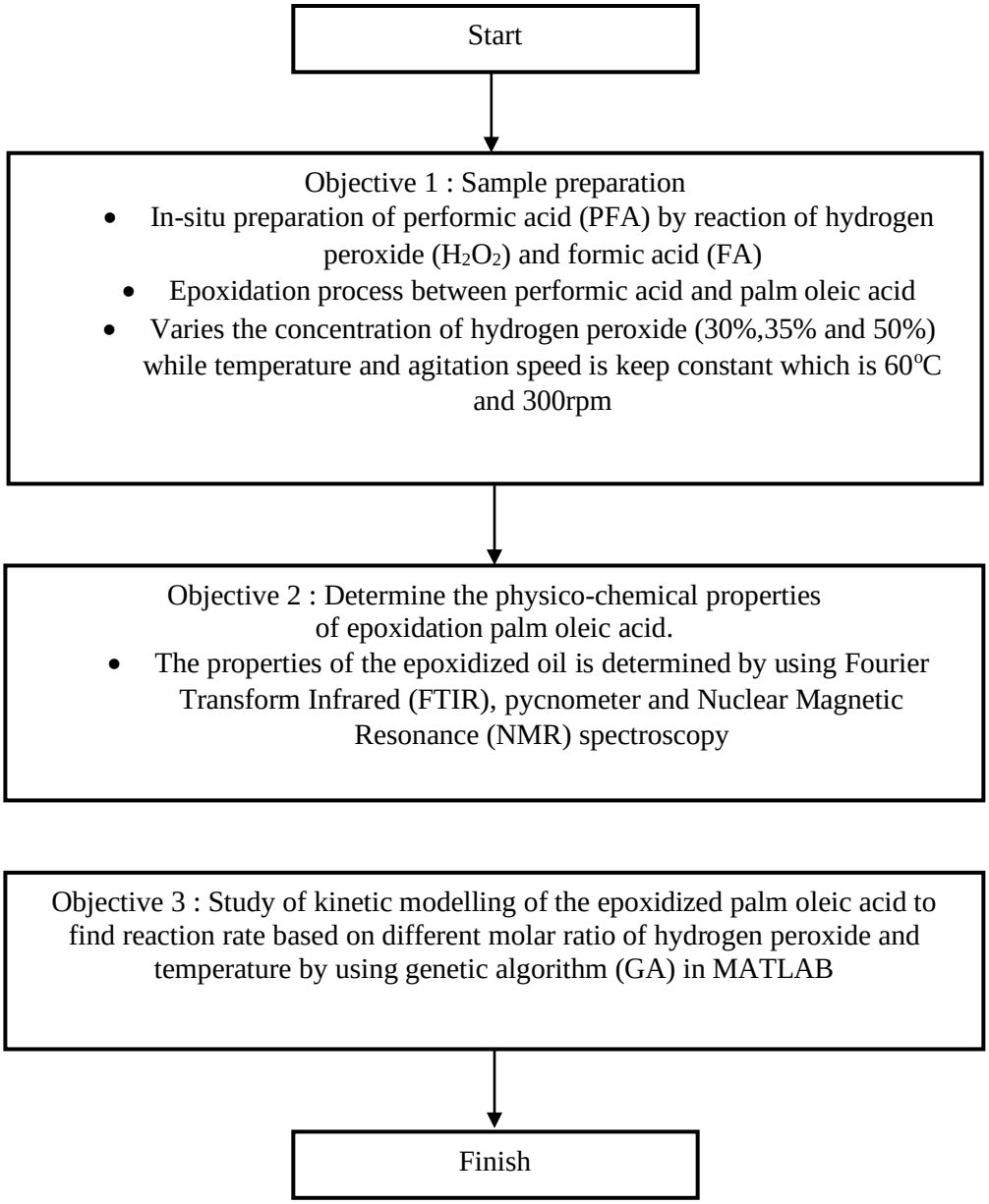
***Keywords*:**
Palm oil, Epoxidation, Concentration, Characterization, Kinetic modelling.

Objectives:

- Determine the effect of hydrogen peroxide (H2O2) toward epoxidation palm oleic acid by organic catalyst.

- To determine the physico-chemical properties of epoxidation palm oleic acid.
- To determine reaction kinetic epoxidation palm oleic acid based on different concentration of hydrogen peroxide (H2O2) and temperature by organic catalyst

Methodology:



Results:

3.1 Statistical Analysis

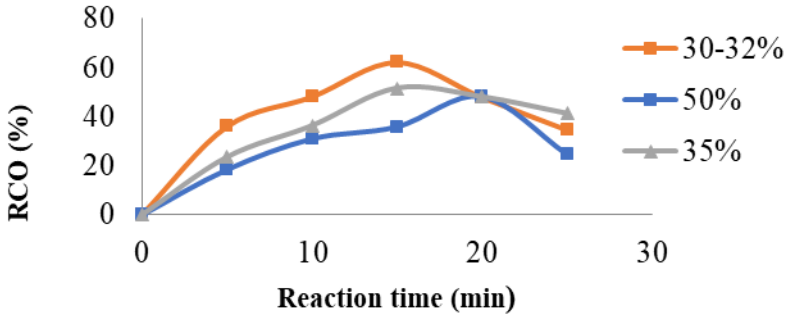


Figure 1 Effect of different concentration of hydrogen peroxide

3.2 Product Characterization

3.2.1 Fourier-Transform Infrared Spectroscopy (FTIR)

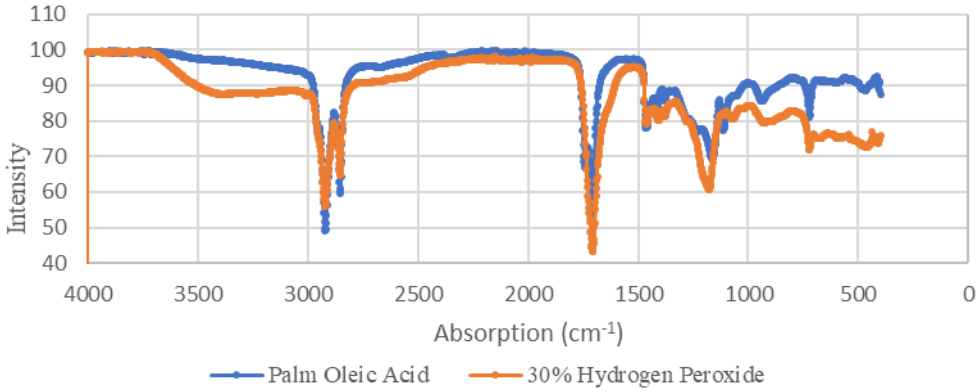


Figure 2 FTIR Comparison of oleic acid and 30% hydrogen peroxide

3.2.2 Pycnometer

Table 4 Sample density

Sample	Density
30% of hydrogen peroxide	0.8806 g/cm^3
35% of hydrogen peroxide	0.8830 g/cm^3
50% of hydrogen peroxide	0.8456 g/cm^3

3.2.3 X-ray Diffraction

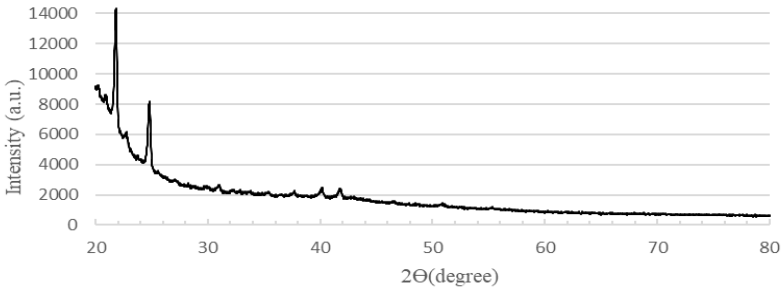


Figure 3 X-ray Diffraction of 30% hydrogen peroxide sample

3.1.4 Nuclear Magnetic Resonance (NMR) spectroscopy

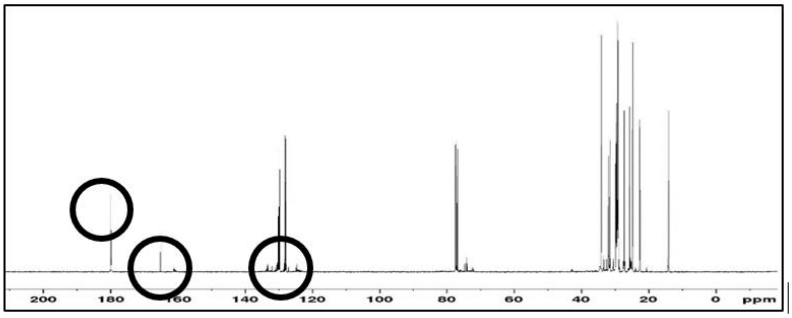


Figure 4 NMR spectra epoxy palm oleic (EPO) acid

3.3 Kinetic Modelling

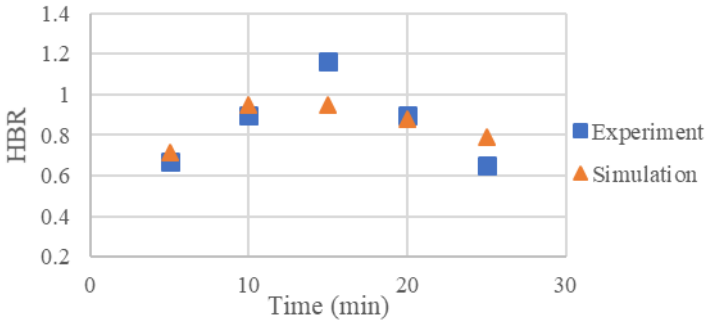


Figure 5 Experiment vs Simulation of 30% Hydrogen Peroxide

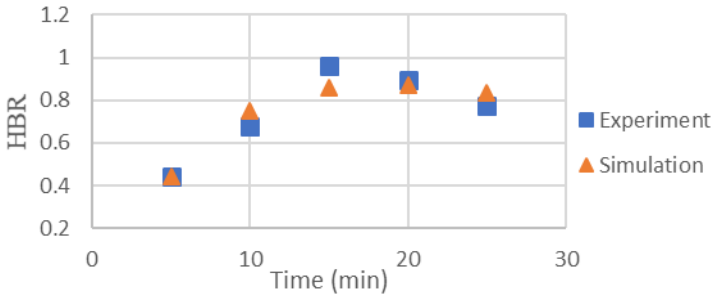


Figure 6 Experiment vs Simulation of 35% Hydrogen Peroxide

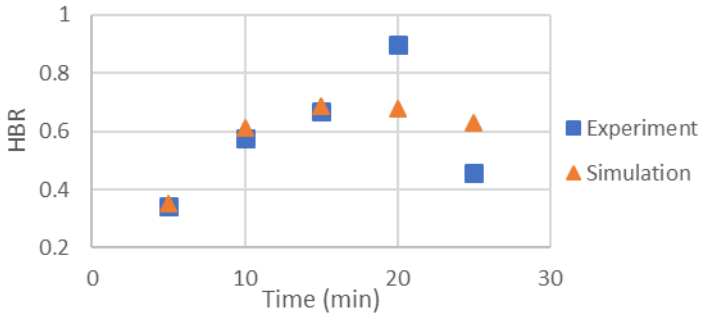


Figure 7 Experiment vs Simulation of 50% Hydrogen Peroxide

Conclusion:

The epoxidation of oleic acid of palm oil by using in situ generated performic acid completed. The result of highest relative conversion to oxirane was obtained to be the lowest concentration of hydrogen peroxide (30%). As the concentration of hydrogen peroxide increase in the mixture, the concentration of peroxy will decrease. The product characterization shows all the result as expected from the past researcher that have been proven in this study.