EPOXIDATION OF VARIOUS PALM FRUIT-BASED OILS AND THE OPTIMIZATION PARAMETER USING TAGUCHI METHOD

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ABSTRACT

Palm fruit-based oils are attractive due to their availability in our country, Malaysia and their role as commodity products that can increase Malaysia economic growth. In *in-situ* epoxidation the unsaturated carbon double bond is modified by adding another atom to produce oxirane ring. Various chemicals have been synthesis using epoxide as the precursor such as alcohols, glycols, olefinic compounds, lubricants, plasticizer and stabilizer for polymers due to high reactivity of oxirane ring. Hence, epoxidized oils are seen as added-value precursors as they are obtained from sustainable and renewable natural resources. The purpose of this study is to establish epoxidation as one of the methods to produce diverse products from crude palm oil, crude palm kernel oil, and refined palm olein. The epoxidized oil was prepared based on peroxy acid epoxidation method. The peroxy acid is generated *in-situ,* using either formic acid, acetic acid or propionic acid. Taguchi Optimization indicates that formic acid, sulfuric acid, crude palm oil and the 75℃ are the best oxygen carrier, catalyst and temperature for the reaction, respectively. The conversion optimized by controlling the parameter that affected conversion of epoxidation processes such as temperature reaction, types of catalyst used, types of oxygen carrier used and different types of material by using Taguchi Optimization method. Sample characterization was done using Fourier transformed infrared (FT-IR) analysis in order to detect the carbon-carbon double bond (C=C) existance in the samples before and after epoxidation.

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CHAPTER 1

INTRODUCTION

1.1 Research background

Malaysia is the second-largest producer of palm oil in the world. The exponential growth of palm oil market in Malaysia allows it to be a potential substitute in producing chemicals that are normally produced from petroleum. It is expected that the global dependence on palm oil will increased from year to year due to insufficient production of other oils and fat. According Yean & Dong(2014), in 2020 the demand for palm oil is at least 78 million tons worldwide.

In addition, Malaysia has held the title as one of the most productive palm oil producers in the world since 2007 (Awalludin et al., 2015). Figure 1.1 shows the production of varience vegetable oils in 1990 and 2014. Palm oil shows the highest increment in production compared to other oils such as rapeseed, soybean and sunflower. The history of oil palm cultivation in Malaysia was started when oil palm trees were planted as ornamental plant before deliberately being used as a national crop. Furthermore, the oil palm tree is a multipurpose crop that benefits the socio-cultural activities of the inhabitants of the area in which it grows.