

## CHAPTER I

### INTRODUCTION

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The refined palm oil consists of saturated fatty acids and unsaturated fatty acids. The saturated fatty acids are hexadecanoic acid (palmitic acid) 43%, tetradecanoic acid (myristic acid) 2% and octadecanoic acid (stearic acid) 7%. The unsaturated fatty acids are 9-octadecenoic acid (oleic acid) 41% and 9,12-octadecadienoic acid (linoleic acid) 7%. The composition of the palm oil is almost the same as the soybean oil, the palm oil also has the oleic acid and linoleic acid which are the unsaturated fatty acids. Although the amount of the unsaturated of the palm oil is lower than of the soybean oil, it should be epoxidized by the same method as the soybean oil. Commercially, the epoxidized soybean oil is used in many fields of industries. Especially, in the PVC industry, the epoxidized soybean oil functions as a secondary plasticizer and a heat and light stabilizer. Due to its similarity, the epoxidized palm oil should have the same function as the epoxidized soybean oil.

#### Scope of the Research

Among many methods of the epoxidation, the in situ epoxidation is selected for a synthesis of epoxidized palm oil because the preformed peracid epoxidation is not safe and difficult to handle. The peracetic acid is chosen instead of the performic acid that reacts rapidly without the catalyst. The performic acid is unstable and more expensive than the peracetic acid. The epoxidation reaction gives 1,2-epoxy compound or the so called oxirane or epoxide ring in the unsaturated double bond. In this work, the  $2^4$  factorial design is used for studying the effects of reaction parameters on the yield of the epoxidized palm oil. Two levels in the quantity of the parameters,

high and low are provided for the experiment. The reactants are 50% hydrogen peroxide solution, glacial acetic acid, concentrate sulfuric acid and solvent. The products are analyzed for the oxirane oxygen and the iodine value, and characterized by FTIR, CNMR and HNMR. The yield of the epoxidation and the amount of reactants used are calculated by a statistical method of the two-way ANOVA to find the significance of the parameters to the yield. Then the amount of each chemical is varied to get the optimum reaction condition that gives the highest yield of the epoxidized palm oil. The reaction temperature, the reaction time and agitation speed are the reaction conditions studied at different levels. The epoxidized palm oil is compounded with PVC, DOP and Ba-Cd- Zn stabilizer. The mechanical properties, the thermal properties and the permanence of plasticizer are measured and compared with the PVC compounded with the epoxidized soybean oil and the PVC compounded without an epoxidized oil. The epoxidized palm oil should be used as a secondary plasticizer and also a stabilizer for the PVC just like the other epoxidized oils.