CHAPTER I

INTRODUCTION

1.1 General

The use of lubricants began in ancient time and has developed into a major international business through the need to lubricate machines of increasing complexity. Synthetic lubricants did not become commercially significant until after World War II. The requirements for lubricants to perform over increasing temperature ranges, that can not be accommodated by mineral oil, is causing a move away from mineral oil to synthetic lubricants. Although these products still represent a small proportion of the lubricants used today, their range of applications is extending steadily, including automotive engine oils, marine engine oils, transmission, and industrial lubricant as well as aviation and aerospace lubricants.

Synthetic base stocks can be obtained by improved formulation based on mineral oils and by chemical reactions of a very limited number of well defined components. In this way the synthetic lubricant can be controlled and can provide desired properties.

Nowaday, many compounds are being investigated as possible base stocks for synthetic lubricants. The major types are polyalphaolefins, alkylated aromatics, polybutenes, aliphatic diesters, polyolesters, polyalkyleneglycols, and phosphate esters. Amongst these, esters are widely use as the main synthetic lubricants because of their high viscosity index, low pour point, low volatility and good thermal stability. In response to increased environmental pressure, the chemistry of esters is being modified so as to produce compounds which have high biodegradabilities, low toxicity and clean engine emission.

Raw materials that have received significant attention for providing synthetic esters are natural fats and oils of vegetable and animal origin.

The purpose of this research is to synthesize diesters for use as lubricating base oil, from palm oil and its free fatty acids such as oleic acid, stearic acid, and palmitic acid. Palm oil, primarily used in food, is now also used as an industrial raw material for the preparation of chemical derivatives, soap, candles, tin-plating, greases and fuel. It has two functional groups : double bonds and esters groups, which open numerous possibilities for chemical reactions.

1.2 Objectives

1. To synthesize diester as lubricating base oils, from palm oil and its free fatty acids.
2. To increase the value of palm oil and its free fatty acids.
3. To decrease the environmental problem of waste used lubricants.

1.3 The Scope of the Investigation

For the preparation of synthetic diesters from palm oil and its free fatty acids, the appreciate conditions and the properties of the products as lubricants were studied. The necessary procedure may be as follows:

1. Literature survey and in-dept study of the work.
2. Preparing the synthetic diesters from palm oil by two main steps.

a.) Transesterification of palm oil by excess methanol and concentrated sulfuric acid at 70-90 °C, for about 3-6 hours.

b.) Re-transesterification of methyl ester from palm oil by diols (such as 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 2,2- dimethyl-1,3-

propanediol, and 2-ethyl-1,3-hexanediol) and concentrated sulfuric acid at 70-90 °C, for about 3-6 hours.

3. Preparing the synthetic diesters from free fatty acids of palm oil (oleic acid, stearic acid and palmitic acid) by esterifications with diols (such as 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 2,2-dimethyl-1,3-propanediol, and 2-ethyl-1,3-hexanediol) and concentrated sulfuric acid with azeotropic removal of water at 110-150 °C, for about 3-6 hours.

4. Characterization of synthetic diester products by FTIR, ^{13}C-NMR, and GC-MS.

5. Determination of physical and chemical properties of synthetic diester products.

6. Summerize the results.