# CHAPTER I

## INTRODUCTION

Lubricating oils have been used for many years. They consist of two components, the base oils and additives. Base oils consist of hydrocarbon compounds that can react with oxygen at high temperature (oxidation) . The degradation of lubricant by oxidation can produce compounds such as aldehydes, ketones, carboxylic acids or gums causing deterioration of the lubricants . Thus, antioxidant additives were necessary to prevent the deterioration by oxygen attack on base oils or to destroy free radicals or to interact with peroxide which are involved in the oxidation mechanism .

Metal dithiophosphates are used as antioxidants and anti-wear additives in lubricants. They are prepared by reacting a dithiophosphoric acid with a basic metal compound . The dialkyl dithiophosphoric acids are usually made by reacting phosphorus pentasulfide ($P_2S_5$) with an alcohol which contains at least four carbon atoms**[1]**.The popular metal dithiophosphates are zinc dithiophosphates (ZDDP). Theoretically, other metals could be used.

In this study, metal dithiophosphates were prepared from metal oxides such as zinc oxide , copper(II) oxide and calcium oxide by reaction with the dialkyl dithiophosphoric acid derived from isoamyl alcohol. This alcohol is a by product of the ethyl alcohol fermentation industry and it is a primary alcohol which has good thermal stability. The metal dithiophosphates were tested for thermoxidation stability and compared with industrial zinc dithiophosphate .

The main purpose of this study was to prepare and characterize metal dithiophosphates and test the oxidative stability of these compounds.

## Scope of the research

The necessary procedures for this research are follow:

1. Preparation of the metal dithiophosphate(MeDDP) .
2. Characterization of metal dithiophosphate by FT-IR, NMR, EA and XRF.
3. Test of oxidative stability of synthesized metal dithiophosphate by thermal gravimetric analysis (TGA).
4. Summarize the results.

## The objective of research

1. To synthesize metal dithiophosphates from isoamyl alcohol.
2. To use MDDP which were synthesized as antioxidant.