# CHAPTER I
# INTRODUCTION

## 1.1. BACKGROUND

Lubricating oil is emitted into the environment in the form of oil mist and micro drops, posing a major threat to the environment [1]. It was reported that the annual production of lubricants is 30-40 million tons; these compounds are often used for many industrial applications in order to decrease friction and heat, protect against corrosion and wear, transmit energy, and eliminate contaminants or sealing processes, among others. It was reported that about 50%–75% of total lubricant production is poured uncontrollably into the environment [2]. About 95% of total lubricant production is petroleum-based, generally denoted as mineral oil. In the natural environment, oil of petroleum origin creates primary hazards for sawing operators, but also secondary hazards due to the accumulation of oils in plant, animal, and groundwater tissues. Lubricating oils produced from crude oil are also a very significant threat to aquatic ecosystems. Water containing 1 ppm of oil is considered contaminated.

The Indonesian Government also stipulates in the Government of the Republic of Indonesia Regulation No.101 of 2014 (PP RI No.101 of 2014) on "The Treatment of Hazardous and Toxic Waste Materials", that used lubricants belong to the type of B3 waste from the source [3].This is because waste from synthetic-based used lubricants and mineral oils have harmful substances that are not easily degraded by the environment such as ferrous metals (Fe) that belong to heavy metals. Used lubricants also contain many harmful substances that can cause death and diseases that can harm human health and living things in the environment.

To reduce further pollution, many lubricants now use biological base oil to create biolubricant. Research studies on lubricants from biological materials are continuously being carried out to obtain lubricants from biological materials that are better than lubricants from mineral substances. Sources of lubricants from biological materials consist of soybeans, cocoa, coconut, jatropha, palm oil, which generally can be grown in tropical areas [4]. Biolubricants play an important role

in supporting the green tribology program. The criteria and characteristics of a lubricant must meet six basic standards, namely: viscosity index, total base number, pour point, flash point. Vegetable oils from palm oil are used for foods, medicinal and health products, household products, and industrial products. For the engineering purpose the palm oil could be used as a lubricant whereas generated by using CPO (Crude Palm Oil) as the base oil. This vegetable oils still have a flaw that it's easy to be oxidized, so to reduce the oxidation effect clove oil will be added as the additive because clove oil contains eugenol. Eugenol is the main component of clove oil, which has strong antioxidant activity [5].

In this final project, we will observe the effect of the addition of clove oil into the palm oil to the physical and tribological properties. The physical properties testing consist of viscosity testing, and the tribological properties testing consist of wear testing, surface texture observation, and coefficient of friction testing by using the pin on disc tribometer. The test will be conducted by mixing the base oil with the additive with a percentage of 0%wt, 5%wt, and 10%wt.

## 1.2. OBJECTIVES

This objective that this study wants to achieve is to analyze the effect of clove oil addition of 0%wt, 5%wt, and 10%wt to palm oil for the physical and tribological properties by conducting viscosity testing, wear testing, surface texture observation, and coefficient of friction testing.

## 1.3. BENEFITS

Study to the addition of clove oil as the additive with palm oil as the base oil through physical and tribological testing is expected to be a reference whether palm oil with variation of clove oil addition can be used as a base material for environmentally friendly lubricants (biolubricant).

## 1.4. PROBLEM LIMITATIONS

1. The raw material for this study is commercial palm oil.

2. Increased temperature due to friction is ignored.
3. Disc surface hardness and roughness is considered uniform.
4. This study is conducted at room temperature.

## 1.5. OUTLINE

The systematics of writing this research proposal in general consists of five parts, namely: **CHAPTER I. INTRODUCTION,** In this section described research background, research objectives, research benefits, limitations of research problems and systematic research writing. **CHAPTER II. LITERATURE REVIEW**, In this section explains about the basic theories about research in which there are basic theories such as lubrication, tribology, and other theories that are deemed necessary. **CHAPTER III. METODOLOGY**, In this section explains about the research methods and processes carried out from the start of the research to the end that will be used to achieve the desired goals and results. **CHAPTER IV. RESULT AND DISCUSSION**, in this section explains the analysis and processing of test result data. **CHAPTER V. CONCLUSION**, in this section explains about the conclusion of the results of research that has been done,