CHAPTER I

INTRODUCTION

Biodiesel is an alternative fuel for diesel engines. It is receiving great attention worldwide. It attracts the most attention because it is renewable, it can be used either pure or in blends with diesel fuel in unmodified diesel engines, and it reduces some exhaust pollutants. It is also attractive because it can be produced easily from common feedstocks. The relative simplicity of biodiesel production can disguise the importance of maintaining high quality standards for any fuel supplied to a modern diesel engine. It is essential to the growth of the biodiesel industry that all fuel produced and sold meet these quality standards.

Biodiesel is defined as the mono-alkyl esters of fatty acids derived from vegetable oils or animal fats. In simple terms, biodiesel is the product obtained when a vegetable oil or animal fat is chemically reacted with an alcohol to produce fatty acid alkyl esters. A catalyst such as sodium or potassium hydroxide is required. Glycerol is produced as a co-product. The mixture of fatty esters produced by this reaction is referred to as biodiesel. In general, biodiesel may also include fatty esters derived from other vegetable or animal sources. Other alcohols besides methanol may be used so it will be necessary to distinguish between the three terms. The fuel properties of biodiesel are determined by the amounts of each fatty acid in the feedstock used to produce the esters. Fatty acids are designated by two numbers: the first number denotes the total number of carbon atoms in the fatty acid chain and the second is the number of double bonds present in the chain. For example, 18:1 designates oleic acid, which has 18 carbon atoms and one double bond.

Water in the oil or fat can also be problem. When water is present, particularly at high temperatures, it can hydrolyze triglycerides to diglycerides and form a free fatty acid. When an alkali catalyst is present, the free fatty acid will react to form soap following the reaction given earlier. When water is present in the reaction it generally manifests itself through excessive soap production. The soaps of saturated fatty acids tend to solidify at ambient temperatures so a reaction mixture with excessive soap may gel and form a semi-solid mass that is very difficult to recover.

The production of methyl esters are used as biodiesel and feedstock for the oleochemicals industry. Commercially, methyl esters of fatty acids can be produced either by esterification of fatty acids or transesterification of triglycerides. The predominant process for production of methyl esters are esterification and transesterification of fats and oils with methanol.

Esterification consists of a sequence of consecutive reversible reactions where the free fatty acids (FFA) in the oil are successively transformed finally into methyl ester and water. The stoichiometry ratio of this reaction thus requires 1 mol of alcohol per 1 mol of FFA to give 1 mol of fatty alkyl ester and 1 mol of water.

Transesterification consists of sequence of consecutive reversible reactions where the triglyceride is successively transformed finally to be ester and glycerol. The stoichiometry of this reaction thus requires 3 mole of alcohol per 1 mole of triglyceride to give 3 mole of alkyl ester and 1 mole of glycerol. The products of the process are mixture of alkyl ester with glycerol as a by-product. The by-product, glycerol, may be used in the soap industry. The alcohols used most frequently are methanol and ethanol while the catalyst may be basic or acid. The basic catalysts are most of the commercial methyl ester produced from transesterification using basic catalysts (KOH or NaOH). The basic catalyzed process is less corrosive than the acid (H_2SO_4) catalyzed and proceeds at a much higher rate.

Today biodiesel have been in commercial use in many countries, almost in every country worldwide there are activities in biodiesel production and utilization. Biodiesel is either used in pure form or as blends with petroleum diesel fuel, which-in contrast to neat vegetable oil/diesel blends-are stable in any concentration.

In this thesis the transesterification process using basic and acid catalyst was studied. The primary purpose of this study is to investigate waste from the process such as residue catalyst, soap and washed water. The experiment was conducted in a batch reactor system. The catalysts were studied such as sulfuric acid and basic catalyst such as potassium hydroxide, sodium hydroxide, and sodium methoxide. Several types of palm oils including, palm olein, palm stearin, used palm olein and blended of palm olein and palm stearin were studied in transesterification reaction with methanol. The results of waste in some of laboratory experiments were comparison with the results of product sample from biodiesel industry process.