CHAPTER I

INTRODUCTION

1.1 Statement of purpose

Biodiesel is an alternative fuel produced from renewable resources. It has been used increasingly as a substitution for diesel due to their similarity in combustion properties. Moreover, this alternative resource also has the capability to degrade itself by natural biological process which is non-toxic to the environment. Due to these advantages, the attention in biodiesel has continuously increased together with its higher consumption.

The production of biodiesel requires a chemical process called "transesterification", a reaction between vegetable oil and alcohol in which a base is used as catalyst [1]. In addition, the process also includes incorporation of additive elements or minerals to enhance the efficiency of the biodiesel engine. Unfortunately, the excess quantity of these additional elements can accelerate the damages to engine and therefore its regulation and quantification is equally important.

Among techniques commonly used for the determination of these elements are Flame Atomic Absorption Spectrometry (FAAS), Electrothermal Atomic Absorption Spectrometry (ETAAS), X-ray Fluorescence spectrometry (XRF), Neutron Activation Analysis (NAA), Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). ICP-AES is one of the most popular techniques for trace elemental analysis as it offers multi-element capability along with a well-balanced performance in terms of sensitivity, accuracy, speed and cost efficiency [2].

For the analysis of biodiesel by ICP-AES; however, the oil sample put directly into the equipment may destabilize the plasma and reduce the ionization/excitation efficiency due to its high viscosity and complicated matrices. In order to reduce these adverse effects, specific sample preparation techniques are required. Several pretreatment methods have been used for the preparation of biodiesel for such

analysis. Organic solvent dilution technique [3] can be considered as the most simple and fastest technique but still have the problems of excessive amounts of organic solvents that will impact the analysis by ICP-AES. The dilution technique also required expensive and unstable metal organic standards for calibration. Another approach is acid digestion technique which uses acids to liberate analyte elements from organic matrix [4]. Nevertheless, this technique is laborious and extremely time consuming. Dry ashing technique [5] has also been used without much success due to lengthy procedure and the risk of introducing contamination to samples. Recently an emulsification technique [6] was introduced as an alternative for oil sample preparation method. The technique is the combination of two different liquids that are not miscible with each other, i.e. aqueous and oil, into a homogeneous emulsion by an emulsifying agent. This technique has been gaining a lot of interest as it is very simple, time saving and economical. Nonetheless, the technique is limited by the stability of the prepared emulsion and metal organic standards are still required to provide reliable and satisfactory results. It is obvious that there is a continual need for a fast and simple as well as economical sample preparation method for elemental analysis of oil samples.

Therefore, this research aims to achieve such goal by developing a pretreatment procedure pertaining biodiesel for ICP-AES analysis based on emulsification technique.

1.2 Objectives

1. To investigate the sample preparation means for biodiesel for use in the determination of elements by ICP-AES.

2. To study the factors affecting the preparation of biodiesel by microemulsion technique.

3. To validate the developed method for elemental analysis of biodiesel and apply to real samples.

1.3 Scopes of this research

To develop the biodiesel sample preparation technique with an emulsification technique and to optimize and validate the developed technique for elemental analysis by ICP-AES.

1.4 The benefit of this research

A simple, fast, and economical sample preparation method for a reliable and accurate determination of elements in biodiesel by ICP-AES will be obtained.