1 INTRODUCTION

1.1 Motivation and statement of problem

Energy is a key element of the interaction between nature and society and is considered as a main input for economic development. However, energy is defined as a maximum obtainable potential of work of an energy or energy flow in relation to the reference environment. Nowadays, main energy source generated from fossil fuels. Fossil fuels as the name suggests are derivatives of plant and animal fossil that are million years old. There are three fuel sources which are coal, natural gas and petroleum to supply energy and electricity. It is obvious that current use of fossil fuels in various sectors for heat and power generation continues threatening global stability and sustainability. The demands of the energy never decrease and industrial revolution shows that fossil fuel demand still going on. This energy resource is the major energy but give disastrous effects such as air pollution. When burnt, they give out carbon dioxide that leads to global warming issues. As the fossil fuels are extracted to an unlimited level it is for sure that will deplete someday. Since they are non-renewable it would take millions of year to replace oil and coal and we are not actually sure where that fuels limit is. Due to these problems, there is a need to find alternative source of energy and biodiesel is one of the solution that have been considered to solve the problems of fossil fuel depletion and degradation (Borugadda and Goud, 2012).

The use of biodiesel as a substitute for conventional diesel has been of great interest. In industry, biodiesel is not to replace the petroleum but to become another alternative source of energy. Currently, the issues of environmental pollution, global warming and depletion of fossil fuel due to demand of energy have drawn serious attention in global dimensions (Kawashima, 2009). This energy resource is the major energy but give disastrous effects such as air pollution. Biodiesel shows a favourable combustion emission profile, producing less carbon monoxide, sulphur dioxide and unburned hydrocarbons than fossil fuel (Chen et al., 2009). Biodiesel can be chemically defined as a mono-alkyl ester of long chain fatty acids derive from renewable source such as animal fats and vegetable oil (Math, 2010). Generally, biodiesel is produced through a process known as transesterification in which triglyceride are react with
alcohol under acidic or basic catalytic condition. The reaction will produce glycerol and fatty acid esters of the respective alcohol.

Moringa oleifera is consider as a versatile plant due to its multiple uses. Some parts of the tree can be eaten and form part of traditional diets in many countries of the tropics and sub-tropics (Siddhuraju and Becker, 2003; Anhwange et al., 2004). Other than that, to its substantial uses and nutritional benefits, Moringa oleifera also has a great potential as a medicinal plant. Most part of this plant such as root, gum, bark, leaf, pod and seed oil has been used as a medicine in Africa and South Asia. It has been used for the treatment of cardiovascular, infectious diseases, inflammation haematological, gastrointestinal and hepatorenal disorders (Siddhuraju and Becker, 2003). The Moringaceae is a single-genus family of oilseed trees with 14 species. The most known and utilized species is Moringa oleifera which ranges in height from 5 to 10 m (Morton, 1991; Sengupta and Gupta, 1970). When fully mature, dried Moringa seeds are round or triangular in shape, the kernel is surrounded by a wooded shell and the seeds as we know can produce between 33% to 41% w/w vegetable oil (Sengupta and Gupta, 1970). Moringa seed oil is potential source of oil, known as Ben oil (Ndabigengeser and Narasiah, 1998). Oleic acid is the most abundant fatty acid present in Moringa seed oil (>70%) and also categorize as high-oleic acid oil. Other important fatty acid founded are palmitic (6.45%), steric (5.50%), behanic (6.16%) and arachidic (4.08%). Moreover, Moringa oleifera also has been found to be potential new source of oil especially with the arrival of the need for oleo-chemical and biodiesel all over the world (Anwar and Rashid, 2007). However, this plant still one of the under explored plants and there is lack of information about physico-chemical properties of the seed oil which has limited their applications.

1.2 Objectives

The objective of the study is to explore the characterizing of biodiesel production from Moringa oleifera seeds and compare with the standard ASTM
1.3 Scope of this research
The following are the scope of this research:

i. Extraction of oil from *Moringa oleifera* seeds.

ii. Preparation of *Moringa oleifera* biodiesel

iii. Experimental analysis of cetane number of *Moringa oleifera* methyl ester

iv. Experimental analysis of kinematic viscosity of *Moringa oleifera* methyl ester

v. Experimental analysis of flash point of *Moringa oleifera* methyl ester

vi. Experimental analysis of density of *Moringa oleifera* methyl ester

vii. Experimental analysis of acid value of *Moringa oleifera* methyl ester

viii. Experimental analysis of pour point of *Moringa oleifera* methyl ester

ix. Experimental analysis of cloud point of *Moringa oleifera* methyl ester

1.4 Main contribution of this work
*Moringa oleifera* has gained the popularity as source of nutritional food and many country especially Africa use all the part of the tree as a food and also as a medicine. *Moringa* seed is one of the part that can produce oil. The main contribution of this work is to find alternative renewable energy resource that are clean, sustainable, and economical feasible. Biodiesel also one of the solution that have been considered to solve the problem of fossil fuel depletion and environmental degradation.