

EXPERIMENTAL INVESTIGATION OF CASTOR OIL AS AN ALTERNATIVE FUEL FOR BIODIESEL

A. S. Ahmed

Corresponding author.

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, Universiti Malaysia, Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia (phone: +6082583299; fax: +6082583410; E-mail: aasaleh@feng.unimas.my).

S. Ismail and R. Rahman

Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia (E-mail: mailkool91@yahoo.com; rmrezaur@feng.unimas.my).

S. Hamdan

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia (E-mail: hsinin@feng.unimas.my).

In this study, the efficiency of biodiesel conversion from crude castor oil to castor biodiesel (CB) through transesterification method was investigated. The acid-base catalyzed transesterification under different reaction condition such as the molar ratio of alcohol and mass ratio of catalyst to oil was studied for optimum proportion to achieve highest yield of Castor biodiesel. The optimum condition for acid-base catalyzed transesterification was determined to be 0.22 oil/methanol (v/v) and 0.005 KOH/oil (v/v). The potential of CaCO_3 to be used as solid base catalyst for transesterification of castor oil was also investigated. Then the fuel properties of the produced castor biodiesel such as the calorific value, flash point and density were analyzed. Component analysis was carried out by using FT-IR. The diesel engine performance and emission test using different castor biodiesel blends were then conducted. B20 blend of castor biodiesel was proved to have the same engine power output as mineral diesel with lower average percentage of change in CO, PM and HC emissions compared to mineral diesel. Thus a B20 blend of castor biodiesel was a suitable alternative fuel for diesel.

Keywords: biodiesel, transesterification, castor oil, diesel engine, emission

1. INTRODUCTION

The petroleum fuels play a very important role in the development of industrial growth, transportation, agricultural sector and to meet many other basic human needs of modern civilization. These fuels are limited and depleting day by day as the consumption is increasing very rapidly. Moreover, the production and use of petroleum fuel is alarming the environmental pollution problems to society. A global movement towards the generation of environment friendly renewable fuel is therefore under way to help meet increased energy needs.

Biofuel had become one of the promising alternatives for fossil fuels. Biodiesel is among the potential biofuel that can easily being produced from vegetable oil. Biodiesel has become an interesting alternative fuel substitute over conventional diesel. Biodiesel is suitable to be used in diesel engine which is due to the similar properties to the conventional fossil diesel fuel in terms of power and torque and none or very minor of engine modification is required [1]. Moreover, the biodiesel has a few special features which are biodegradability and being much more environmentally friendly compared to the conventional fossil diesel and resulting in less environmental impact upon accidental release to the environment [2]. Biodiesel has many important technical advantages over conventional diesel such as inherent