

A Study on Chicken Fat as an Alternative Feedstock: Biodiesel Production, Fuel Characterisation, and Diesel Engine Performance Analysis

M. N. Mohiddin, A. A. Saleh*, A. N. R. Reddy and S. Hamdan

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering,
Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia

*Email: aasaleh@unimas.my

Phone: +6082583299; Fax: +6082583409

ABSTRACT

Biodiesel is one of the promising renewable sources to fulfill the future energy demand of the world. Sustainable feedstock for biodiesel production is one of the major criteria to ensure the process of renewability. Chicken fat is an encouraging feedstock for biodiesel. In this study, waste chicken fat was converted to biodiesel via catalysed transesterification. Optimised process parameters were recorded at 1:4 oil-to-methanol volume ratio and 0.5 wt% KOH catalyst concentration with a biodiesel yield of 96%. The FT-IR spectral analysis of chicken fat and chicken fat biodiesel confirmed the conversion of chicken fats into biodiesel. The physico-chemical properties of biodiesel were tested in accordance with ASTM D6751 and EN 14214 biodiesel standards. The specific fuel properties of chicken fat biodiesel that include calorific value, viscosity and acid value were found to be lower than that of petrodiesel. The diesel engine performance tests confirmed that the biodiesel blends performance was similar to petrodiesel. It is noted that while the brake horsepower increased with the increase of biodiesel blending percentage, the engine power output was found to decrease. Specific fuel consumption also increased along with the biodiesel blending percentage.

Keywords: Chicken fat; biodiesel; transesterification; engine performance.

INTRODUCTION

In the near future, world's fossil fuel reserves may be exhausted as their formations take millions of years [1-3]. Some sources even predicted that petroleum oil will be depleted by the year 2045 [4-6]. However, fossil fuels availability may be prolonged by decreasing their overall consumption [7, 8]. The search for technically, economically and environmentally acceptable alternative fuels for diesel engine escalated with the decline of global petroleum reserves and the increase of environmental consciousness especially for transportation sector [9-11].

Biodiesel (mono-alkyl ester) is a biodegradable, renewable and sustainable source of energy. Triglycerides in oil undergoes transesterification process with alcohol to yield biodiesel. The production of biodiesel is possible by utilising oil feedstocks such as waste cooking oil, palm oil, sunflower oil, canola oil, corn oil, fish oil, and chicken fats [12, 13]. Due to various tangible benefits of using biodiesel especially for environmental care and economic development, fats and oil-derived fuels have become attractive alternatives for petroleum-based diesel [14]. Besides, biodiesel is non-toxic and poses no threat to human health [15, 16]. Biodiesel's major disadvantage is its high commercial cost. Biodiesel costs 50 % more than petroleum diesel [17]. Moreover, the raw material for