AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

PARAMETRIC STUDY OF USING BIODIEESEL FUEL PRODUCED FROM RECYCLING FRYING OIL IN DIESEL ENGINE

By

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Statement

This dissertation is submitted to Ain Shams University in fulfilment of the requirements for the degree of Master of Science in Mechanical Engineering.

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No part of this thesis has been submitted for degree or qualifications at any other university or institute.

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ABSTRACT

The comparative spray characteristics of petroleum diesel, biodiesel blends and biodiesel-ethanol blends were reported. 25%, 50% and 75% by volume biodiesel–diesel blends were used to examine the effect of varying the biodiesel content on the performance and emissions of a single-cylinder naturally- aspirated direct injection (DI) compression ignition engine at various engine loads. 50 % biodiesel fuel was used to determine the effect of varying both of alcohol concentration on the engine performance.

The spray angle was found to decrease by about 45 % while its tip penetration distance increased by about 22 % upon switching from diesel to biodiesel. No significant changes in the spray pattern were found by blending the diesel/biodiesel mixture with ethanol.

Brake specific fuel consumption (BSFC), exhaust gas temperature (EGT), nitrogen oxides (NOx) and carbon dioxide emissions (CO_2) increased by about 24, 11, 10 and15 % respectively in addition to a reduction in the brake thermal efficiency (BTE), carbon monoxide (CO) and unburned hydrocarbons (HC) emissions by 11, 50 and 51 % respectively upon switching from pure diesel to pure biodiesel.

Reduction in BTE, EGT, NO_x, CO and HC by about 5, 7, 10, 11 and 39 % respectively and an increase in CO_2 and BSFC by about 10 and 9 % respectively were identified when ethanol was blended with biodiesel-diesel mixture. Increasing the injection pressure enhanced the engine performance by increasing the BTE and reducing BSFC, CO and HC emissions.

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Abbreviations

B0	Pure diesel fuel (100 % Diesel)
B25	75 % Diesel + 25 % Biodiesel
B50	50 % Diesel + 50 % Biodiesel
B50E5	45 % Diesel + 50 % Biodiesel + 5 % Ethanol
B50E10	40 % Diesel + 50 % Biodiesel + 10 % Ethanol
B75	25 % Diesel + 75 % Biodiesel
B100	Pure biodiesel (100 % Biodiesel)
BSFC	Brake Specific Fuel Consumption
BTE	Brake Thermal Efficiency
EGT	Exhaust Gas Temperature
HCs	Unburned Hydrocarbons Emissions
CO_2	Carbon Dioxide Emissions
CO	Carbon Monoxide Emissions
NO_x	Nitrogen Oxides Emissions
WVO	Waste Vegetable Oil
RSOME	Rapeseed oil methyl ester
CaOME	Canola oil methyl ester
COME	Corn oil methyl ester
PKOME	Palm kernel oil methyl ester
RPOS	Refined palm oil stearin
PNOME	Peanut oil methyl ester
DRE	74% Diesel fuel + 20% Rapeseed oil + 5% Ethanol + 1% Iso propanol
SBOME	Soybean oil methyl ester
SFOME	Sunflower oil methyl ester

Nomenclature

W	Energy equivalent of the calorimeter
C. V.	Calorific value
η_1	Dynamic viscosity Fuel
η_2	Dynamic viscosity of water
ρ_1	Densities of liquid
ρ_2	Densities of water
t_1	Times taken by fuel to flow between the two marks A and B.
t_2	Times taken by water to flow between the two marks A and B.

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