ScienceDirect

Materials Today: Proceedings

Volume 63, 2022, Pages 535-541

Experimental analysis of nano additive blended in Mahua oil biodiesel on engine characteristics

S. Ramasubramanian [a], V.S. Shai Sundram [a], L. Karikalan [a], S. Baskar [a], Sandip Kumar Sahu [b], Dilip S. Borkar [c], Prashant Kumar [d]

Show more

https://doi.org/10.1016/j.matpr.2022.03.657

Get rights and content

Abstract

Fossil fuel depletion and environmental degradation are currently facing the planet. Increased automobile, power plants, and factories emit more carbon monoxide (CO), unburnt hydrocarbon (HC), and nitric oxide (NO_x) emissions as a result of increased automobiles, power plants, and factories. As a result, the globe is looking for an alternative fuel that will not hurt the environment and will also be less expensive. It should also be renewable resources. It pushes the car into the next generation. Vegetables, which satisfy the need for physical and chemical qualities of mineral diesel in the current context. When vegetable oil is used in a diesel engine, it has a negative impact on performance and durability. As a result, the oil should be converted to biodiesel. Transesterification is a useful procedure for changing the properties of raw oil. One of the most essential solutions to the global energy dilemma is biodiesel. The performance and emission parameters of Mahua oil bio-diesel were investigated in this study (MOB). Additives are used to improve biodiesel's combustion properties. Tests were conducted across the whole spectrum of engine operation and under various load circumstances. Engine performance factors like as specific consumption, braking thermal efficiency, and exhaust gas emissions are reduced as biodiesel concentration is increased. MOB blends can be used to replace diesel in diesel engines used in transportation and agriculture.

Introduction

The usage of renewable fuels such as vegetable oils has become increasingly vital in the face of rapidly dwindling fossil fuels and an ever-increasing diesel vehicle population. Global energy use is expected to rise by 42 % by 2025, based on the International Energy Agency [1]. Many experiments are being undertaken to see if alternative fuels like biodiesel may be used to replace diesel fuel [2], [3], [4]. Biodiesel is the best alternative to diesel fuel, it's also simple to make from seeds and blooms. In the twenty-first century, it is expected that finding and manufacturing crude oil and petroleum products would become increasingly complex [5]. Despite major advancements in engine fuel efficiency, the expanding number of automobiles alone indicates that gasoline will continue to be in great demand. Alternative fuel technology, availability, and use must and will become more widespread in the next decades. Another reason pushing the development of alternative fuels for IC engines is concerns about pollution created by gasoline engines. Automobiles contribute significantly to the global air quality problem when combined with other air-polluting

technologies [6]. Energy is important in every facet of a country's economy. A country's per capita energy usage is directly proportional to its standard of life [7].

In everyday life, energy is vital. The ability of a country's economy to grow is primarily dependent on the availability of energy. Primary energy sources include energy that is available in its natural state, like crude oil, solar heat, coal, natural gas, and so on. Many of these sources aren't immediately useable and must be processed or converted before being used. Petroleum refineries refine crude oil, and the resulting petroleum products, such as gasoline, are classified as secondary energy sources [8], [9], [10]. Supply and demand at the moment in the current trend of countries, the world will be more congested in the next 50years than it is today. The world's population could exceed ten billion people. Traditional energy sources are decreasing, and they may be depleted by the end of this century or the beginning of the next. Vegetable oil, Biogas, methanol, producer gas and ethanol are among the several alternative fuel options investigated for diesel. Among all of these vegetable oils, one stands out because it has fuel qualities that are identical to diesel [11], [12]. Sunflower, soybean, peanut, cottonseed, and other edible vegetable oils have been successfully tested in diesel engines [13], [14]. Experiments using edible oils in this direction have generated promising results. However, because India continues to import Nonedible oils from minor oilseed, such as mahua oil, have been examined as a diesel fuel extender since they include high levels of edible oils. Using biomass energy instead of fossil fuels results in a net reduction in carbon monoxide (CO) and carbon dioxide (CO_2) emission, according to several research conducted throughout the world. SO_2 emissions from biomass energy are substantially lower than those from gasoline, coal, and even certain natural gases because related trees and plants contain only trace levels of sulfur.

Section snippets

Additives for Nano metal

Nano metal additions are a relatively novel type of metal additive with atom sizes of less than 1–100nm [15]. To improve thermophysical qualities, making them a natural choice for use. With the advancement of nanotechnology in recent years, scientists have been focusing on employing Nano-metal additions to improve a conventional diesel engine's combustion behavior, stability, and other engine performance metrics and emission characteristics[16]. High thermal conductivity improves heat and mass …

Biodiesel

Madhuca longifolia and Madhuca indica are two madhuca species found in India. Mahua is a plant that grows in wastelands and dry locations and is also called Illupai Maram. The seeds of the tree are sometimes referred to as the Indian butter tree. Mahua oil has a specific gravity of 9.11% higher than diesel. At 40°Celsius, mahua oil had a kinematic viscosity of 3.8 times that of diesel. When temperature of mahua oil was elevated to 80°C and the amount of diesel in fuel blends was increased, the …

Experimental Setup

Sri Venkateswara Engineering Consultancy Services, Kancheepuram, conducted the experiments. To test the performance and combustion characteristics, a 5-HP (5.2kW) four-stroke C.I engine was utilized. The mass flow sensor was used to detect the airflow rate into the engine, and the burette method was used to measure the fuel consumption. In the eddy current dynamometer, loading was applied to the engine. The experiment was conducted with various loads. During the experiment, various sensors…

Results and discussion

The key performance variables are analyzed, including braking power (BP), specific fuel consumption (SFC) and brake thermal efficiency (BTHE)….

Conclusion

The goal of the experiment was to see how Aluminum oxide (Al_2O_3) Nanoparticles added to Mahua oil affected CI engine combustion performance, and emission characteristics. Based on the experimentations, the subsequent assumptions were drawn: The thermal efficiency of diesel and Mahua oil combined with Aluminum oxide brakes was virtually comparable (20ppm). When Mahua oil combined with Aluminum oxide (20ppm) was used instead of diesel, carbon monoxide (co) emissions were reduced. Mahua oil…

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

Special issue articles Recommended articles

References (23)

S. Arya *et al.*
Tyre pyrolysis oil as an alternative fuel: A review
Mater. Today:. Proc. (2020)

R.A. Lee *et al.*
From first- to third-generation biofuels: Challenges of producing a commodity from a biomass of increasing complexity, Animal
Frontiers. (2013)

A. Sharma *et al.*
Effect of nozzle opening pressure on the behaviour of a diesel engine running with non-petroleum fuel
Energy. (2017)

A. Sharma *et al.*
Investigation on the behaviour of a DI diesel engine fueled with Jatropha Methyl Ester (JME) and Tyre Pyrolysis Oil (TPO) blends
Fuel (2013)

A. Sharma *et al.*
Potential for using a tyre pyrolysis oil-biodiesel blend in a diesel engine at different compression ratios
Energy Convers. Manage. (2015)

A. Sharma *et al.*
Combustion, performance and emission characteristics of a di diesel engine fuelled with non-petroleum fuel: A study on the role of fuel injection timing
J. Energy Inst. (2015)

A. Sharma *et al.*
Durability analysis of a single cylinder DI diesel engine operating with a non-petroleum fuel
Fuel (2017)

J. Thamilarasan *et al.*
Investigation of plastic Pyrolysis oil performance on CI engine blended with magnesium oxide nanoparticle using Taguchi method
Mater. Today:. Proc. (2021)

A. Sharma *et al.*

Effect of blending waste tyre derived fuel on oxidation stability of biodiesel and performance and emission studies of a diesel engine
Appl. Therm. Eng. (2017)

N.L. Panwar *et al.*
Performance evaluation of a diesel engine fueled with methyl ester of castor seed oil
Appl. Therm. Eng. (2010)

View more references

Cited by (0)

View full text