

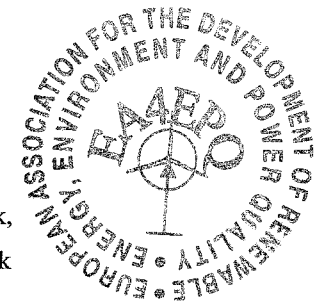
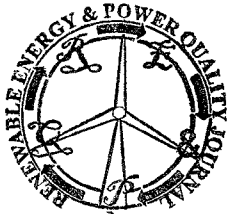
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## Combustion Characteristics of CI Engine Running with Biodiesel Blends

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### Abstract

Biodiesel is one of the promising renewable, alternative and environmentally friendly biofuels that can be used in diesel engine with little or no modification in the engine. In the present study an experimental investigation has been carried out on the combustion and performance characteristics of a CI engine running with biodiesel under steady state operating conditions. The experimental work has been conducted on a four-cylinder, four -stroke, direct injection (DI) and turbocharged diesel engine. In this investigation, biodiesel (produced from the waste oil by transesterification process) and normal diesel have been used. During the experiment the in-cylinder pressure and the specific fuel consumption were measured. The experimental results of this study can be summarised as follows. The tests on engine running with different fuels (biodiesel and diesel) have resulted in almost overlapping P-V diagrams. The power output values at 1300rpm and at 105, 210, 315 and 420 Nm torque values for both the diesel and biodiesel fuels are almost the same. The engine running with biodiesel has produced slightly higher in-cylinder pressure and peak heat release rate than the engine running with normal diesel at all operating conditions. Furthermore, the brake specific fuel consumption values for the engine running with biodiesel are higher than the engine running with normal diesel by a maximum of 14%. However, the thermal efficiency of the engine running with biodiesel is lower than engine running by diesel by 10%.

**Key words:** combustion characteristics, brake specific fuel consumption, thermal efficiency

### 1. Introduction

A large number of studies have shown that biodiesel is one of the promising renewable, alternative and environmentally friendly biofuels that can be used in diesel engine with little or no modification in the engine [1-5]. The stringent emission laws, the depletion of fossil fuels and relation of fuels with politics have forced the world to find alternatives to fossil fuels. Numerous

vegetable oil esters (biodiesel) have been investigated for use in internal combustion engines and have been shown to have higher potential to reduce CO<sub>2</sub> emission [6], [7]. The effects of different fuels on the performance characteristics of engines have been extensively reported. The common engine parameters on which effects have been quantified include: brake specific fuel consumption, brake effective power and thermal efficiency. Many researchers have compared the performance of engines running with biodiesel and its blends with engines running with normal diesel. It has been reported by a large number of researchers that the use of biodiesel results in have higher brake specific fuel consumption and higher thermal efficiency than the use of diesel in an engine [8-11].

However, use of different biodiesels in an engine results in variability in engine performance and emission due variation in physical and chemical characteristics of the biodiesel [12]. The effects of these physio-chemical properties on fuel supply system such as fuel pump, fuel filter and air-fuel mixing cylinder have already been reported [13]. To improve the performance and emission characteristics of the engine running with biodiesel and to understand the effects of physical properties of the fuel on the engine performance and emissions a detailed investigation is required on the underlying combustion and heat release characteristics. The heat released and resulting pressure and temperature fields affect the performance and emission characteristics most however most of the researchers so far have correlated the performance and emission characteristics of biodiesel against test parameters such as biodiesel fraction blend, engine-speed, engine load, injection timing, injection pressure and engine compression ratio. However, there are very few works that have been reported on the engine combustion characteristics and heat release phenomena corresponding to different biodiesels and its blends [14]. Therefore, the objective of this study is to investigate the performance, combustion characteristics and heat release rate phenomena of a compression ignition engine running with biodiesel and biodiesel blends.