

# Effects of fuel injection parameters on emission characteristics of diesel engines operating on various biodiesel: A review



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## ABSTRACT

Many researches have been carried out towards the reduction in noxious emissions from diesel engines. This paper reviews the studies on the outcomes of operating parameters discrepancy on the engine emission issues carried out by various authors in different diesel engines fuelled with biodiesel from different feedstocks. The main goal of this paper is to enlighten the momentous of injection parameters like injection timing and injection pressure on the engine emission characteristics. This paper touches upon the advancement and retardation methods of fuel injection timing and injection pressure to inspect the engine emission indicators such as carbon monoxide, hydrocarbon, oxides of nitrogen, smoke, particulate matter and carbon dioxide contents. Comparative evaluation has been conversed accompanied by apropos causes for the deviation of emission characteristics.

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**1. Introduction**

On comparing to gasoline engines, diesel engines are highly efficient. Hence it has been used as a chief prime mover of major engineering applications. At the same time, diesel engines are accountable for the emission of environmental pollutants like carbon dioxide, carbon monoxide, oxides of nitrogen, particulate matter, hydrocarbon and other unsafe compounds which are the culprit for rising global warming. The CO<sub>2</sub> concentration in the ambiance on the year 2030 has been predicted to acquire 80% above the levels of the year 2007 [43]. Hence the reduction of these pollutants is mandated by the government rules. Several studies have been conducted over the past two decades for thinning the emission scale. It was reported that the adoption of biodiesel in the diesel engine curbs the degree of emission. The present range of engine operating parameters like fuel injection timing and injection pressure are effective only for diesel fuel, while for biodiesels they have to be modified and optimized. Many researchers have analyzed the consequences of varying the operating parameters on performance, emission and combustion behaviors. This review paper focuses its light on the emission parameters of diesel engines powered by biodiesels with varied injection timing and injection pressure.

**2. Intention of the review**

*2.1. Requisite of biodiesel*

Various sectors like transportation, agriculture and industries are using diesel fuel as a major source of power. With ever-increasing population, the usage of automobiles also increased, which leads to the consumption of higher amount of fossil fuels.

As the stipulation of diesel fuel increases, the price of the fuel is also escalating. The year by year increasing consumption of fossil fuels from 1989 to 2014 has been evaluated [76] and displayed in Fig. 1. Biodiesel is a cleaner burning replacement fuel for diesel available from natural sources such as virgin and used vegetable oil, algae and animal fats. This paper focuses on the use of biodiesel as a substitute to the petroleum fuels, as the biodiesel provides environmental advantage by eliminating pollutant emissions..

Previous reviewers in this area collected and reported the engine exhaust emission results with different types of biodiesel blends investigated by various authors upto the year 2014 [81–83]. Many new researches have been done concerning the effects of injection parameters on the emission characteristics of various biodiesel in the year 2015. The objective of this assessment is to review the emission characteristics of different biodiesel blends with standard, advanced and retarded fuel injection timing along with the distinctiveness of standard, lower and higher fuel injection pressure, experimented by numerous authors up-to-date.

*2.2. Indian scenario of biodiesel*

The planning commission of India has initiated a biofuel project on cultivation and production of biodiesel from jatropha and karanja in 200 districts from 18 states in India. It was predicted that India would be able to generate 288 metric tonnes of biodiesel in the year 2012, which would complement 41.14% of demand for diesel consumption in India [75]. According to BP's (British Petroleum) Statistical Review of World Energy- 2015, India shows increased fossil fuel consumption in the year 2014 which is 7.1% higher than 2013 levels. In the year 2010 India projected highest change in biofuel production from its former year by adding 0.113 million tonnes of oil, which was 85% higher to 2009 year biofuel

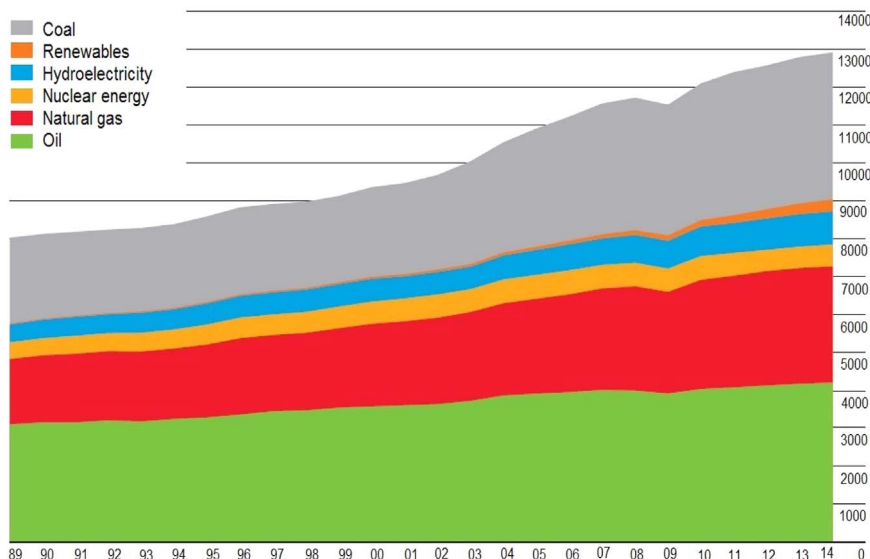


Fig. 1. Year by year increasing fossil fuel consumption (Million tonnes oil equivalent) from 1989 to 2014 (Source: BP's Statistical Review of World Energy- 2015).

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