Chapter 7

Comparative Assessment of Various Nanoadditives on the Characteristic Diesel Engine Powered by Novel Tamarind Seed–Methyl Ester Blend

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ABSTRACT

This chapter focuses on enhancing the performance, combustion, and emission characteristics of a novel biodiesel blend—a mix of diesel (80%) and tamarind seed oil (20%), represented as tamarind seed methyl ester (TSME) with alumina oxide (Al2O3), Carbon nano tubes (CNT), and Cerium oxide(CeO2) considered as potential nanoparticles. These were added to TSME at concentration of 50 ppm and were uniformly dispersed in the biodiesel blend with the help of a magnetic stirrer as well as an Ultrasonicator to attain stable suspension. The immersed nanoparticles in the tamarind seed oil blend exhibit multiple advantages such as an enhanced air-fuel mixing, better oxidation process, larger surface area to volume ratio results in higher brake thermal efficiency, as well as a significant reduction in smoke opacity, hydrocarbon, and carbon monoxide emissions.

DOI: 10.4018/978-1-7998-2539-5.ch007
INTRODUCTION

The fast exhaustion of raw petroleum assets, rising natural pollution concerns and climb in fuel costs have required a more prominent attention on the need to exploitation of the biodiesel as an alluring sustainable feedstock for the diesel engine. Biodiesel is generally viewed as a domain inviting, prudent and plentifully accessible energy source. Over the past numerous years, researchers have analyzed distinctive feedstock of biodiesel got from linseed oil, palm oil, cotton seed oil, jatropha seed oil, pongamia oil, sunflower oil, coconut seed oil, lemon feel oil and so forth., and completed broad examinations on their impact on the characteristics of the compression ignition engine. Ramakrishnan et al. (2018) examined the comparative assessment of the diesel engine characteristics with and without preheated neem and pumpkin biodiesel blends. They noticed diesel had shown higher brake thermal efficiency than biodiesel blends. It was due to higher heating value of diesel. Preheated biodiesel blends neem oil and pumpkin oil have shown improved thermal efficiency and also greater reduction in engine tailpipe emissions like carbon monoxide, smoke and hydrocarbons when compared to the without preheated blends. Agarwal et al. (2008) studied the performance and emission characteristics of the various vegetable oils like mahua oil, linseed oil and rice bran oil as viable sources for the diesel fuel replacement. They found some problems such as operational and durability problems while engine was operated with the vegetable blends. Further, they suggested transesterification technique was highly effective approach for reducing the viscosity and the above-mentioned biodiesel problems. Venu and Madhavan (2017) performed experiments on diesel engine with different levels of alumina nano particles. They observed significant reductions in brake specific fuel consumption, oxides of nitrogen, and hydrocarbons. However, they were reported that a marginal increment in the carbon monoxide and smoke emissions at all load conditions. Basha and Anand (2014) studied the characteristics of the diesel engine fuelled with carbon nanotube and diethyl ether added biodiesel blends. They reported that additions fuel additives to the biodiesel fuel had shown promising results of the diesel engine.

Dhana Raju et al. (2018) investigated the viability of various biodiesel blends prepared from the tamarind seed oil through the transesterification process for the diesel engine applications. They found enhance performance and reduced engine tailpipe emissions for 20% blending of tamarind biodiesel with diesel fuel. Chen et al. (2018) studied the influence of three nanoparticles namely silicon oxide, alumina oxide and carbon nanotubes as fuel catalysts for the augmentation of combustion, performance and emission characteristics of the diesel engine. They used these nanoparticles at different levels like 25ppm, 50ppm and 100ppm with the diesel fuel and also they have done the ultraviolet-visible spectrophotometer for stability analysis of the nanoparticle blended diesel fuel. They noticed better stability for the silicon oxide and alumina oxide. However, the carbon nanotubes were least stable. They concluded that use of nanoparticles have shown significant reductions in NOX emissions. Ramesh et al. (2018) explored the viability of the poultry litter biodiesel as an alternative fuel for diesel in diesel engines. They have tested 20% poultry litter biodiesel along with 30mg/l of alumina nanoparticle as fuel additive. They found greater reductions in hydrocarbon and carbon monoxide oxides of nitrogen emissions by the addition of nanoparticles when compared to the biodiesel blend without nanoparticles.

Nour et al. (2018) examined the effect of alumina nanoparticles at various concentrations such as 25, 50, 75 and 100mg/l into diesterol blended fuel (10% Jojoba biodiesel+ 20% ethanol +70% diesel) on the exploitation of diesel engine characteristics. They observed greater reduction in oxides of nitrogen and hydrocarbon emissions at dose level of 25mg/l when compared to the other additions of nanoparticles, but significant enhancement in peak cylinder pressure and considerable reduction in specific fuel con-
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