IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 7, July 2021

DOI: 10.17148/IARJSET.2021.8778

Study Of Combination of After Treatment Devices into Existing Diesel Engine Fueled by Nanoparticles

Dr. Nagaprasad K S*, Nitin L[1], Mohamed fauzan S[2], Kiran C[3], Kundan B[4]

Associate Professor, Mechanical Dept., KSIT, Bangalore, India*

Student, Mechanical, KSIT, Bangalore, India[1-4]

Abstract: Internal combustion engine are established as the main power source for automobile vehicles. At present emission norms because strict for any I.C Engine. The main pollutant are CO, HC, NOx, PM, soot etc. the aim of this work is to inject inject nanoparticle to reduce the emission norms like CO, HC, NOx, PM, soot and by using after treatment devices. Cerium oxide being oxygen buffering capability, especially in the nanosized form, hence when used as an additive in the diesel fuel it leads to simultaneous reduction and oxidation of nitrogen dioxide and hydrocarbon emissions, respectively from diesel engine. However , the work investigates the effect of ceriumoxide nanoparticles on emissions of diesel engine.

Keywords: Internal combustion engine, Nanoparticles, Nitrogen dioxide, Catalytic converter

I.INTRODUCTION

As we all know that diesel engine Diesel engine is an internal combustion engine in which ignition of the fuel is caused by the elevated temperature of the air in the cylinder due to the mechanical compression This increases the air temperature inside the cylinder to such a high degree that atomized diesel fuel injected Into the combustion chamber ignites spontaneously. However diesel engines are one of the major contributors to the emissions such as hydrocarbons, particulates, nitrogen oxides, and sulphur oxides. These emissions are very harmful to human beings and also responsible for acid rain and photochemical contamination and hence subject to strict environmental legislation. Thus wide use of diesel engines leads to harmful threat of nitrogen oxide and hydrocarbon emissions. Improvement in the performance of diesel engines is an important challenge to be addressed, in the current era due to the fast depletion of fossil fuel resources as well as due to the harmful hydrocarbon and nitrogen oxide emissions. The nanoparticle as additive in diesel has emerged as a new promising fuel additive for utmost improvement in the performance and level best reduction of exhaust emission, there are few nanoparticle which are used in internal combustion like cerium oxide nanoparticle, aluminum nanoparticle, cobalt oxide and magnesium-aluminum nanoparticle and many more nanoparticles additives for diesel fuels. Among these oxides, cerium oxide is the most abundant element in rare earth family with good thermal stability as well as cross-over efficiency which will undergo redox cycling between the trivalent and tetravalent oxidation states. Cerium oxide, when used in the nanoparticles form exhibits a high catalytic activity because of its high surface-to-volume ratio leading to improvement in the fuel efficiency and reduction in the emissions, By the addition of after treatment devices like DPF, DOC & new device which help in better combustion of fuel & also reduces thew harmful gases in the emission. DPF, DOC are the devices that physically capture diesel particulate matter in the exhaust pipe to prevent the release to the atmosphere, In order to cope with the strict emission standards, diesel engine which reduces exhaust emission should be developed, The present experimental study aims at the investigation of the effect of cerium oxide (CeO2) in the form of nanoparticles, as an additive in diesel. Single cylinder water-cooled direct injection diesel engine was used for conducting the performance tests. Engine performance and emission characteristics were obtained and analyzed. The experimental investigations were carried out by varying the dosing levels of CeO2 nanoparticles in the fuel (from 5 to 35 ppm). The study of the stability of the nanofluid also has been carried out, with the addition of surfactants in the diesel, in the present worl

II.NANOPARTICLE

As the new emissions norms are being strict there is a need to identify new options to reduce emissions and some of the nanoparticles have been proved to reduce certain amount of poisons gases. Nanoparticles like aluminum oxide, cerium oxide, graphene oxide and many more. In this paper cerium oxide has been consider as an additive to pure diesel.
The cerium oxide nanoparticle has been obtained by sol-gel method where the size of the particles is 30-50 nm, with the colour grey, containing a surface specific area of 15-25 m^2/g, Also the density was found to be 7.1 g/cm^3.

© IARJSET This work is licensed under a Creative Commons Attribution 4.0 International License

IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 7, July 2021

DOI: 10.17148/IARJSET.2021.8778

Nanoparticles have a relatively large surface-area-to-volume ratio, making them ideal catalysts.
The nanoparticles disperse throughout the fuel and encourage better air-to-fuel mixing and enhance chemical reactivity during combustion, leading to better performance, combustion, and quality of emissions
The cerium nanoparticle present in the fuel longer and more complete combustion as compared to the base fuel, as cerium oxide acts as an oxygen buffer releasing and storing oxygen depending upon the partial pressure of oxygen,
The catalyst also donates oxygen molecules during the combustion to extend the burn, which chemically alters the timing of a diesel engine to burn a more significant percentage of the fuel during the Power stroke. Another advantage of a shorter ignition time keeps the engine temperatures low to prevent the formation of NOx
Normally, about 20 to 25% of the fuel injected into diesel engines are not burnt, which demands the production of enough oxygen during the combustion process with the usage of these nanoparticles this demand would be partially reduced.

III.CATALYTIC CONVERTER

As emission regulations have tightened, the complexity of the catalytic converter system has increased. Meeting the demands of tightening legislation may require increased converter volume, translating into the use of multiple catalytic converter elements within a vehicle exhaust system.
Components used in this work consisted of Cordierite flow-though monoliths wash coated with alumina and platinum catalyst as well as Pt/Pd which provides low temperature T50 values for CO and HC, But in the case of underfloor catalytic converter, which is widely used for many years because of convince of packaging as its catalyst LOT has 200 to 300s. In order to reduce this delay, and to increase the efficiency of the catalyst at low temperature, the improvement in washcoat formulation is introduced with the help of new precious metals such as Pt/Pd
Oxidation of carbon monoxide to carbon dioxide:
$2CO + O2 \rightarrow 2CO2$
Oxidation of hydrocarbons (unburned and partially burned
fuel) to carbon dioxide and water:
$CxH2x+2 + [(3x+1)/2]\ O2 \rightarrow xCO2 + (x+1)\ H2O$ (a combustion reaction)

IV.PREPARATION OF TEST FUELS

In this research work, commercially available diesel fuel are employed. The fuel properties for all the test fuels are verified before they are subjected for the engine experimental investigations. Nanoparticle such as Cerium oxide were purschased from a comsny called ultrananotech respectivelty. Now the dispersion of nanoparticles with fuels is prepared by using an apparatus called ultrasonicator where the solution was sonicated for about 45 min to prepare the homogenous tests fuel. The prepared test fuel was subjected to the stability investigation: kept in a 100 ml graduated scale glass test tube under static condition and was found stable. The physicochemical properties for the diesel test fuels are tested as per ASTM standards

Properties	ASTM standards	Diesel
Density (kg/m^3)	D1298	816
Kinematic viscosity	D88	2.20
Flash point	D 93	48
Fire point	D 93	55
Calorific value (MJ/kg)	D240	45.66
Pour point	D97	-9
Total acidity (mg of KOH/g)	D664	0.38

V.CONCLUSION

This paper shows that the emissions can be reduced by the implementation of nanoparticles such as CeO_2, AlO_2 . mixed with diesel and using a catalytic converter. Considering cerium oxide nanoparticle as the study point, synthesis of the cerium oxide nanoparticles and investigation on the effect of nanoparticles on various physicochemical properties of diesel and engine performance and emissions. Also significant improvement in brake thermal efficiency is observed for nanoparticles dispersed in the diesel fuel and the NO_x emissions were reduced for about 30% as compared to base fuels. The flash point and fire point was also increased. By the use of catalytic converter there was a significant reduction in HC, CO, NO_x, PM.

© IARJSET This work is licensed under a Creative Commons Attribution 4.0 International License

IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 7, July 2021

DOI: 10.17148/IARJSET.2021.8778

REFERENCES

[1]. Arulprakahasajothi M, Elangovan K Reddy KH Suresh S (2015) heat transfer study of water- based nanofluids containing titanium oxide nanoparticles . mater toady: proc 2(4-5):3648-3655. https://doi.org/10.101016/j.matpr.2015.07.123 article goggle scholar.

[2]. Barker G, Aisearya r (2016) trends in catalytic production of biodiesel from various feedstocks. Renew sust energy rev 57:496-504. https://doi.org/1016/j.rser.2015.12.101CAS article google scholar.

[3]. Celik M , Solamz H, Serdar YH (2015) examination of the effects of organic based manganese fuel additive on combusytion and engine performanance of a flat-plat solarv water heater. Energy fuel 30(11):9908-9913. https://doi.org/10.1021/acs.energyfuels.6b02264 article goggle scholar.

[4]. Yuvarajan D, Dabu MD (2016) analysis on the influence of nanoparticles of alimina, copper oxide, and zirconium oxide on the performance of a flat-plate solar water heater. Energy fuel 30(11):9908-9913. https://doi.org/10.1021/acs.energyfuels.6b02264 Article google scholar.

[5]. Gumus S, Ozcan H, Ozbey M, Topaloglu B (2016) aluminium oxide and copper oxide nanodiesel fuel properties and usage in a compression ignition engine. Fuel 163:80-87. https://doi.org/10.1016/j.fuel.2015.09.048CAS article goggle scholar.

[6]. Vertin *et. al* [6] "Review of Diesel Emissions and Control", published on 04/12/2010, SAETechnical paper No 2010-01-0301.

[7]. Mayer *et. al* [7] "Review of Diesel Emissions and Control", published on 04/12/2010, SAETechnical paper No 2010-01-0301.

[8]. Sumiya *et. al* [8] "Review of Diesel Emissions and Control", published on 04/12/2010, SAETechnical paper No 2010-01-0301.

[9]. Cavataio *et. al* [9] "Review of Diesel Emissions and Control", published on 04/12/2010 ,SAETechnical paper No 2010-01-0301.

[10]. Furuta *et. al* [10] "Review of Diesel Emissions and Control", published on 04/12/2010, SAETechnical paper No 2010-01-0301.

[11]. Sappok *et. al* [11] "Review of Diesel Emissions and Control", published on 04/12/2010, SAETechnical paper No 2010-01-0301.

[12]. Rose and Boger *et. al* [12] "Review of Diesel Emissions and Control", published on04/12/2010,SAE.

© IARJSET This work is licensed under a Creative Commons Attribution 4.0 International License