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Investigation of Performance and Emission Characteristics in VCR Engine by Using Nano Fuel Additives in Biodiesel- *REVIEW PAPER*

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Abstract

Growing demand of fuel in daily life and its risk cause serious problem for this globe. Serious attention is required to see this problem. In this review article there is a comparative study to find out the effects of additives for biodiesel fuel and efforts to recover the combustion and performance and to diminish the emissions. By using biodiesel, there are most disadvantages such as higher density, lesser heating value, high fuel consumption and high oxides of nitrogen. To avoid above disadvantages, the fuel additives help in playing a very important role in minimizing the drawbacks of biodiesel and in maintaining international fuel standards. Additives can be considered toward to improve combustion, fuel economy and to decrease the emissions. Aluminium oxide nanoparticles (ANPs) or Cerium Oxide Nanoparticles were added to palm oil biodiesel blend in different proportions to investigate the effects on a four stroke, single cylinder [2]. variable compression ratio engine using Cerium Oxide Nanoparticles and Carbon Nano-tubes as fuel-borne nanoparticles additives in Die sterol (diesel–biodiesel–ethanol) blends. As Diesel and Ethanol are immiscible, Castor oil biodiesel is used as an additive which acts as a bridging agent to prevent the phase separation. Stability studies are carried out using Aluminium oxide nanoparticles and Cerium Oxide Nanoparticles (CERIA) each 25, 50, 100 ppm in the Die sterol blends subjected to high speed mechanical agitation followed by ultrasonic bath stabilization[4].The metal based additives, cetane number additives, antioxidant additives and oxygenated additives help in improving the quality of the biodiesel. From this literature review, the effects of additive on biodiesel are explained. The reviews conclude thatthe uses of additive to the 2nd generation of biodiesel are the best in improving the combustion performance and emission reduction.A classical differential evolution algorithm (DEA) is further used on the network model to find out optimal combination of nanoparticles, biodiesel and diesel and proven through experimental validation[1].

Keyword- *biodiesel*, *nano fuel additives*

I.INTRODUCTION

Bio Diesel is an alternative fuel produced from non-edible oil seeds. Depletion of fossil fuels, increasing fuels prices and environ-mental considerations have encouraged engineers and scientists to develop alternative fuels and improve the efficiencies of energy systems. Nanofluids are a new class of solid-liquid composite materials consisting of Nano-sized solid particles dispersed in any base fluid [8]. In the similar way, the nanoparticles can be added to diesel fuels as base fuel. This type of new fuel is called as Nano diesel (modified diesel). Conducted an experimental investigation to find the influence of Cerium Oxide Nanoparticles on the major phys-ico-chemical properties and the performance of a CI engine with the dosing levels from 20 to 80 ppm in biodiesel. They found that the addition of Cerium Oxide Nanoparticles increase the flash point and kinematic viscosity of the biodiesel. In addition, they

observed a significant improvement in engine efficiency and reduction of hydrocarbon and nitrogen oxides emissions by 40% and 30% respectively [4].The oil obtained from the seeds has high viscosity more than that of diesel. Biodiesel is receiving more attention due to increasing of crude oil price and decreasing oil reserves. Biodiesel is made by transesterfication of animal fat and vegetable oil.

The production of biodiesel in India is non-edible oils obtained from species e.g.: palm oil, Jatropha, Pongamia pinnata, polanga. The high cost of edible oils in India, non-edible oil is used for production of biodiesel. The advantage of the biofuel over the diesel fuel includes high cetane numbers low smoke and particulates, low carbon dioxide and hydrocarbon emissions. Biodiesel is Eco friendly for alternative fuel for diesel engine. The vegetable oil has high viscosity and low calorific value affects the spray formation of fuels. It has total combustion and less

exhaust emissions than diesel fuel. The energy content of biodiesel is about 12% less than diesel fuel. Biodiesel Contains 10-15% of Oxygen. It is an Oxygenated fuel. An advantage of palm oil and Pongamia pinnata oil is having oxygen content, cetane number and it is clean. Pongamia pinnata biodiesel having certain disadvantage lower performance and higher emission. The chemical substance is used to control the problem associated with biofuel, like fuel additives is consequent from organic and inorganic metal is used. Nano additive is usually improves combustion efficiency and reduces the emission. Metallic compounds generally used as combustion catalyst for hydrocarbon fuel, like copper, iron, rhodium, zinc and platinum, etc.., recent technology in the nano field enables the production, nano particles are highly energetic materials. The

Advantage for using nano particles is its size, due to the particles are micron sized so no chance of clogging[1,2]. The effect of additive based on a Vegetable oil combined with Nano additive on exhaust emission of diesel engine fuelled with biodiesel. Nano additives help the engine to burn fuel better and air has reduced Cu content. The reduce a temperature inside the cylinder during combustion, because the presence of Nano additive in the blended fuel. It has also reduced a NOx emission. Study to improve an ignition property of the diesel fuel and studied the influence of size and quantity of Nano Al and Al_2O_3 particles and ceramic oxide particles in a fuel. To conclude the possible of decreasing the evaporation time of droplets by the increasing heat and mass transfer properties of the fuel[13]. The probability to increase the ignition of diesel and the shortens the ignition delay by adding additives. The transesterfication process is used to prepare a Pongamia / plam oil biodiesel. The main advantage of the transesterfication process is reduced the high viscosity of oil is suitable for CI engine [14].

II PROBLEM STATEMENT

India is importing more than 70% of its fuel demand to satisfy the needs and huge expenses are done to satisfy this needs. Biodiesel is attaining more important as a smart fuel due to the fast depleting fossil fuel resources. The properties of biodiesel are almost similar to the diesel fuel. Biodiesel having certain disadvantage lower performance and higher emission. The chemical substance is used to control the problem associated with bio fuel, like fuel additives is consequent from organic and inorganic metal is used. That's why Nano additive will be used to improve combustion efficiency and reduces the emission. Internal combustion engines (VCR) are the common sources of energy in automobiles in the world. This kind of application means that the rate of fossil fuel utilization is high and so is the rate at which petroleum reserves are getting depleted. This increased demand has raised the prices of these petroleum fuels. Furthermore, the use of fossil fuels has presented a very significant contribution to the production of biodiesel. Burning of diesel fuels produces pollutants such as carbon dioxide (CO2), nitrogen oxides NOx, carbon monoxide (CO), Unburned hydrocarbons and other oxides of sulphur that pollute the environment. These challenges have therefore led to a need for alternative source of fuel for automobiles. That's why biodiesel +diesel with blend nanoparticle will be used to improve combustion efficiency and reduces the emission.

III LITERATURE SURVEY

Chiranjeeva Rao Seela [1] Investigated **,**Jatropha based bio-diesel blends offer very close or higher BTE when compared to pure diesel at both pre-heated and normal conditions. Though reduced CO and HC emissions are assured, high values of BSFC and NOx emissions are the most common short comings .Pongamia and its blends have been proven with better results in most of the performance characteristics such as BTE, HRR with reduced emissions and BSFC. Mahua is one of the prominent sources of bio-diesel with greater availability in Asian countries. Even though BTE is less at the lower loads, it offers reduced emissions with low BSFC due to slightly higher .The BTE is 2–3% more with the B20 added with 50 and 100 ppm of ZnO Compared to the diesel fuel. The fuel B20 with 50 ppm ZnO has given lower NOx emission compared to all tested fuels including diesel.

C. Syed Aalam [2] in his research , aluminium oxide nanoparticles (ANPs) were added to Mahua biodiesel blend (MME20) in different proportions to investigate the effects on a four stroke, single cylinder, diesel engine. The experimental results exposed a substantial enhancement in the brake thermal efficiency and a marginal reduction in the harmful pollutants (such as CO, HC and smoke) for the nanoparticles blended biodiesel. It can be observed that the brake thermal efficiency(BTE) increases with the load for both Mahua biodiesel blend (MME20) and ANP blended MME20.

V. Arul MozhiSelvan [4] carried out experimental investigation to establish the performance, combustion and emission characteristics of a variable compression ratio engine using Cerium Oxide Nanoparticles and Carbon Nanotubes as fuel-borne nanoparticles additives in Diesterol (diesel–biodiesel–ethanol) blends. As Diesel and Ethanol are immiscible, Castor oil biodiesel is used as an additive which acts as a bridging agent to prevent the phase separation. Stability studies are carried out using Cerium Oxide Nanoparticles (CERIA) and Carbon Nanotubes (CNT) each 25, 50, 100 ppm in the Diesterol blends subjected to high speed mechanical agitation followed by ultrasonic bath stabilization. The combined effect of Ceramic oxide and carbon Nano tubes as fuel-borne nanoparticles additives in the Diesterol fuel blend contributes for the cleaner combustion and significantly reduces the harmful exhaust gas emissions.

Mortaza Aghbashlo [5] In this paper the determining exergy-based sustainability parameters of a single cylinder DI diesel engine in response to various fuel blends and engine loads at a fixed engine speed of 1000 rpm. Engine tests were conducted at four engine loads (25%–100%) using a 95% diesel + 5%biodiesel blend (B5) emulsified with water (3, 5, and 7 w/w%). Two levels of cerium oxide nanoparticle concentrations (0 and 90 ppm) were also applied. The results showed that engine load and fuel type profoundly affected the exergy-based sustainability indices of the engine. Generally, increasing engine load steadily decreased exergy efficiency, while normalized exergy destruction declined by up to 75% under full load condition. Among the fuel blends prepared, the B5 blend containing 3 w/w% water and 90 ppm cerium oxide nanoparticles (B5W3m) showed the best exergy-based sustainability parameters at all the studied engine loads as its respective performance approached that of the basal petro-diesel.

IV.OBJECTIVE.

1. To Investigate Performance Characteristics of VCR Engine using various Biodiesel blends for different loads and its comparison with standard diesel.

2. To Investigate Emission Characteristics of VCR Engine using various Biodiesel blends for different loads and its comparison with standard diesel.

3. To investigate performance exhaust emission characteristics of a VCR engine with Nano fuel blends.

4. Optimization of Nano fuel blend using optimization technique.

V.METHODOLOGY

1.Literature survey: This is the initial stage in project where the comparison is done with conventional fuels followed by studying characteristics of it to put better results.

2. Study of Fuel Properties: This section of project covers the brief study of conventional fuels, biodiesel and nanoparticles and their impact of various mechanical properties. This is required to predict the properties of alternative fuel and to decide percentage of ingredients of proposed fuels.

3. Select of Quantity of Fuel: select the percentage of pure diesel and biodiesel blend and how many percentage nanoparticle added in biodiesel**.**

4. Select VCR Engine: Select the specification of the CI engine and its operating load and speed conditions.

5. Blending of fuel: after finalizing the fuel properties and desired requirement, we need to go for blending process and essential to define and utilize the suggested fuel in ci engine.

6. Experimentation: Once fuel is finalised the experimental testing will be done to check the impact of generated fuel.

7. Analysis: Compare the different parameter of Nano biodiesel fuel to the pure diesel fuel parameter.

8. Result and Conclusion: To find out the performance and emission parameter in different proportion to Nano fluid and biodiesel in VCR engine and conclude which proportion get the best result in both performance and emission.

VI . MATERIALS AND METHODS.

1. Materials

Palm oil and diesel were obtained from local market. All chemicals(methanol, potassium hydroxide and acetic acid) used in this study are analytical grade.

2. Analysis

Palm oil/palm oil methyl ester blends with diesel fuel were analyze dusing gas chromatograph/mass spectroscopy with flame ionization detector. The chromatographic analysis was made using Hewlett Packard Model 6890 Chromatograph. Detector temperature was 2800C, injection temperature was 3000C and the column temperature was increased from 100 to 2400C using a ramp rate of15C/min.

3. Blend preparation

Palm oil/palm oil methyl ester was added to diesel at low stirring rate. The mixture was stirred for 20 min and left to reach equilibrium before analysis. Palm oil/palm oil methyl ester was added in volume percentages of 5%, 15%, 20%, and 30%. In order to measure the properties of the oil diesel fuels, the test methods were used as follows; Density (ASTM D941), Viscosity (ASTMD445) and Flash point.

4. Nanoparticle preparation

Alumina nanoparticles were prepared using sol-gel method. In this method, initially aluminium nitrate solution (0.5 M) is dissolved in 50 ml deionised water (H2O) at 22 _C and stirred magnetically. Secondly, urea (0.05 M) is dissolved with prepared aluminium nitrate solution and reacted for 30 min until the solution attains a pH level of 2. This is the base solution which is to be titrated with a mixture of 0.1 M sodium hydroxide and 25 ml ofH2O till pH level 6 is attained. Further addition of sodium hydroxide to the base solution forms a clady gel (pH = 8), which is dried and calcined at 1500C for 12 h. Finally, alumina nanoparticles were collected after the dried sample is subjected to 3000C and 2 h in furnace.

5. Nano diesel preparation

Nanoparticles have generally higher surface energy due to their larger surface area. Hence they tend to agglomerate to form a micro sized particle and start to sediment. Stability of the suspensions is a crucial issue for both scientific research and practical applications. CuO (size ranged from 30 to 50 nm), Al2O3 (from 27to 43 nm) nanoparticles, biodiesel and diesel fuel were used to produce Nano biodiesel fuels. The nanoparticles were supplied from Nano structured and Amorphous Materials, Inc. and were used as-receive. Sonics VCX 750 model ultrasonic processor was used to stir nanoparticles with neat diesel in order to obtain Nano diesels. The preparation of Nano diesel begins by direct mixing of the diesel fuelas base fluid with the nanoparticles and ultrasonicated for 1 h at40 Hz. The dispersion stability of the prepare Nano diesels was study by controlling the sedimentation of particles. In order to make nanoparticles to be stable in a base fluid, it should be evolve to surface modification. A dispersant is generally used to prevent particle agglomeration during Nanofluid formation. Ammonium\ Polymethacrylate (Darvon C) and sodium silicate (Na2O7Si3) are the well-known dispersants for water based Nano fluids. The effect of these dispersants on stability of Nanodiesel fuel will investigate. In addition, well-dispersed suspension can be obtained with high surface charge density to generate strong repulsive forces. The pH of the suspension can affect the surface charge density. Therefore, the effect of pH on stability was also investigate. The pH was control using hydrochloric acid (HCl) and sodium hydroxide (NaOH) in analytical grade.

VII . SCOPE

In modern era to satisfy the needs of human, automobile sector is increasing day by day which ultimately result in increasing the pollution in the surrounding. To reduce this adverse effect of current fuel we need to go for alternative fuel in combination with biodiesel and nanoparticles and it should satisfy mechanical needs such as better brake thermal efficiency and reduce brake specific fuel consumption. The successful combination of particles in suggested fuel will decrease the dependency on conventional fuel purchase in future.

VIII ADVANTAGES

1.By adding nano particales in biodiesel,the efficiency of engine increases.

2. By adding nano particales in biodiesel the reduces the exhaust emissions.

3.The availability of biodiesel like Palm Oil is easy.

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IX CONCLUSION

The subsequent results and future scope research were able to be concluded from this literature work. An additive is playing a magnificent task in increasing the performance of the VCR engine, improving the combustion and reducing the emissions. The additives are blended with additives fueled in diesel engine and investigated the characteristics of performance, combustion and emissions and compared with the diesel fuel. The conclusion of the work carried out is, the increase of BTE upto 2 to 3%with adding Alumimium oxide & Ceramic oxide in best combination (B20 biodiesel+D80 diesel +25 ppm AlO_2 OR 25 ppm CeO_2).

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