OPTIMIZATON OF DIESEL ENGINE FUELLED WITH NOME BIO-DIESEL AND ZnO NANO PARTICLES

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Abstract: Emanations from Diesel motors have truly compromised nature and are viewed as one of the significant wellsprings of air contamination. It was demonstrated that these contaminations cause impacts in the natural frameworks, lead to ecological issues, and convey cancer-causing segments that altogether jeopardize the wellbeing of individuals. To conquer the issues brought about by the non-renewable energy sources elective fills, for example, Biodiesels are being utilized and gotten expanding consideration because of expanding fossil oil costs and the negative natural impacts coming about because of their utilization in diesel motors. Biodiesel, an inexhaustible, biodegradable, and oxygenated elective fuel of diesel, is gotten from the transesterification of different vegetable oils, squander cooking oils, or creature fats. Past examinations with biodiesel have shown that diesel motors fuelled with biodiesel can lessen CO, CO2, and hydrocarbon (HC), yet marginally increment BSFC due to its lower warming worth, while the torque and power yield for biodiesel were nearly a similar when contrasted with those of diesel fuel. This work gives an outline on the most widely recognized approach to deliver biodiesel i.e., Transesterification of the oils (Neem oil) with a liquor (Methanol) within the sight of a basic impetus (NaOH). It is a low temperature and low - pressure response. It yields high transformation (96% - 98%) with insignificant side responses and short response time. It is an immediate transformation to biodiesel with no middle of the road mixes. An added substance called ZnO – Nano molecule has likewise been utilized related to Bio – Diesel which will be useful for decreasing the discharges and improving the fuel properties. Properties like Density, Specific gravity, Viscosity, Calorific qualities, Carbon buildup, Flash and Fire focuses are resolved for the mixes of Bio – Diesel. Execution attributes of the considerable number of Blends with and without Nano particles are thought about.

Index Terms **– impact, ecological systems, bio diesels, Nano particle.**

I. INTRODUCTION

The entire world is confronting the emergencies of exhaustion of non-renewable energy sources just as the issue of natural debasement. The fast exhaustion of non-renewable energy source holds with expanding request and vulnerability in their supply, just as the quick ascent in oil costs, has animated the quest for different options in contrast to petroleum products. In perspective on this, there is a pressing need to investigate new choices, which are probably going to decrease our reliance on oil imports just as can help in securing the earth for reasonable advancement. Numerous elective powers are as a rule as of late investigated as potential choices for the present high-contamination diesel fuel got from decreasing business assets.

Biodiesel rises as one of the most vitality proficient naturally inviting choices as of late to full fill the future vitality needs. Biodiesel is a sustainable diesel substitute that can be gotten by joining synthetically any common oil or fat with liquor. During the most recent 15 years, biodiesel has advanced from the examination stage to an enormous scale creation in many creating nations. In Indian setting, non-consumable oils are rising as a favored feedstock and a few field preliminaries have additionally been made for the creation of biodiesel.

Biodiesel alludes to a group of items produced using vegetable oil or creature fats and liquor, for example, methanol or ethanol, called mono alkyl esters of unsaturated fats. Study demonstrates that, on the mass premise, biodiesel has a vitality substance of about 12% not as much as oil based diesel fuel. It lessens unburned hydrocarbons (HC), carbon monoxide (CO), and increment oxides of nitrogen (NOx) than diesel-fuelled motor. It is a local, sustainable fuel for diesel motor got from regular oil like Neem oil. Biodiesel is condition cordial fluid liquid like customary diesel fuel in motor tests, the power and fuel utilization

II LITERATURE REVIEW

Anand Prakash shopping center has examined the impact of different parameters on execution of Kirlosker motor for various mixes of diesel and bio-diesel (removed from muck neem oil feedstock by applying bio-diesel creation procedure) have been dissected. Jibitesh kumar panda et al. has investigated the exhibition and emanation examination by utilizing different mixes of leucas zeylanica methyl ester, diesel and diesel added substances like 2-ethyl hexyle nitrate. This exploratory examination gives less motor emanation and better execution as contrast and mineral diesel. In the extreme part of this examination fluffy based taguchi enhancement for foreseeing the ideal info mixes which result in the ideal mix of execution and discharge parameters.

A.K.Hossain et al. has dissected that various plant oils can be utilized acceptably in CI motor, without transesterification, by preheating the viol and adjusting the motor parameters and the upkeep plan. Has respects life cycle vitality and ozone harming substance discharge examinations, these ravel impressive focal points of crude plant oil over fossil diesel and bio-diesel. Run of the mill results demonstrate that the existence cycle yield to enter vitality proportion of crude plants is around multiple times higher than fossil diesel relying upon either essential vitality or fossil vitality prerequisite. The existence cycle vitality proportion of crude plant scope of 2-6 times higher than relating bio-diesel in addition, crude plant oil as the most noteworthy capability of

decreasing life cycle GHG outflows when contrasted with bio-diesel and fossil diesel. Mustafa balat said that right now bio-diesel is principally arranged from traditionally developed eatable oils, for example, rapeseed, soybean, sunflower and palm in this manner prompting reduce nourishment versus issue. About 7% of worldwide vegetable oil supplies were utilized for biodiesel generation in 2007 broad uses on palatable oils may cause other noteworthy issues, for example, starvation in creating nations. The utilization of non-palatable plant oils when contrasted and consumable oils is exceptionally critical in creating nations due to the gigantic interest for eatable oils as sustenance, and they are unreasonably costly to be utilized fuel at present. The creation of biodiesel from various non-consumable oilseed yields has been broadly examined in the course of the most recent couple of years.

T.K. Gogoi has said that exhibition and burning qualities of the motor at fluctuates burdens are looked at and broke down. The outcomes indicated higher brakes explicit fuel utilization (BSFC) and lower brake warm productivity (BTE) for the KSOME mixes. The motor demonstrated power (IP) was more for the mixes up to B30, yet observed to be decreased mix 40 when contrasted with that of diesel. The motor burning parameters, for example, weight wrench edge outline, top weight, time of event of pinnacle weight, net warmth discharge rate, Cumulative warmth discharge, Ignition postponement and burning span where figured. The KSOME mixes displayed comparative burning pattern with diesel anyway the mixes demonstrated a promising start of ignition with shorter start defer period.

M. satyanarayana said that the different procedure factors like tempparature, impetus fixation, measure of methanol and response time were upgraded Biodiesel from elastic seed oil was delivered by utilizing two stage pre-treatment procedure to diminished corrosive incentive from 48 to 1.72 mg NaOH/g with 0.40 and 0.35 v/v, 0.5w/v KOH as soluble impetus with 40 min response time to yield 98to99% Biodiesel. The break warm proficiency of palm oil biodiesel was higher with lower break explicit fuel utilization yet elastic seed oil biodiesel demonstrated less emanation contrasted with different biodiesels.

III. Procedure of making Bio – Diesel

- Take 1000ml neem oil (obtained from the local grocery store) in a beaker and heat it up to 60-65^{0}C.
- While heating the oil, prepare a catalyst solution with 180 ml Methanol and 7.21 grams of Sodium hydroxide flakes.
- Mix the catalyst solution by using a Magnetic stirrer.
- Take the oil out of the heater and keep it at rest for about 10-15 seconds and after that add the Catalyst solution to the warm oil.
- Keep the oil & catalyst solution mixture on magnetic stirrer for about 10-15 min.
- Take the Solution from the stirrer and keep it to rest for 24 hours.
- Bio – diesel is formed after 24 hours along with the residual glycerine.
- The Glycerine will be settled down under the layer of formed biodiesel.
- Separate the biodiesel and glycerine.

IV. EXPERIMENTAL SETUP

a) REDWOOD VISCOMETER

The property of the liquid, which offers protection from the development of one layer of liquid over another neighboring layer of the liquids, is called consistency.

Here the opposition offered by the liquid or oil while it goes through the opening is considered as the factor for consistency estimation. Additionally, when the liquid is a lot thicker it requires some investment to go through the opening and as temperature expands the liquid continues winding up less gooey and it would require some investment to go through the hole and henceforth the time factor is measure here. In the accompanying passages you locate the short portrayal of the device and the technique of leading the analysis for various liquids.

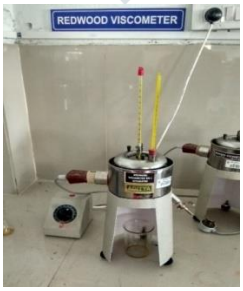


Figure1. Redwood viscometer

The mechanical assembly comprises of an oil cup with spread and oil check. The oil cup is given the standard hole for the oil the oil to stream is additionally being planned so that the little circular ball is utilized to stop and run the stream. Thermometer focuses are given on the cup spread and shower to quantify the temperature. The cup is set in the water/oil* shower made of SS and comprises of the radiator with controller. The game plan is refreshed on the power covered MS outline with leveling screws. The plan affirms to IP 70 Standards.

TABLE:1 Properties of Neem oil and its Blended fuels

Type of Blend	Redwood number	Kinematic viscosity (η)	Dynamic viscosity (μ)	Calorific value	Density (ρ)
B100	9.58	12.306	9788	44663	795.4
B05	6.26	5.38	4070	44918	756.2
B10	6.33	5.55	4215	44519	759.6
B15	6.82	6.65	5068	44279	761.2
B05N	8.14	6.23	5511.16	50542	701.8
B15N	8.10	6.23	4372.21	49613	789

1. Viscosity in Redwood Number,

$$n = \frac{K \times t \times S}{tx \times Ss}$$

Where

K = Constant = 100 for standard oil.

t = time taken for flow of 50cc of oil, sec

t_s = 535 secs, time taken for flow of 50cc of standard oil,

S = Specific gravity of oil being tested

S_s = 0.915 = Specific gravity of standard oil.

2. Kinematic Viscosity, η

$\eta = (0.260t - 179/t) \times 10^{-6}$ m^2/sec for 34<t<100

$\eta = (0.247t - 50/t) \times 10^{-6}$ m^2/sec for 100<t<2000

t=time taken for flow of 50cc of oil, sec,

3. Dynamics Viscosity, μ

$\mu = \eta \times \rho$ N-sec/m^2

Where,

ρ = density of the fluid under test in kg/m^3, sec

b) **PENSKY-MARTEN'S FLASH-POINT APPARATUS**

A glimmer point can be depicted as the temperature at which the material gives so much vapor that this vapor with the blend of air frames an ignitable blend and gives the passing blaze when presented to the pilot fire.

The mechanical assembly comprises of an oil cup with spread and oil measure. The front of cups comprises of ports for presentation of the fire for perception (one at the inside and other along the edge). Fire wick with the oil fly is given to run the fire and the slide to present the fire. A thermometer point is given on the cup spread to quantify the temperature. The cup is place in the Hot Air shower made of SS and comprises of the warmer with controller. The course of action is refreshed on the power covered MS outline.

Figure 2. Pensky-Martens's apparatus

Type of Biodiesel	Flash point(°C)	Fire point(°C)
B5	70	78
B10	78	83
B15	90	98
B100	200	210
B5N	70	75
B15N	80	87

TABLE: 2 flash & fire points of blends

c) **CARBON RESIDUE (CONRADSON) APPARATUS**

The greater part of the oil oils are containing high level of carbon in consolidated structure and fills containing less level of carbon in joined structure. On warming, they break down keeping a specific measure of carbon. The testimony of such carbon in machine is unfortunate, especially in interior burning motors and air blowers. A decent oil should store least measure of the carbon being used.

The mechanical assembly comprises of an oil cup with spread and oil measure. The front of the cup comprises of ports for presentation of the fire for perception (one at the inside and other of the side). Fire wick with the oil stream is given to run the fire and slide to present the fire. A thermometer point is given on the cup spread to quantify the temperature. The cup is place in the Hot Air shower made of SS and comprises of the warmer with controller. The course of action is refreshed on the power covered MS outline. The arrangement affirms to IP-34 and ASTMD-93 details.

Figure 3. Carbon residue (Conradson) apparatus

CALCULATIONS

1. Weight of the crucible W_1 = 33.11gms
2. Weight of the crucible with oil W_2=35.11gms
3. Weight of crucible with residue W_3=33.19gms
4. Percentage of carbon residue=4%

Type of fuel	Crucible weight(w_1)	Crucible with oil weight (w_2)	Carbon Residue (w_3)	Percentage (%)
B100	33.11	35.11	33.19	4
B05	33.11	35.11	33.12	0.5
B10	33.11	35.11	33.13	1
B15	33.11	35.11	33.14	1.5
B05C(500ppm)	33	35	33.05	1
B15C(750ppm)	33	35	33.05	2.5

TABLE:6 carbon residue of blends

d) BOMB CALORIMETER

Bomb calorimeter is utilized to decide higher calorific estimation of a strong or fluid fuel by consuming it at steady volume in at air of oxygen. The body is made of hardened steel. At the highest point of the bomb there is an oxygen valve for conceding oxygen and items discharge valve for the fumes gases. The base of the bomb is in a bad way into a spread, which structures the base. The base front of the bomb underpins two columns, one of the them conveying a ring to help pot in which known load of the fuel is put. A fine wire made of Nichrome or Platinum plunges into the cauldron. The base of the columns is given protecting fittings through which the leads from the principle supply are taken. The bomb is set inside a copper vessel known as calorimeter, which contains a known amount of water(2500cc).

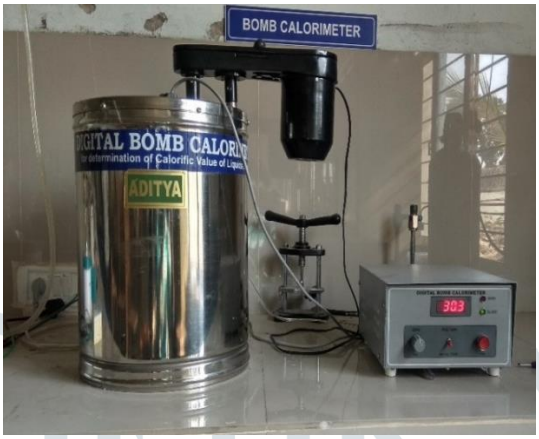


Figure 4. Bomb calorimeter

The calorimeter is provided with a stirrer to agitate the water in the calorimeter and the thermometer to measure the temperature of the water up to an accuracy of 0.001°C. The calorimeter is further surrounded by a jacket and an air space provided between the two to reduce the loss of heat due to radiation.

CALCULATIONS

Water equivalent 'W', gm: $= \frac{HCV*(m) + \{(F*C_F) + (T*C_T)\}}{4.187*(T_2-T_1)}$

Where HCV = calorific value of known fuel.

m = mass of fuel used.

T = mass of cotton thread.

C_T = calorific value of cotton thread.

W = weight of water in use.

T_1 = Initial temperature of water in calorimeter in °C.

T_2 = Final temperature of water in the calorimeter in °C.

F = Mass of fuse wire burned in gm.

Higher calorific value (CV) = $\frac{(W+w)*(T_2-T_1)*4.187-\{(F*C_F) + (T*C_T)\}}{P}$

P = Mass of fuel taken in the crucible in gm.

F=Mass of fuse wire burned in gm.

W=Mass of water taken in calorimeter in gm.

w=Water equivalent of the calorimeter in °C.

T_1 = Initial temperature of water in calorimeter in °C.

T_2 = Final temperature of water in the calorimeter in °C.

C_F=Calorific value of fuse wire in J/gm.

T=Weight of cotton Thread.

C_T=Calorific value of cotton thread in use.

Type of fuel	Higher Caloric Value (HCV) in KJ/Kg
Diesel	44631
B100	38200
B5	44309
B10	43987
B15	43666
B5N (200ppm)	47836
B15N (340ppm)	46794

TABLE: 7 Calorific values of fuels.

V. RESULTS AND DISCUSSIONS

EMISSIONS TABLES

Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	0.36	0019 ppm	1.47	18.75	00040 ppm
2	10	0.36	0019 ppm	1.4	18.79	00041 ppm
3	10	0.36	0019 ppm	1.49	18.82	00042 ppm
4	10	0.37	0019 ppm	1.52	18.82	00043 ppm
5	10	0.37	0020 ppm	1.56	18.82	00044 ppm
6	10	0.37	0020 ppm	1.59	18.81	00046 ppm

Table 8 : B05-0CR-Full Load

Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	0.93	0042 ppm	2.68	16.77	00059 ppm
2	10	0.93	0042 ppm	3.1	16.3	00062 ppm
3	10	0.93	0042 ppm	3.14	16.3	00065 ppm
4	10	0.94	0042 ppm	3.14	16.3	00067 ppm
5	10	0.94	0042 ppm	3.12	16.4	00069 ppm
6	10	0.94	0042 ppm	3.07	16.5	00069 ppm

Table 9 **B05-0CR-Half Load**

Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	0.033	0013 ppm	2.06	17.62	00061ppm
2	10	0.033	0013 ppm	2.09	16.8	00065 ppm
3	10	0.033	0013 ppm	2.12	17.1	00060 ppm
4	10	0.033	0013 ppm	2.16	16.7	00064 ppm
5	10	0.033	0014 ppm	2.21	16.8	00063 ppm
6	10	0.033	0014 ppm	2.25	16.6	00065 ppm

Table 10 B05-0CR-No Load

Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	00.101	0049 ppm	2.51	17.05	00057ppm
2	10	00.101	0049 ppm	2.59	17.06	00057ppm
3	10	00.101	0049 ppm	2.63	17.07	00057ppm
4	10	00.101	0049 ppm	2.69	17.08	00057ppm
5	10	00.101	0049 ppm	2.71	17.09	00057ppm
6	10	00.101	0049 ppm	2.79	17.10	00057ppm

table 11 **B05-10CR-Full Load**

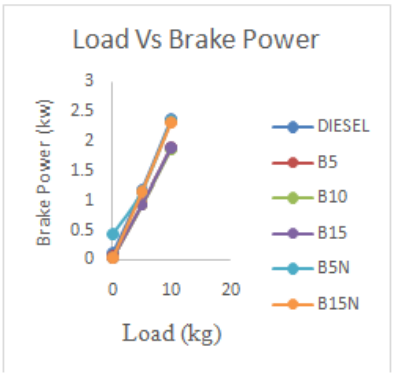
Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	00.071	0058 ppm	2.65	16.66	00066 ppm
2	10	00.071	0058 ppm	2.52	16.67	00066 ppm
3	10	00.071	0058 ppm	2.64	16.50	00066 ppm
4	10	00.071	0058 ppm	2.65	16.3	00066 ppm
5	10	00.071	0058 ppm	2.35	16.8	00066 ppm
6	10	00.071	0058 ppm	2.9	16.3	00066 ppm

Table 12 **FILE NAME : B05-10CR-Half Load**

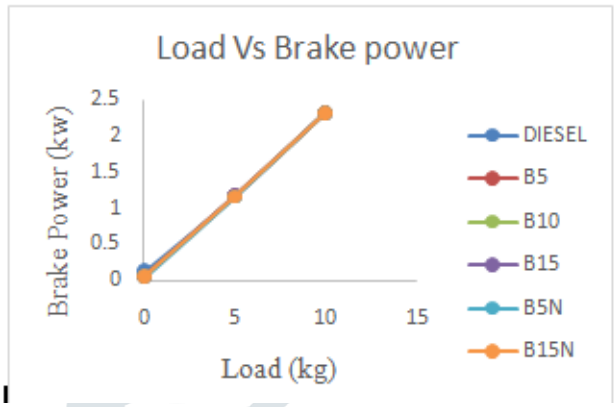
Sl No	Duration	CO	HC	CO2	O2	NOx
1	10	0.114	0069 ppm	2.88	16.53	00074 ppm
2	10	0.114	0069 ppm	2.79	16.54	00074 ppm
3	10	0.114	0069 ppm	2.69	16.55	00074 ppm
4	10	0.114	0069 ppm	2.4	16.56	00074 ppm
5	10	0.114	0069 ppm	2.24	16.57	00074 ppm
6	10	0.114	0069 ppm	2.63	16.58	00074 ppm

table 13 **FILE NAME : B05-10CR-No Load**

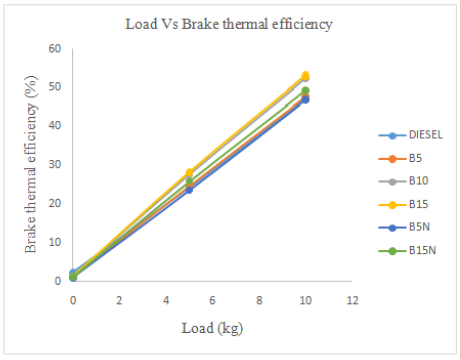
PERFORMANCE PARAMETERS



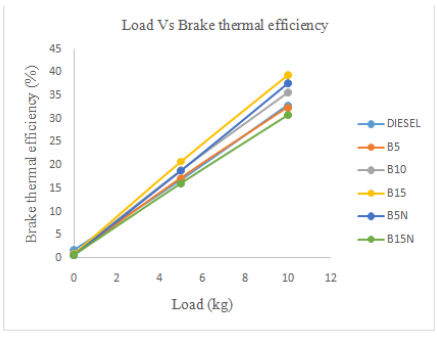
Graph 1.Load Vs Brake Powerat 23.12:1 CR



Graph 2.Load Vs Brake Powerat 0.92:1 CR



Graph 3.Load Vs Brake thermal efficiency 23.12:1 CR



Graph 4.Load Vs Brake thermal efficiency 0.92:1 CR

VI CONCLUSIONS

The presentation and outflow attributes of unadulterated Diesel, Bio – Diesel mixes with the expansion of Zinc Oxide nanoparticles are examined to assess the emanation decrease potential on the single chamber CI motor. The finishes of this examination are as per the following:

- The properties of Bio – Diesel and Biodiesel – Nano article mixes takes after near that of business Diesel.

- These are generally monetary than diesel and radiates less poisons. It very well may be utilized for Vehicular use, Railway use, as warming oil when mixed with other fuel oil in extent. Streak and fire focuses are altogether lower than diesel.

- Densities of Bio-Diesel and Nano molecule mixes are not exactly the thickness ofDiesel (850.768 kg/mt3)

- The CV estimations of mixes are around equivalent to the CV of Diesel (44631.96 MJ/kg) and particularly B15N (340ppm) (46794MJ/kg) has More CV than Diesel. Thus these can be utilized as Bio – Diesels.

- Mechanical Efficiency for Bio – Diesel and Nano particles particularly B15C750 is more than the Pure Diesel. Along these lines, it very well may be utilized as biofuel.

Discharges have likewise been decreased a tad, Carbon Residue of Bio – Diesel with Nano particles is exceptionally less and thus brings about less particulate issue.

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