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Performance of Biodiesel Fuel and Neem Oil Blends in Single Cylinder Diesel Engine

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Abstract: Biodiesel, a promising elective fuel has increased huge consideration because of the anticipated brevity of regular powers. One of the most encouraging options for utilizing customary non-renewable energy sources is the utilization of fluid energizes, for example, biodiesel got from neem oil by means of transesterification forms speaks to one of the most suitable alternatives for the utilization of regular petroleum derivatives. In this venture, within the sight of a homogeneous corrosive impetus, the oil is changed over into butyl ester known as biodiesel. The physical properties of neem oil, neem butyl ester, such as density, flash point, Kinematic viscosity, fire point and Pour point, have been found. To request to acquire the information for investigation, similar attributes test will likewise be led for the diesel fuel Diesel and mixes of neem oils are to be tried in a CI Engine to look at execution and discharge qualities.

Key words: Neem Oils, CI Engine, Bio Diesel

I. INTRODUCTION

Petrochemical assets, coal, oil and flammable fuel are the actual assets which meet the sector's energy desires at present.Anyway steady decrease within the unrefined petroleum holds around the sector, required to discover suitable options in evaluation to diesel. Biodiesel is a website amicable replacement gasoline for diesel which contains of alkyl monoesters of unsaturated fat that is by and large gotten from vegetable oils and creature fats.The oil received from exclusive plant assets like sunflower, rice wheat, palm, mahua, jatropha, karanja, soybean, rapeseed and mustard had been efficiently attempted in C.I. Cars. Among the one of a kind plant based oil, Neem Oil is less applied for human usage due to the nearness of Uric corrosive that is dangerous to humans. Anyway the thickness of the oil have to be diminished through extraordinary methods. Out of the distinct techniques attempted to reduce the thickness, transesterification is the maximum regularly utilized business method to supply best and natural gasoline.

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In the present work, ignition and execution attributes of single cylinder diesel engine was assessed with Neem Oil mixes at a share of 10:90 and 20:80 with the guide of weight wrench edge chart obtained by using piezo electric powered weight transducer and TDC encoder. These parameters were contrasted and the engine continues going for walks on unadulterated diesel. The Engine used for alternative fuels are revised Engines which first proposed for gas fuelling. Hence, it is not suitable for alternate fuel such as Neem Oil. In this way point by point creative work is required over some stretch of time to achieve most prominent execution and adequacy from these engines.Regardless, it is incredibly difficult to legitimize until the moment that the fills are recognized as reasonable for considerable number of Engines. As of late couple of diesel engines have begun showing up on market which utilizes methanol or petroleum gas and a little measure of diesel fuel that is infused at appropriate time to touch off the two energizes. Most alternative fuels are expensive now daily, since the amount utilized is less. A significant number of these energizes will cost considerably less if the measure of their uses gets expanded.

II. LITERATURE SURVEY

A test set-up is created to test the effectiveness of a little diesel Engine in the lab of the engine utilizing different bio-diesel blends got from neem oil. Developing human populace and industrialization has prompted a lack of oil saves. This has made it all the more speaking to elective vitality alternatives. Elective vitality assets ought to be maintainable, sustainable and proficient Biodiesl is viewed as one of the promising elective choices for diesel engines. Matt Johnston1 et al. [1] investigated both the size and spatial changeability of new farming generation potential coming about because of the conclusion of yield holes for 20 ethanol and biodiesel feedstock crops. S.L.Sinha et al. [2] examined, the biodiesel got from jatropha seeds was viewed as a ground-breaking wellspring of biodiesel. Dhar and Agarwal [3] examined the effect of enormous scale usage of karanja biodiesel in transportation engines on greasing up oil debasement and found a higher thickness increment. Utlu et al. [4] explored the productivity and discharges of turbocharged direct infusion diesel engines utilizing biodiesel as fuel. It has honey bee Explicit fuel utilization of WFOME has been seen as expanded to 14.34%, emanation esteems are decreased to 17.14% and 1.45% separately for carbon monoxide (CO) and nitrogen oxides (NOx). In a 7.5 KVA diesel engine generator exhibit, Kalbande et al. [5] tried biodiesel created from crude jatropha and karanj oil and its mixes with diesel for control generation.

For jatropha and karanj biodiesel mixes, the generator's general execution for 6,000 W charging conditions has been improved and found in the scope of 31–33% and 33–39% separately. Biodiesel mixes B80 and unadulterated karanja biodiesel have expanded power also, most extreme by and large effectiveness in contrast with diesel powered generator. It is discovered that the general productivity of jatropha-biodiesel-mixed fuel is lower than that of diesel-energized generator. Sahoo et al. [6] tried ten fuel mixes (Diesel, B20, B50 and B100) of non-palatable, karanja and polanga oil-based methyl esters for their utilization as a trade fuel for a tractor engine and found that most extreme power expanded with 50 percent biodiesel.

Baiju et al. [7] inquired about the engine's proficiency and fumes outflow attributes utilizing petro-diesel as the fundamental fuel and a few diesel and biodiesel mixes as test powers. Results show that Karanja oil methyl esters grew a lot higher power than ethyl esters. Sanjidet al. [8] chipped away at biodiesel palm and biodiesel jatropha delivered by transesterification from the separate unrefined vegetable oils.

Concentrate test results directed to decide the BSFC, engine power, fumes and clamor discharge qualities of a mixed palm and jatropha mix in a diesel engine at different engine speeds ranging from 1400 to 2200 rpm, all the deliberate outflow parameters and commotion emanation have been essentially diminished, with the exception of NO outflow. CO discharges for PBJB5 and PBJB10 were 9.53% and 20.49% lower than for diesel fuel. Arbab et al. [9-10]. Two distinctive fuel mixes were utilized to test V for a 4-stroke 5 hp diesel engine [11]. In the principal case, diesel lamp fuel mixes (with 10% to 40% lamp fuel mixing by volume) and in the subsequent case, LPG blend (15% to 25% LPG blending by volume) was tried with diesel at a steady engine speed of 1700 rpm S. Jindal et al. [12].

Normal fumes discharges were estimated at 30% lamp oil mix with diesel-lamp oil mixes. Emanations from fumes gas, for example CO, UHC, and SO2, diminished by 40%, 18%, and 19%, individually, comparative with unadulterated diesel emanations. Biodiesel has been expressed to be created from neem oil with the expansion of 1% v/v H_2SO_4. B10, B20, B30 joins the consequences for a solitary cylinder, 4-strokediesel engine. The test for B10 shows lower discharges and better than different blends and diesel [13].

III. METHODOLOGY-TRANSESTERIFICATION OF NEEM OIL

Transesterification is the manner of conversion of triglyceride to glycerol and ester inside the presence of alcohol and catalyst. This reaction additionally called alcoholysis in which the alcohol from an ester via any other alcohol in a manner similar to hydrolysis besides that an alcohol is used in preference to water. Experimental work suggests that the parameters affecting the transesterification reaction are the loose fatty acid and the moisture content material the rate of response is strongly motivated by using the reaction temperature. Then with the assist of washing put off the catalyst, soap and extra methanol from bio diesel.

A 250 ml methanol CH3OH (90% pure) mixed 150 ml NaOH of 1 Normality in the glass container and swirled the container until methanol is dissolved in NaOH completely. If NaOH effects with methanol CH3OH, there is an exothermic reaction that allows the glass jar to warm up, so the solution is swirled very carefully. After that start heating up the one liter pure neem oil up to 60° C and then add this hot one liter neem oil to the glass container and start swirling the glass container up to 10 minutes in order to dissolve the neem oil in the mixture completely. After the reaction has been completed, the material is stored for a certain period of time to isolate bio-diesel and Separation of biodiesel and glycerol.

Two plant oils were selected, i.e., neem oils, for the present studies. There were a total of two different diesel blends (10%, and 20%). Upon mixing, oils are esterified to acquire their butyl esters. The main objective of transesterification was to reduce the viscosity of vegetable oils in order to get close to diesel fuel. Esterification also improved their physical properties as shown in Table 1.

IV. EXPERIMENTAL WORK AND SETUP

Technical specifications of the engine Experiment turned into performed on a four-stroke. Four 2 Type single acting, absolutely enclosed, high velocity, four stroke, vertical, bore and stroke-78x82mm, variety of cylinders-1, potential-425cc, most electricity-7.5 BHP, compression ratio-15.5:1, speed-1500 rpm, cooling gadget ability-five liters, crank case oil capability-three liters. This test was carried out to investigate the efficiency and emission properties of a stationary single-cylinder diesel engine running on vegetable oils neem and its diesel blends (volume 10:90 and 20:80) as well as diesel fuel alone. The engine was coupled to a dynamo meter with an eddy current.

Table 1 Properties of neem oils as compared with diesel

Properties	Diesel	Neem
Specific gravity	0.83	0.968
Viscosity (20°C) mm^2/sec	4.7	37.42
Calorific value (MJ/kg)	42	29.97
Carbon (%)	86	78.92
Hydrogen (%)	14	13.41
Properties	Diesel	Neem
Specific gravity	0.83	0.934

Viscosity (20°C) mm^2/sec	4.7	6.3
Calorific value (MJ/kg)	42	31.142
Carbon (%)	86	83
Hydrogen (%)	14	15

The engine was started before the start it's allowed to warm up for about 15 minutes. The engine was run on diesel fuel alone first, followed by the blends of neem oils. The following parameters were taken in order to evaluate the performance of oil blends and pure diesel fuel: I efficiency and (ii) intensity of smoke. The engine was tested for each percentage of blending at a constant speed of 1,500 rpm under six different loads (0, 1.8, 3.6, 5.4, 7.2 and 9.0 kg). The time taken for fuel consumption of 10cc was then noted for each load. The method was replicated in this study of different blends.

Figure 1.Kirloskar Engine Setup

V. RESULTS AND DISCUSSION

This examination was directed to research the execution and discharge qualities of a stationary single cylinder diesel Engine keep running on neem mixes with diesel and furthermore on diesel fuel alone. The execution information was gathered and investigated from the diagrams recording power yield, fuel utilization, explicit fuel utilization, Thermal proficiency for all mixes of bio diesel. The best mix was found from the diagrams, in view of most extreme thermal efficiency productivity.

The real pollutants toxins showing up in the fumes of a diesel Engine were carbon monoxide, hydrocarbons and oxides of nitrogen. Table 2, Table 3 and Table 4 shows Emission Test of Diesel, Neem Blend: 90% Diesel and 10% Biodiesel, Neem Blend: 80% Diesel and 20% Biodiesel with Varying Load and Exhaust Gas.

Test results appeared in the Table 2, Table 3 and Table 4 demonstrated that the emission gas percentages increments with increasing load and measure of gas depleted which likewise expanded by the speed and load of diesel fuel and also demonstrates that the diesel mixed with bio diesel indicated comparable outcomes as got by the load condition, in view of consuming and to the extent of neem oil which demonstrates higher fumes temperature however low power yield because of its thermal misfortune. Table 5 demonstrates that, the brake thermal efficiency has been enhanced minimal higher than when diesel fuel is utilized. In any case of exhaust gas emission levels, the qualities are diminished.

Table 2. Emission Test -Diesel with varying load and exhaust gas

S.No.	R.P.M	Time Taken For 50cc (Sec)	Load (Kg)	Temperature (˚c)			CO (%vol)	CO_2 (%vol)	HC (ppm)	NO_X (ppm)	Smoke (%)
				W_{in}	W_{out}	Exhaust Gas					
1	2025	236.1	0	34	60	235	0.05	3.3	12	282	28.4
2	1987	212.6	1.8	34	67	244	0.05	4.1	16	442	36.4
3	1955	172.1	3.6	34	66	291	0.04	5.4	20	764	42.8
4	1921	137.9	5.4	34	67	335	0.04	6.9	32	1260	56.5
5	1908	112.6	7.2	34	67	410	0.04	8.4	38	1520	76.9
6	1896	89.3	9.0	34	66	503	0.13	10.7	50	1880	93

Table 3. Emission Test -Neem Blend: 90% Diesel and 10% Biodiesel with Varying Load and Exhaust Gas

S.No.	R.P.M	Time Taken For 50cc (Sec)	Load (Kg)	Temperature (˚c)			CO (%vol)	CO_2 (%vol)	HC (ppm)	NO_X (ppm)	Smoke (%)
				W_{in}	W_{out}	Exhaust Gas					
1	2025	299.2	0	34	60	226	0.04	2.5	27	433	18
2	1987	226.7	1.8	34	61	239	0.04	3.6	23	605	34.6
3	1955	170.6	3.5	34	62	263	0.04	5.1	24	987	38.4
4	1921	132.8	5.4	34	63	306	0.03	6.8	29	1375	54.6
5	1908	112.6	7.2	34	64	374	0.04	8.2	35	1743	60.1
6	1896	97	9.2	34	65	412	0.06	9.6	42	2098	76.6

Table 4. Emission Test -Neem Blend: 80% Diesel and 20% Biodiesel with Varying Load and Exhaust Gas

S.No.	R.P.M	Time Taken For 50cc (Sec)	Load (Kg)	Temperature (˚c)			CO (%vol)	CO_2 (%vol)	HC (ppm)	NO_X (ppm)	Smoke (%)
				W_{in}	W_{out}	Exhaust Gas					
1	2025	301.6	0	34	61	232	0.04	2.5	29	437	20.8
2	1987	229.4	1.7	34	62	248	0.05	3.6	35	836	32.7
3	1955	176	3.5	34	63	270	0.04	4.8	37	1143	40.6
4	1921	136	5.3	34	64	314	0.04	6.5	42	1766	62.4
5	1908	116.5	7.1	34	65	386	0.05	7.0	46	1972	74.5
6	1896	94.4	9.1	34	66	423	0.09	9.9	58	2237	84.7

Table 5. Efficiency Compression of Diesel, Blend 10; Neem Oil and Blend 20; Neem Oil

S.No.	Diesel			Blend 10: Neem Oil			Blend 20: Neem Oil		
	BHP	T_{fc}	Efficiency	BHP	T_{fc}	Efficiency	BHP	T_{fc}	Efficiency
1	66.91	1.219	32.9%	68.85	0.962	42%	68.34	0.954	41%
2	66.87	1.354	29.7%	67.55	1.270	32%	67.93	1.255	32%

3	66.84	1.673	24.05%	66.47	1.688	25%	67.18	1.636	24%
4	66.13	2.088	18.07%	65.314	2.168	18%	65.38	2.117	18%
5	64.56	2.55	15.24%	64.872	2.557	16%	64.39	2.472	15%
6	64.39	3.22	12.04%	64.464	2.969	13%	63.75	3.050	12%
	Average		22%	Average		24.3%	Average		23.6%

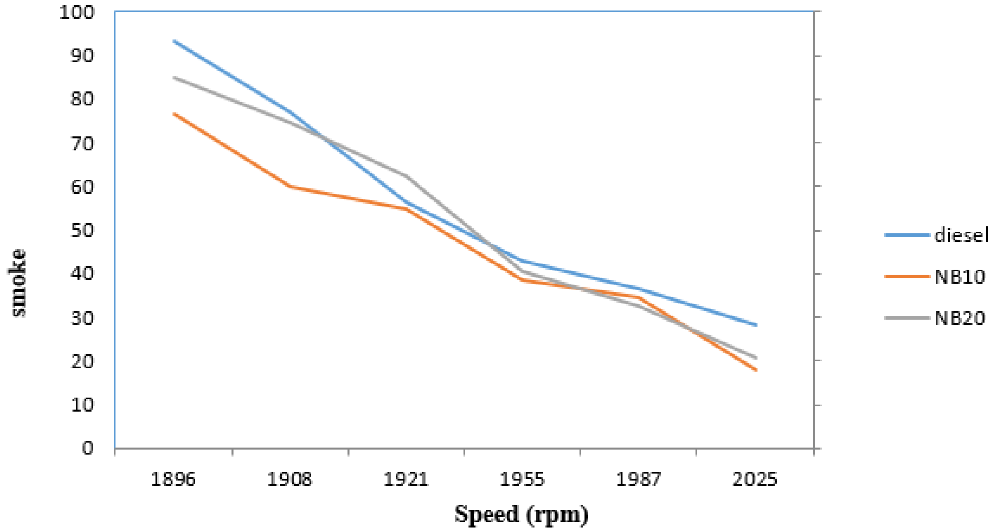

Figure 2. Comparison of Smoke between Diesel, Neem Blends 10 and 20

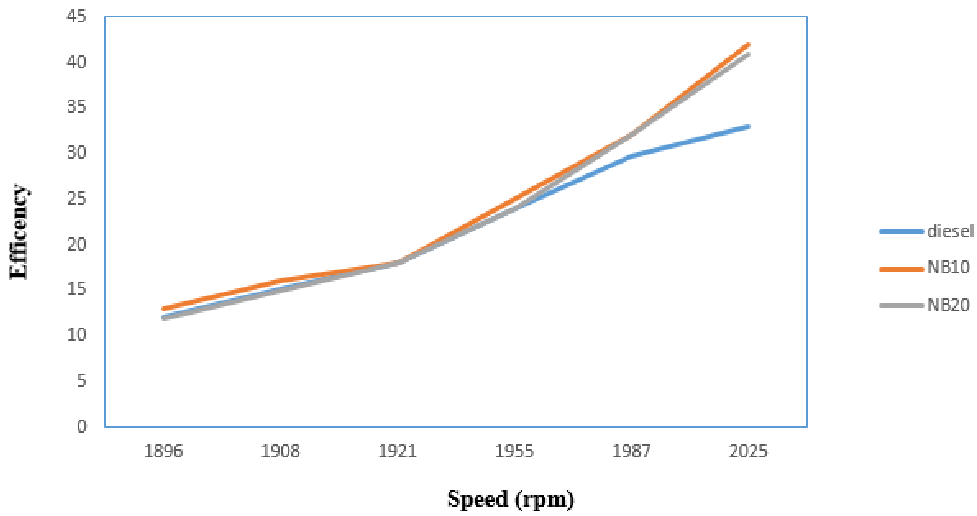

Figure 3. Comparison of Efficiency between Diesel, Neem Blends 10 and 20

The variety in brake thermal efficiency with load for various fills is introduced in Tables 5. In every one of the cases, thermal effectiveness expanded with increment in load. The most extreme thermal efficiency was superior than diesel. Variety in CO discharges with Engine loading for various fuel was looked at in Figure 2 and 3. It is seen that CO emissions for biodiesel and its mixes were lower than diesel fuel. The lesser release of their progressively entire oxidation when contrasted with diesel.

VI. CONCLUSION

Butyl ester of neem oil at 10% blend with diesel offers the most excellent performance in terms of efficiency and emission. As per the fuel properties and exhaust emission characteristics of neem oil butyl ester can be regarded as an alternative to diesel fuel. Emissions of CO, CO_2, and HC were found to be lesser for the esterified oil. The transesterification process, used for making biodiesel is simple and cost effective to solve viscosity problems encountered with vegetable oils.

The cost of dual fuel can be considerably reduced than when pure diesel is used. In future, the transesterification process will be done with the neem oil in various blends of diesel and biodiesel. The properties of the blend will be observed and the testing will be done according to the biodiesel characteristics. Also combination using other edible oil is to be done in the future.

REFERENCES

1. Matt Johnston, Global potential for increasing biofuel production through agricultural intensification. Environmental Research Letters, Vol. 6, Issue 3, 034028, (2011).
2. R. K. Yadav and S. L. Sinha, Performance and Emission Characteristics of a Direct Injection Diesel Engine using Biodiesel Produced from Karanja Oil, International Journal of Enhanced Research in Science Technology & Engineering, Vol. 4, Issue 2, pp. 151-158, (2015).
3. K. P. Mc Donnel, S. M. Ward, P. B. Mc Nully, R. Howard Hildige, Results of Engine and vehicle testing of engine and vehicle testing of semi refined rapeseed oil, Transactions of the ASAE, Vol. 43, pp. 1309-1316, (2000).
4. A. Dhar and A. K. Agarwal, Experimental investigations of effect of karanja biodiesel on tribological properties of lubricating oil in a compression ignition engine, Fuel, Vol. 130, pp. 112-119, (2014).
5. Z. Utlu and M. S. Kocak, The effect of biodiesel fuel obtained from waste frying oil direct injection diesel engine performance and exhaust emissions, Renewable Energy, Vol. 33, pp.1936-1941, (2008).
6. S. R. Kalbande, G. R. More and R. G. Nadre, Biodiesel Production from Non-edible oils of Jatropha and Karanj for utilization in electrical generator, Bio-energy Research, Vol. 1, pp. 176-178, (2008).
7. P. K. Sahoo, L. M. Das, M. K. G. Babu, P. Arora, V. P. Singh, N.R. Kumar and T.S. Varyani, Comparative evaluation of performance and emission characteristics of jatropha, karanja and polanga based biodiesel as fuel in a tractor engine, Fuel, Vol. 88, pp. 1698-1707, (2009).
8. B. Baiju, M. K. Naik and L. M. Das, A comparative evaluation of compression ignition engine characteristics using methyl and ethyl esters of Karanjaoil, Renewable Energy, Vol. 34, pp. 1616-1621, (2009).
9. A. Sanjid, H. H. Masjuki, M. A. Kalam, S. M. Ashrafur Rahman, M. J. Abedin and S. M. Palash, Production of Palm and jatropha based biodiesel and investigation of palm-jatropha combined blend properties, performance, exhaust emission and noise in an unmodified diesel engine, Journal of Cleaner Production, Vol. 65, pp. 295-303, (2014).
10. M. I. Arbab, H. H. Masjuki, M. Varman, M. A. Kalam, S. Imtenan and H. Sajjad, Fuel properties, engine performance and emission characteristic of common biodiesels as a renewable and sustainable source of fuel, Renewable and Sustainable Energy Reviews, Vol. 22, pp. 133-147, (2013).
11. M. A. Kalam and H. H. Masjuki, Biodiesel from Palmoil- An analysis of its properties and potential, Biomass and Bioenergy, Vol. 23, pp. 471-479, (2002).
12. S. Jindal, B. P. Nandwana, N. S. Rathore and V. Vashistha, Experimental investigation of the effect of compression ratio and injection pressure in a direct injection diesel engine running on Jatropha methyl ester, Applied Thermal Engineering, Vol. 30, pp. 442-448, (2010).
13. R. K. Yadav and S. L. Sinha, Performance and Emission Characteristics of a Direct Injection Diesel Engine Using Biodiesel From Waste Cooking Oil, International Journal of Enhanced Research in Science Technology & Engineering, Vol. 4, Issue 2, pp. 45-52, (2015).