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Research paper

Comparison and Performance Analysis of Bio-Diesel Fuel and Mustard Oil Blends in Single Cylinder Diesel Engine

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Abstract

Present day advancement is much subject to fossil essentialness and imperativeness got from fossil resources is significantly higher than various assets. Biodiesel, a promising elective fuel has expanded tremendous thought due to the foreseen shortness of standard forces. The usage of fluid energizes like biodiesel delivered from mustard oil by transesterification process speaks to a standout amongst the most encouraging alternatives as exchange to regular diesel and petroleum products. In this paper, the oil is changed over into butyl ester known as biodiesel. Biodiesel oil and diesel were mixed in the proportion of 10:90 and 20:80 in the presence of homogeneous acid catalyst.. The physical properties, for example, density, kinematic, viscosity, flash point fire point were resolved for mustard oil, and mustard butyl ester. Similar qualities was carried out for the diesel as a fuel to get the information for investigation. Diesel and its mixtures of mustard oils were tested in a CI Engine for execution and emission discharge qualities which demonstrated extensive enhancement in improvement in reducing the emission of gases.

Key words: *- Mustard oils, CI engine, Bio Diesel*

1. Introduction

Petrochemical assets, coal, oil and flammable gas are the real sources which meet the world's vitality needs at present. A lofty increment in the quantity of vehicles as of late has made more noteworthy interest for petrol items. Anyway constant decrease in the unrefined petroleum holds around the world, required to discover appropriate options in contrast to diesel. Biodiesel is a domain amicable substitute fuel for diesel which comprises of alkyl monoesters of unsaturated fats that is mostly gotten from vegetable oils and creature fats.

The oil acquired from different plant sources like sunflower, rice wheat, palm, mahua, jatropha, karanja, soybean, rapeseed and mustard have been effectively tried in C.I. motors. Among the different plant based oil, mustard oil is less utilized for human utilization because of the nearness of Uric corrosive which is unsafe to people. Anyway the thickness of the oil should be diminished through different procedures. Out of the different techniques tried to lessen the thickness, transesterification is the most regularly utilized business procedure to deliver perfect and natural fuel.

In the present examination, ignition and execution attributes of single barrel diesel motor was assessed with mustard oil mixes at a proportion of 10:90 and 20:80 with the guide of weight wrench edge chart acquired by utilizing piezo electric weight transducer and TDC encoder. These parameters were contrasted and the motor keeps running 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 mustard 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

2. Literature Survey

A lab scale creation of Chlorella and Botroyococcus braunii was executed in open lake and bioreactor framework by Md. Imran Kais et al (2011) in Bagladesh. At that point diesel was created by transesterification from gathered algae oil. Matt Johnston1 et al (2011) examined the size and spatial variety of new farming creation potential from shutting of yield holes for 20 ethanol and biodiesel feedstock trims, the utilization of focused escalation by means of set up agrarian practices may offer an option for proceeded with development of new biodiesel generation. S.L.Sinha et al (2010)

investigated that the bio-diesel made from the jatropha seeds have been considered as a potential choice for running the weight begin engines.Sangat Johar et al (2011) portrayed the necessity for extending maintainable and elective imperativeness in the overall essentialness mix which has been all around seen by Governments and major intelligent exchanges to diminish natural change influence for this living planet. Ulf Schuchardt et al (1998) reviewed the transesterification of vegetable oils with methanol and the jobs of unsaturated fat methyl esters.Avinash Kumar Agarwal et al (2009) detailed the specialized plausibility of utilizing straight vegetable oils (Jatropha oil), into a consistent speed coordinate infusion pressure start motor. Jomir Hossain et al (2011) explored the mustard oil properties in the fuel testing research facility and concentrated the execution of a little diesel Engine in the Thermal lab utilizing distinctive mixes of bio-diesel changed over from mustard oil. Ruslans Smigins, Aivars Aboltins et al (2010) nitty gritty the impact of biodiesel and its blends on engine dynamic and money related parameters. The tests were performed using customary diesel fuel at 5, 20, 35 and 100 % blends of 5RME, 20RME, 35RME, 100RME which meets the EN14214 standard. The engine execution parameters can be impacted by the testing conditions and measure of biodiesel included. The results exhibit that control for biodiesel and blends is lower than with typical diesel. Daniela Russi et al(2008) revealed biofuels as a commitment towards the answer for the issues identified with the utilization of petroleum products. Daniel Bichel et al (2007) broke down the utilization of biodiesel in the farming business and concentrated the execution of biodiesel as a swap fuel for traditional diesel. The execution qualities incorporates the generation of ozone harming substance oxides of nitrogen and powers appropriateness for use in stationary Engines.V P Senthil et al (2004) directed research on a 4-stroke 5 hp diesel motor and tried with two distinctive fuel mixes viz., diesel lamp oil mixes (with 10 to 40% lamp fuel mixing by volume) and air-melted oil gas blend (15 to 25 % LPG blending by volume) alongside diesel at consistent Engine speed of 1700 rpm. Distinctive motor fumes emanations, viz.,, carbon dioxide (CO_2), carbon monoxide (CO), unburnt hydrocarbons (UHC), sulfur dioxide (SO_2), oxides of nitrogen (NOx) and unused oxygen (O_2) were looked at utilizing diesel and revealed 80, 71, and 21% decrease in the fumes gas emmisions of CO, UHC, and SO_2 individually..

3. Methodology

Transesterification is the procedure of transformation of triglyceride to glycerol and ester within the sight of liquor and impetus. This response has been broadly used to decrease the consistency of triglycerides. Test consider demonstrates the real factors influencing the transesterification response as free unsaturated fat (FFA) and dampness content and the rate of response is firmly impacted by response temperature.

A 250 ml methanol CH3OH (90% pure) in the glass compartment was blended with 150 ml of 1 N NaOH and whirled until the point that methanol is totally broken up in NaOH. At the point when NaOH responds with methanol (CH3OH), an exothermic response happen because of which the glass holder gets warm so it is cautiously done to twirl the blend. Warmth one liter unadulterated mustard oil up to 60º C and after that additional to the glass holder and twirl up to 10 minutes with the goal that the mustard oil is totally broken up in the blend. After the finishing of response, the item is kept for determined time interim for the partition (approx. 24 hours or more) of bio-diesel and glycerol. Mustard oil was decided for the present examination and two particular blends (10 and 20%) with diesel were made. The Oil was esterified to get their butyl esters before blending. The essential purpose of transesterification was to cut down the thickness of vegetable oils so as to get close diesel fuel and besides to upgrade their physical properties.

4. Experimental Setup

4.1. Technical specifications of the engine

Experiment was led on a Kirloskar Oil Engine which is a solitary acting, completely encased, rapid, 4 stroke, vertical, bore and stroke-78x82mm, number of barrels 1, limit 425cc, greatest power-7.5 BHP, pressure proportion 15.5:1, speed-1500 rpm, cooling framework limit 5 liters, wrench case oil limit 3 liters.

4.2. Execution test technique

This examination was directed to research the execution and emissions qualities of a stationary single barrel diesel Engines as appeared in fig 1which keep running on vegetable mustard oil and their mixes with diesel (10:90 and 20:80 by volume) and contrasted and the diesel fuel alone. The Engine was coupled to a whirlpool current dynamo meter. Before starting the investigations, the motor was begun and permitted to get ready for 15 minutes. The motor was worked first on diesel fuel alone, trailed by the two oil mixes. So as to assess the execution of oil mixes and unadulterated diesel fuel, the parameters, for example, (I) Efficiency and (ii) Smoke power were recorded. The Engine was tried under six distinct Loads (0, 1.8, 3.6, 5.4, 7.2, and 9.0 kg) at a constant speed of 1500 rpm, for every level of mixing. From that point, time taken for 10cc of fuel utilization was noted for each load. The strategy was rehashed for different mixes utilized in the investigation.

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Fig 1: Kirloskar Engine setup

5. Results and discussion

This examination was directed to research the execution and discharge qualities of a stationary single chamber diesel motor keep running on mustard oil mixes with diesel (10:90 and 20:80 by volume) 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. The variety in brake thermal efficiency with load for various fills is introduced in Tables. In every one of the cases, thermal effectiveness expanded with increment in load. .This was because of decrease in heat loss and increment in influence with

increment in load. The most extreme thermal efficiency was higher than that of diesel

5.1. Carbon monoxide

Variety in CO discharges with Engine loading for various fuel was looked at in Fig. 2 and Fig. 3. It is seen that CO emissions for biodiesel and its mixes were lower than diesel fuel. The lesser release may be because of their progressively entire oxidation when contrasted with diesel. Test results appeared in the table 1 and 2 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.

Table 3 and 4 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 mustard oil which demonstrates higher fumes temperature however low power yield because of its thermal misfortune.

Table 7, 8 and, 9 demonstrates that, the brake thermal efficiency has been enhanced minimal higher than when diesel fuel is utilized. In any case, if there should arise an occurrence of exhaust gas emission levels, the qualities are diminished

Table 1: Diesel as fuel with varying load and exhaust gas

S.NO	SPEED	TIME TAKEN FOR 50CC (SEC)	LOAD (KG)	TEMPERATURE(C)		
				W_{in}	W_{out}	EXHAUST GAS
1	1968	236.1	0	34	60	202
2	1967	212.6	1.8	34	67	244
3	1966	172.1	3.6	34	66	291
4	1945	137.9	5.4	34	67	335
5	1899	112.6	7.2	34	67	410
6	1894	89.3	9	34	66	503

Table 2: Diesel as fuel varying load its corresponding emissions

S.NO	MANOMETER	CO	CO_2	HC	NO_X	SMOKE
	INLET AIR					
1	18	0.05	3.3	12	282	28.4
2	19	0.05	4.1	16	442	33.4
3	17	0.04	5.4	20	764	34
4	16	0.04	6.9	32	1260	56.5
5	16	0.04	8.4	38	1520	76.9
6	15	0.13	10.7	50	1880	93

Table 3: Mustard Oil Blend: 90%Diesel and 10%Bio Diesel with varying load and exhaust gas

S.NO	SPEED	TIME TAKEN FOR 50CC (SEC)	LOAD (KG)	TEMPERATURE(C)		
				W_{in}	W_{out}	EXHAUST GAS
1	1994	276.1	0.3	34	60	225
2	1981	226	1.8	34	61	240
3	1944	170.4	3.5	34	62	267
4	1934	137.4	5.3	34	63	316
5	1915	109.2	7.3	34	64	375
6	1891	91.9	9.1	34	65	442

Table 4: Mustard Oil Blend: 90% Diesel and 10% Bio Diesel Varying load (Table3) with its corresponding emissions

S.NO	MANOMETER	CO	CO_2	HC	NO_X	SMOKE
	INLET AIR					
1	16	0.04	2.6	23	349	26.9
2	16	0.05	3.5	32	568	32.1
3	16	0.04	5.1	23	977	48.9
4	16	0.04	6.4	26	1350	56.7
5	16	0.05	8.2	33	1685	73.2
6	16	0.09	10.1	44	1986	78.3

Table 5: Mustard Oil Blend: 80%Diesel and 20%Bio Diesel With varying load and exhaust gas

S.NO	R.P.M	TIME TAKEN FOR 50CC (SEC)	LOAD (KG)	TEMPERATURE		
				W_{in}	W_{out}	EXHAUST GAS
1	2022	295.3	0	34	60	204
2	1990	225.9	1.8	34	61	237
3	1968	177.1	3.6	34	65	260
4	1932	140.5	5.7	34	66	312
5	1911	110.6	7.2	34	67	374
6	1895	94.8	9	34	68	442

Table 6: Mustard Oil Blend: 80%Diesel and 20%Bio Diesel Varying load (Table5) with its corresponding emissions

S.NO	MANOMETER READINGS	CO	CO_2	HC	NO_X	SMOKE
	INLET AIR					
1	16	0.04	2.5	23	476	29.6
2	16	0.04	3.7	37	888	30
3	16	0.04	4.8	33	1130	33
4	16	0.03	6	21	1450	41
5	16	0.04	8.2	32	1696	60.3
6	16	0.1	10.1	31	2137	81.1

5.2. Calculations

Table 7: Efficiency of engine when diesel fuel is used

S.NO	BHP	T_{FC}	EFFICIENCY%
1	66.91	1.219	32.90%
2	66.87	1.354	29.70%
3	66.84	1.673	24.05%
4	66.13	2.088	19.07%
5	64.56	2.55	15.24%
6	64.39	3.22	12.04%
AVERAGE			22.16%

Table 8: Efficiency of engine when Mustard oil blend is10

S.NO	BHP	T_{FC}	EFFICIENCY%
1	67.79	1.043	39.10%
2	67.35	1.274	31.80%
3	66.09	1.69	23.50%
4	65.75	2.096	18.80%
5	65.11	2.637	14.80%
6	64.29	3.133	12.35%
AVERAGE			23.39%

Table 9: Efficiency of engine when Mustard oil blend is 20

S.NO	BHP	T_{FC}	EFFICIENCY %
1	68.748	0.9752	39.50%
2	67.66	1.274	31.90%
3	66.91	1.626	24.70%
4	65.68	2.049	19.30%
5	64.97	2.603	15.03%
6	64.43	3.037	12.40%
AVERAGE			23.80%

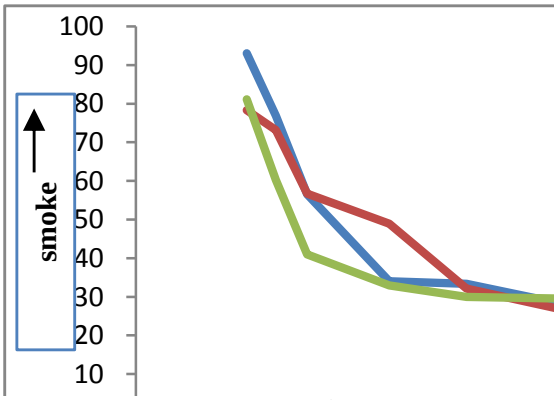

Fig 2: Emission vs Speed comparison of diesel, Mustard blend 10 and Mustard Blend 20

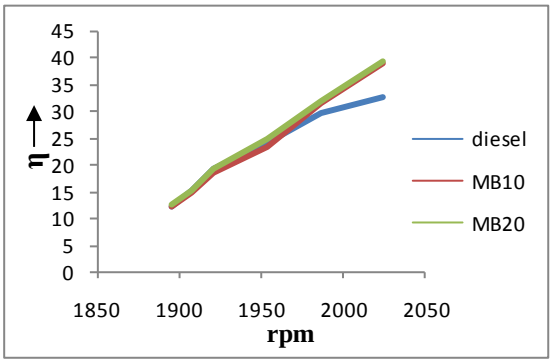

Fig 3: Efficiency vs Speed comparison of diesel, Mustard blend 10 and Mustard Blend 20

6. Conclusion

Butyl ester of mustard oil at 20% mix with diesel offers the best execution results as far as efficiency and emission. According to the fuel properties and exhaust fumes emanation qualities, mustard oil butyl ester can be utilized as an option in alternative to diesel fuel. Discharge emissions of CO, HC were observed to be lesser for the esterified oil. The transesterification procedure, utilized for making biodiesel is straightforward and financially savvy to take care of consistency viscosity issues experienced with vegetable oils. The expense of dual fuel can be extensively diminished than diesel.

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