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Experimental Investigation on Diesel Engine by using Diesel, Sesame Oil as a Biofuel with Magnesium Oxide (MgO_2) Catalyst

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ABSTRACT

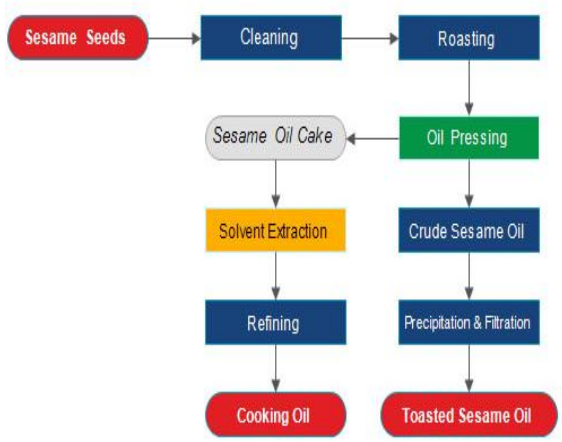
One of the most pressing issues facing the globe today is the energy problem and environmental degradation. Fuel is an unavoidable part of any country's industrial development and growth. Bio diesel is a clean, sustainable, and domestically produced diesel fuel. In this study, biodiesel is derived from sesame oil using the transesterification process and a Mgo2 additive. Biodiesel's various qualities, such as flashpoint, fire point, cloud point, density, and calorific valve, are all measured. The valves that were obtained met biodiesel specifications. The performance and emissions of biodiesel blends (sesame oil +Mgo2) are B8, B16, B24, B32, and B40 blends in my paper. In this study we are analyzed that B08 and B16 blends are suitable compared to diesel fuel because it gives less emissions at part loads in emissions contents like Co, Co2, NOx, HC and opacity was obtained.

*KEYWORDS:*Emissions, Biodiesel blends, Fuels properties, Specifications.

INTRODUCTION

The mono-alkyl ester of a long chain fatty acid generated from plant/animal fats is known as biodiesel. To produce biodiesel, a variety of conventional and non-conventional crops have been used, including used oil from the frying industry. Soybean oil, rapeseed oil, safflower oil, and palm oil are some of the most used oils. In the face of volatile oil prices, interest in biofuels has skyrocketed. At the same time, the cost of hydrogen technology remains high, as does the impracticality of delivering hydrogen. The cleanliness of electric vehicles has been called into question by recent study. The amount of CO2 saved by these vehicles is highly dependent on how the electricity is generated. Fossil fuels are used to power a huge number of power plants. These factors have prompted numerous automakers to focus on biofuels as a fuel source that can deliver both performance and sustainability. Improved understanding of the potential for biodiesel and its blends to reduce regulated emissions. Sesame (Sesamumindicum L.) is a popular oilseed crop that ranks sixth among vegetable oils in the globe. Asia and Africa generate 2.55 million and 0.95 million tonnes of the world's 3.66 million tonnes of sesame, respectively. After Sudan and Uganda, Nigeria is Africa's third-largest sesame grower. Despite the good weather conditions for growing this crop on a wide scale for commercial purposes, Africa sesame's net export is just 38% of its production. Currently, most African sesame growers produce non-certified organic sesame that can easily meet the specific requirements. Sesame is a very old crop that is regarded to be one of the world's oldest oil crops (Bedigian and Harlan, 1986; Ashri, 1998). Its research history was divided into three distinct periods'., the era of "germplasm collection and gene bank establishment, "the period of "classical breeding and genetics," and now. The "Omics" epoch (Figure 2). During the first millennium (before year 2000), cultivated sesame genetic materials as well as wild sesame related genetic materials morphologically, species were collected from a variety of growth locations. Defined, and a variety of seedbanks have been established in several locations. Hildebrandt (1932); Kinman and Martin (1954); Bedigian Bisht et al., 1998; and Harlan, 1986). The current study used an analytical approach to investigate the primary categories of fuel parameters, such as density, kinematics viscosity, cloud point, pour point, flash point, Sulphur content, acid number, and qualitative character. Magnesium oxide (MgO) is an organic compound found naturally in the mineral periclase. In aqueous conditions, it quickly interacts with water to form magnesium hydroxide. It's an antacid and a mild laxative with a wide range of non-medical use.

2.SESAME OIL:



Cleaning, Stone Removal, Cooking/Roasting, Oil Pressing, Oil Filtering, Winterization, Toasted Sesame Oil Sesame Seeds, Cleaning, Stone Removal, Cooking/Roasting, Oil Pressing, Oil Filtering, Winterization, Toasted Sesame Oil. The solvent extraction process is not ideal for sesame seeds because of their high oil content. Pre-pressing (hydraulic press or screw press) and solvent extraction are typically used in medium and large-scale industrial sesame oil production.

Table:1. Important assembling markets of sesame seeds in different states:

S.N.O	State	Important markets
1.	Andhra Pradesh	Gigacandela, Narasaraopet, gudur, KADAPA, CHEMNUR
2.	Bihar	Patnacitu, Gaya, Betiah
3.	Gujarat	Bhuj, Jamnagar, Surendrangar
4.	Tamil Nadu	Salam, Villupuram, Cuddlaore
5.	West Bengal	Tamlur, Armbar, Kalna, katwa, Islampur
6.	Orissa	Jal war, Bal sore, Bari pada
7.	Rajasthan	Alwar, Bhagalpur, Pali

Table: 2. Properties of sesame biodiesel:

S.N.O	Parameters	Sesame oil	Sesame Biodiesel
1.	Moisture content	0.09	0.014
2.	Kinematic Viscosity(40c)	31.39	4.03
3.	Iodine valve	108	86.72
4.	Acid valve	0.50	0.25
5.	Density	833	873
6.	Higher heating valve	40.20	41.35
7.	Diesel index	55.80	69.17
8.	API	29.30	30.03
9.	Cetane number	50.73	59.80
10.	Flash point	-	180

3.TRANSESTERIFICATION PROCESS:

To make cloudless transparent oil, 1.5 liters of sesame oil is placed in a 2-liter beaker and cooked on a water bath (about 400□ C). 13.65 gm KOH is combined with 324 ml methanol and agitated until the KOH is completely dissolved. To guarantee adequate mixing of oil, alcohol, and catalyst, a mixture of KOH and methanol is added to 1.5 liters of sesame oil at 400C, then the contents are transferred to a 2-liter bottle and shaken vigorously for 10 minutes. For two days, the bottle is maintained upside down with no movement, and the creation and settlement of glycerin at the bottom and biodiesel at the top is seen. Glycerin is carefully collected, and any remaining biodiesel is washed with water and dried in the sun to remove any water. At last biodiesel yield is collected.

4.EXPERIMENTAL PROCEDURE:

Fig:1. Experiment set up of Kirloskar Engine

Fig:2. Gas analyzer of Kirloskar Engine

Table3. Kirloskar Engine Tv1 Specifications:

Type: Four Stroke, Single Cylinder Vertical Water-Cooled Diesel Engine

Rated power	5.2 KW
Rated Speed	1500rpm
Bore Día (D)	87.5 mm
Stroke (L)	110mm
Compression ratio	17.5:1
C.V of fuel for diesel	42,000 kJ/kg
Density of Diesel	830 kg/m3

A single cylinder, four-stroke single cylinder engine was used for the engine performance test. The engine was directly connected to a "Eddy current dynamometer," which allowed for full or partial engine operation. The experimental setup is represented schematically in Figure, and the engine characteristics are listed in the engine specifications. The fuel for the test engine is supplied by a tank that can be readily drained with the help of a three-way stop valve for fuel change. A 100cc glass burette was also attached in parallel to this tank and was used to measure the fuel flow rate. The fuel line was cleansed of remaining fuel after each fuel change. To stabilize on new fuel conditions, the engine was forced to operate at maximum power for at least 30 minutes. The test rig was outfitted with everything it needed. Instruments and equipment for recording dynamic Crank angle and combustion pressure measurements.

Following percentages of various biodiesel blends:

1) 8% of sesame oil+1%Mgo2+91%diesel
2) 16% of sesame oil +1%Mgo2+83%diesel
3) 24% of sesame oil+1%Mgo2+75%diesel
4) 32% of sesame oil+1%Mgo2+67%diesel
5) 40% of sesame oil+1%Mgo2+59%diesel

Observations were used to determine brake power, indicated power, total fuel consumption, specific fuel consumption, real volume, swept volume, brake thermal efficiency, indicated thermal efficiency, volumetric efficiency, and mechanical efficiency.

5.RESULTS AND DISCUSSIONS:

1.Brake power vs BTE:

From above graph shows that B.P Vs BTE, the variations of BTE for the biodiesel blends of B8, B16, B24, B32, B40 (sesame oil+MGo2) as a function of engine speed. BTE of various blends increases at constant speed. The Thermal efficiency is an indicator of how much of the energy released by the fuel in burning is being transformed into useful work compared to diesel B16 blend has completely straight line remaining as at second load of B. P has gets curve. At higher loads the

Brake thermal efficiency maintained at constant rate. B32 and B40 was gets nearly same BTE.

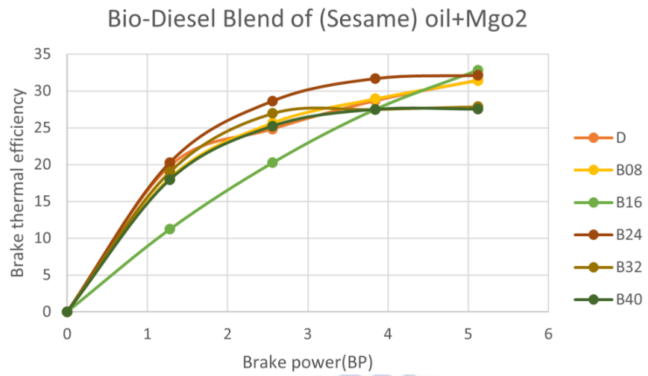


Fig: 3.B.P Vs Brake thermal efficiency

2.Brake power vs BSFC:

From above graph shows that B. P vs BSFC the variations of the BSFC for all biodiesel blends of B8, B16, B24, B32, B40 (Sesame +Mgo2) as function of engine speed. It can be observed that the BSFC decreases and increases as per Brake power. At first load the B.P Vs BSFC was gets infinity. The curve was not linear It does not start at Zero. The B16 blend gets maximum blend and high BSFC it can be without modification of engine. For higher blends we must modify the engine because engine life was less.

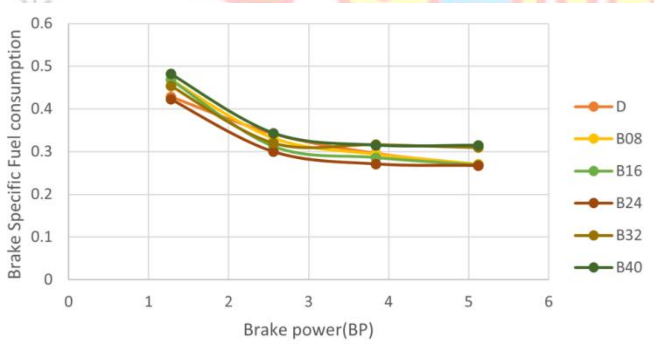


Fig:4. Bp Vs BSFC

3.Brake power Vs Mechanical Efficiency:

From the above graph shows that B. P Vs Mechanical Efficiency the variations of the BSFC for all biodiesel blends of B8, B16, B24, B32, B40 (sesame oil+Mgo2) as a function of engine speed. At First load the efficiency of B16 slightly change remaining loads are same. B32 and B40 has higher thermal efficiency, B16 has slightly decreased.

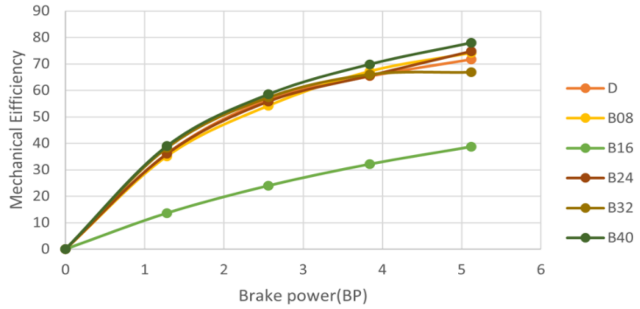


Fig:5. BP Vs Mech efficiency

Emissions:

a. Brake power vs Carbon monoxide:

The concretions of Co emissions of the biodiesel blends as a function of Various loads of B.P as B8, B16, B24, B32 and B40 results lower concentrations compare to Diesel. B16, B24 has lower 'CO' concentrations among all biodiesel blends at constant speed, At B32 and B40 has high 'CO' emissions to reduce that we want to do modifications.

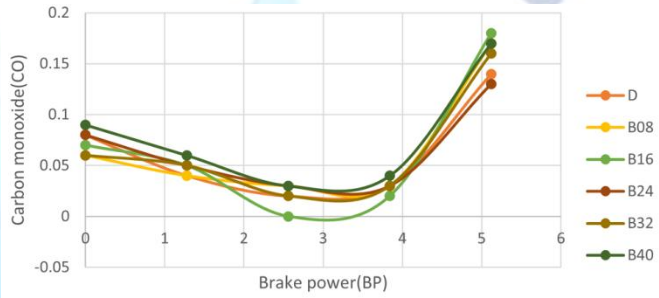


Fig: 6.B.p Vs Co

b. Brake power vs hydrocarbons:

The concentrations of HC emissions of the biodiesel blends as a function of various loads of brake power, B8 ,B16 ,B24 ,B32 ,B40 of biodiesel blends are having lower concentrations compare to diesel ,the reduction of concentrations of HC emissions is due to the leaning effect which is associated with the higher oxygen content of biodiesel blend which enhance the fuel combustion efficiency, reduced HC emissions is also attributed to the faster flame speed of biodiesel blend which promotes complete combustion.

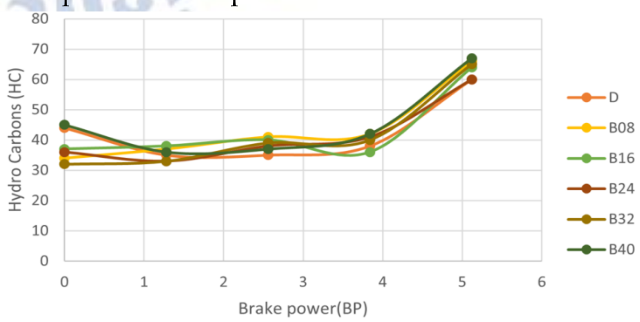


Fig:7. B. p vs Hydrocarbons

c.Brake power Vs Co2 emissions:

The concentrations of C02 emission of all biodiesel blends investigation as the function of engine speed. Its apparent the amount of CO2 concentrations is higher than for all biodiesel blends compare to diesel. The B16 and B24 gets lower valves of Co2 concentrations compare to remaining blends the blends have higher latent HOV and auto ignition temperature which reduces the combustion efficiency at lower engine speed and consequently reduce Co2 concentration.

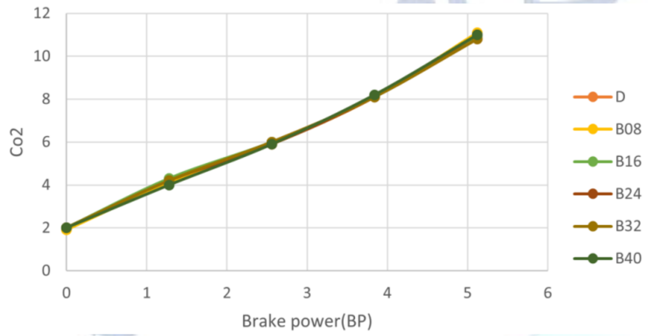


Fig: 8. BP Vs Co2

d.Brake power vs NOx emissions:

The concentration of NOx emissions of all biodiesel blends as a function of the engine speed. The NOx concentration increases with an increase in engine speed for all fuel blends tested in the study, in comparison to diesel the biodiesel blends give low NOx emissions. B16 and b24 has same NOx emissions nearly remaining B32 and b40 has high compare NOx to diesel.

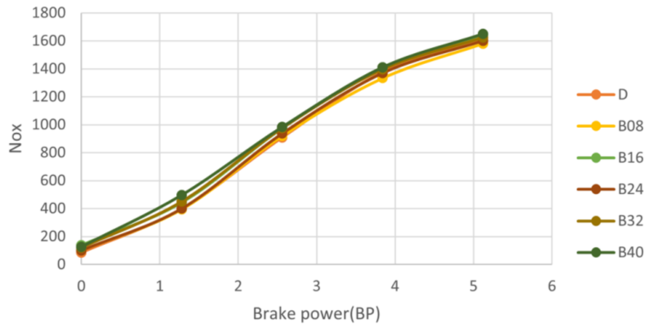


Fig: 9. BP VS NOx

e.Brake power vs opacity:

The concentrations of opacity of all biodiesel blends as a function of the engine speed. At first load the blend of B16, B24 as low opacity at remaining loads at high opacity, The B32 and B40 as nearly high opacity compared to diesel.

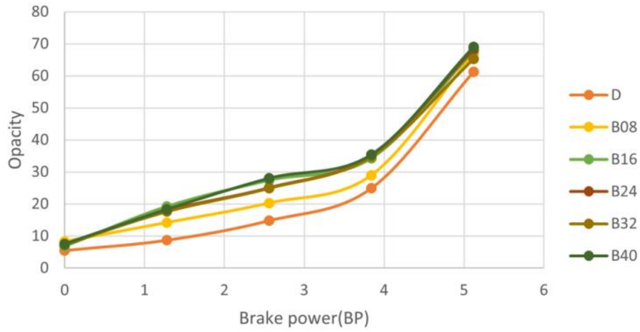


Fig:10. Bp Vs opacity

Table:4. Fuel properties of tested blends of biodiesel and diesel blends:

S.No	Fuel	Density	Kinetic Viscocity	Cetane Number	Heating Value	Cold Point	Pour Point	Flash Point
1	Diesel	0.855	30.6	50	43.8	-----	-16	76
2	Sesame Oil	0.9133	35.5	40.2	39.3	-3.9	-9.4	260
3	B8	0.863	31.1	43	41	-2.5	-10	180
4	B16	0.891	32	41	42	-3.1	-12	192
5	B24	0.90	33	44	46	-----	-14	200
6	B32	0.92	34	42	48	-2.9	-13	226
7	B40	0.93	35	40	50	-3	-10	246

6.CONCLUSION:

Sesame (Sesamum indicum L.), one of the oldest edible oil crops, contains up to 60% fat in its seeds, which are utilized as a food source.

Sesame oil has a lot of potential as a diesel substitute, but its application in direct-injection engines is limited due to its high viscosity, low volatility, and polyunsaturated triglycerides. Transesterification of sesame seed oil is one method for making sesame seed oil-based products feasible fuel. Sesame oil was used as the raw oil in this experiment. Potassium hydroxide (kOH) with ethanol to go through a transesterification process.

Because of the oxygen content in their molecules, sesame seed oil has around 7.5 percent lower heating value than diesel oil. The viscosity and density of sesame seed oil was found to be extremely like that of diesel. The Biodiesel's calorific value is determined to be somewhat lower. Compared to diesel (5.4 percent). The current findings back up the theory that Diesel can be made from the of sesame seed oil.

- Because no engine modifications are required, sesame biodiesel can be utilized in any diesel engine.
- Short-term tests were conducted; longer-term tests could provide a more realistic picture of engine performance and lifetime.
- The engine develops the fastest rate of pressure rise and the fastest rate of heat release when compared to (sesame +Mgo2) and its mixtures. As the percentage of sesame in the mix increases, both the maximum rate of pressure rises and the maximum rate of heat release decrease.
- Because (sesame +Mgo2) has a lower calorific value, it has a higher specific fuel consumption as the percentage of sesame in the blend increases.
- The braking thermal efficiency decreases as the percentage of (Sesame + Mgo2) in the fuel increases.

Greater oxygen content in diesel blends results in improved combustion and a higher combustion chamber temperature when compared to diesel. NOX levels rise as a result.

References

[1] G. Antolin, F.V. Tinaut, Y. Briceno, V. Castano, C. Perez, and A.I. Ramirez, 2002. Transesterification of sunflower oil improves biodiesel production. 111–114 in Bioresource Technology.

[2] M. Bayazit, I. Avci, M. Bayazit, M. Bayazit, M. Bayazit, M. Bayazit, M. Bayazit, M. Bayazit, M Planning, development, and management are all important aspects of any project. International Journal of Science and Technology443–452. Water Resources Development, vol. 13, no. 4, pp. 443–452.

[3] H. Baydar, R. Marquard, and I. Turgut, 1999. Selection of pure lines for increased production, oil content, and fatty acid composition of Sesamum indicum is the scientific name for sesame. 462–464 in Plant Breeding.

[4] Improved "conversion of plant oils and animal fats into biodiesel and co-products" (Praveen r. Muniyappa, Bio-source technology, volume 6, issue 1, April 1996).pages19-24.

[5] A review of biodiesel production-FangruiMa, BioSource pages 1-15 in volume 70, issue 1 (October 1999).

[6] Diesel Fuels Based on Triglycerides-Anjana Srivastav, Ram Reviews of Renewable and Sustainable Energy by Prasad 111-133 in 4(2000).

[7] A survey of biodiesel fuels produced from vegetable oils using catalytic and non-catalytic supercritical alcohol transesterification and other methods-Ayhan Demibras, EnergyAugust, volume 44, issue 13 of conversion and managementPages 2093-2109 in 2003.

[8] Experimentation with a diesel engine running on kerosene Addanki produces fuel and biodiesel from sesame illipes International Journal, Sreenivasulu, Dr.L. Rasidha Volume 4, Issue 9 of the International Journal of Mechanical Engineering (IIJME). September of that year.

[9] Bailey's Industrial Oil and Fat Products, 6th vol., John Wiley & Sons, Inc., Hwang, L.S., Hwang, L.S., Hwang, L.S., Hwang, L.S., Hwang, L.S., Hwang, L.S., Hwang, L A.A. Warra (2011); Sesame Seeds (SesamumIndicum L.)

[10] Extraction Methods for Seed Oil and Their Prospects A Review of the Cosmetic Industry; Bayero Journal of 4(2): 164–168 in Pure and Applied Sciences.