RESEARCH ARTICLE OPEN ACCESS

EXPERIMENTAL INVESTGATION ON COTTON OIL & SUN FLOWER OIL USED IN C.I ENGINE AS BLENDS

B T Naik[1], Prof Muralikrishna[2]

1(Assoc Professor Abhinav Hi-Tech College of engineering Himayath nagar Hyderabad Telangana state)

2 (C B I T College C B Post Hyderabad. Telangana state, and Place)

Abstract:

In a modern day world alternative source of energy are given importance due to gradual depletion of fossil fuels reserves vegetable oils can be used as an alternative to diesel in CI engines. The use of vegetable oils in CI engine results in low CO and HC emissions compared to conventional diesel fuel. The present study covers the various aspects of biodiesels fuel derived from cottonseed oil. Cottonseed oil is converted to cottonseed oil methyl esters by trans etherification process An experimental investigations were carried out on C.I. engine with Bio Diesel blends of cotton seed Methyl Esters and Neem Oil Methyl Esters .The engine used for the experiments was single cylinder Four Stroke water cooled, constant speed diesel engine . Cotton seed Methyl ester (CSOME) and Neem oil methyl ester (NOME) are derived through transterification process and parameters of transterification were optimized. The blends of various proportions of the CSOME & NOME with diesel were prepared, analyzed and compared with diesel fuel, and comparison was made to suggest the better option among the bio diesel. Various Tests have been carried out to examine properties, performance of different blends (C05, C10, C15, and C20) of CSOME and NOME in comparison to diesel. From the experimental Results it is indicated that C20 have closer performance to diesel. However, its diesel blends showed reasonable efficiencies. From the experimental results it is observed that cotton seed methyl ester gives better performance compared to Neem methyl esters and also the emissions and smoke for these diesel blends are less as compare to the pure diesel.

I. INTRODUCTION

This An alternative fuel vehicle is a vehicle that runs on a fuel other than "traditional" petroleum fuels (petrol or diesel); and also refers to any technology of powering an engine that does not involve solely petroleum (e.g. electric car, hybrid electric vehicles, solar powered). Because of a combination of factors, such as environmental concerns, high oil prices and the potential for peak oil, development of cleaner alternative fuels and advanced power systems for vehicles has become a high priority for many governments and vehicle manufacturers around the world.

Hybrid electric vehicles such as the Toyota Prius are not actually alternative fuel vehicles, but through advanced technologies in the electric battery and motor/generator, they make a more efficient use of petroleum fuel. Other research and development efforts in alternative forms of power focus on developing all-electric and fuel cell vehicles, and even the stored energy of compressed air.

HISTORY OF ALTERNATIVE FUEL DEVELOPMENT

The history of bio fuels has less to do with technology advancements and more to do with political and economical greed. In order to understand the foundation for biofuel technology though, it is necessary to know the history of the diesel engine. In 1893, a German Inventor named Rudolph Diesel published a paper entitled "The theory and Construction of a Rational Heat Engine". In this paper, he described a revolutionary new engine where air would be compressed by a piston to increase pressure and therefore raise temperatures. (Planet Fuels, 2001) Because of the high temperatures, it was found that the engine could run off a variety of vegetable oils such as hemp and peanut oil. In 1911, at the World's Fair in Paris, Rudolph ran his engine on peanut oil, and later described that "the diesel engine can be fed with vegetable oils and will help considerably in the development of the agriculture of the countries which use it." Rudolph wanted an alternative to expensive and inefficient steam engine, and his new diesel engine was the answer.

2.0 LITERATURE SURVEY

1. Water and Rice [1] tested RapO blends up to neat RapO in an IDE and concluded that all blends were acceptable in comparison to DF and the 50% blend gave the best results. In particular, BSFC was in the same level for all fuels; except in high load levels where neat RapO gave higher BSFC. Thermal efficiency (TE) was found to be better as oil content in the tested fuel was increased. Exhaust gas temperature followed the same trend as thermal efficiency and engine lubrication oil performed well, showing acceptable viscosity reduction. Unburned hydrocarbons were lessened when neat RapO was used.
2. McDonnell et al. [2] used semirefined RapO blends up to 75% in an agricultural tractor direct injection diesel engine (DDE) and resulted that oil blends up to 25% were suitable alternative fuels. More specifically, as oil content in the fuel was increased, Power was reduced and BSFC was augmented, but according to the tractor operators, engine performance was not affected highly; while engine lubricating oil was slightly influenced from the fuel alteration and injector fouling was increased, but not quantified.
3. Karaosmanoğlu et al. [3] completed a 50-hour endurance test of a DDE with SunO, and there were no significant changes in engine operation in comparison to DF. More precisely, there was no significant drop or increase of power or fuel consumption. The lubrication oil was not affected remarkably and injector nozzle was clean.
4. Altin et al. [4] compared several preheated VOs in a DDE with minor power loss and emission increase. Between the tested VOs, SunO, CotO, and RapO were tested and rapeseed had better engine performance and cottonseed better emissions. The worst torque release was obtained with SunO and the best with RapO. The least power output was released with CotO, while the highest values were taken when RapO was used. SunO gave the highest BSFC. CO emissions were most increased with RapO, and CO2 was higher with SunO, followed by RapO and CotO. NO2 was lower with cotton, followed by SunO and RapO. Smoke level was the highest with RapO, followed by CotO and SunO.
5. Rao and Mohan [5] investigated the effect of supercharging on a DDE performance with Cotton and found that changes in injection pressure did not affect performance, but supercharging, even if low, provided better performance with BSFC reduction

3.0 PROCEDURE AND SAMPLE CALCULATIONS

1. The engine is started and run for at least 15 minutes for warming up. Motor for circulating the water is simultaneously started .Then, under no load condition, the time taken for the consumption of 10cc of fuel, the load applied, the speed and manometer readings are recorded.
2. The load is increased and allowed to run for 10 minutes. Then, the time taken for the consumption of 10cc of fuel, the load applied, the speed and manometer readings are recorded.
3. The load is further increased in approximately four equal steps up to the rated value and readings are noted as in earlier steps.
4. In addition, the temperature of cooling water at the inlet and outlet,

temperature of exhaust gas and discharge of water are required at every load.

5. The engine is then stopped taking suitable precautions.

The test samples are

1. B0(Pure Diesel)
2. B10 (10% Soya bean Oil and 90% Pure Diesel)
3. B20(20% mahua Oil and 80% Pure Diesel)

The testing procedure is carried by mixing the specimen samples with diesel in calculated proportions. The mixture of specimen sample and diesel is used in single cylinder diesel engine and several tests are conducted under controlled atmospheric conditions.

Single cylinder diesel engine

Step 1: Take bio diesel blend say ethanol B10, the composition contains 100 ml of ethanol and 900 ml of diesel, as ethanol is very dangerous proper atmospheric condition are to be maintain, water is used as the cooling agent in the experiment when the fuel is added to engine and cranking is done. Calculated proportions are taken and constant atmospheric conditions are maintained.

Step 2: load to be added to engine to engine and increased simultaneously with the help of the electrical loading and the mean difference of the two gauges are calculated to fine the exact torque applied on engine

Loads are added in ascending order. The adding of load the rpm of the engine will be changing simultaneously that will be displayed on the digital meter. All this testing will give the performance of the fuel used in the engine and will be used in calculating to find the brake power and mechanical efficiency of the engine with using different types of test specimens.

4.0 RESULTS:

Experimental values for 15%cotton +85% diesel:

s.no	items	Units	Test-1	Test-2	Test-3	Test-4	Test-5	Test-6
1	load	Kw	0	1	2	3	4	5
2	Speed	Rpm	1553	1529	1527	1516	1503	1496
3	Time taken fo sec	Sec	36.8	29.3	25.5	21.5	19.9	174
4	Monometer readings	Mm	15.2	15.2	15.2	15.2	15.2	15.2
5	Cooling water flow rate	Rpm	4.6	4.6	4.6	4.6	4.6	4.6
6	Total fuel consumption	Kg/hr	0.404	0.507	0.583	0.692	0.747	0.855
7	Specific fuel consumption	Kg/kw-hr	150.37	0.7661	0.455	0.3882	0.3882	0.3301
8	Break power	Kw	0.00269	0.663	1.2827	1.78312	1.7812	2.59006
9	Friction power	Kw	1.75	1.75	1.75	1.75	1.75	1.75
10	Indicate power	Kw	1.75269	2.413	3.0327	3.53312	3.9679	4.3409

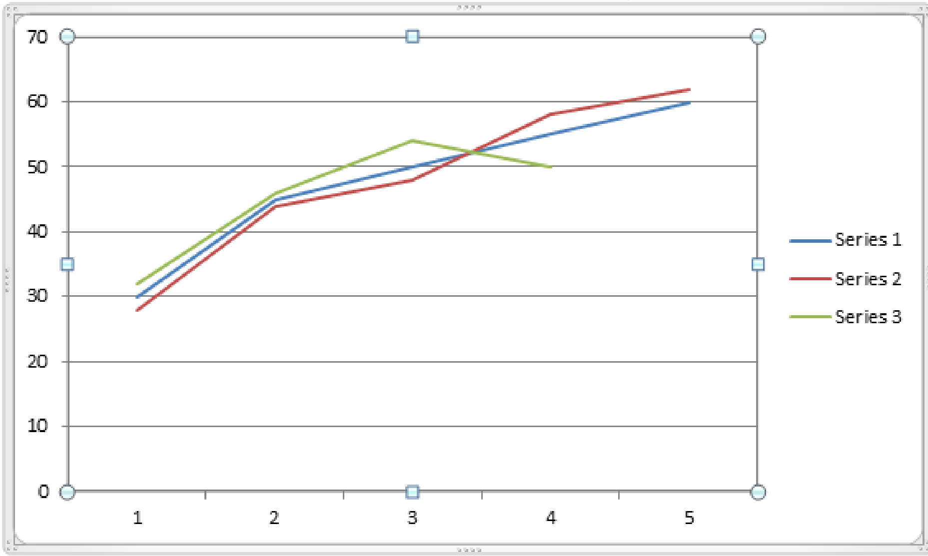
11	Mechanical efficiency	%	0.00153	27.47	42.295	50.468	55.892	59.68
12	Break Thermal efficiency	%	$1.44*10^{-4}$	6.98	22.738	37.049	53.03	63.3099
13	Actual air intake	M^3/min	0.00307	0.00307	0.00307	0.00307	0.00307	0.00307
14	Theoretical air intake	M^3/min	0.02862	0.02818	0.02814	0.02794	0.0277	0.02757
15	Value metric efficiency	%	10.72	10.89	10.90	10.98	11.08	11.13
16	Co	%vol		0.074		0.038		0.047
17	HC	Ppm		13		15		24
18	Co_2	%vol		1.89		2.17		6.33
19	O_2	%vol		18.02		17.61		11.66

Experimental values for 30% cotton seed oil +70% diesel

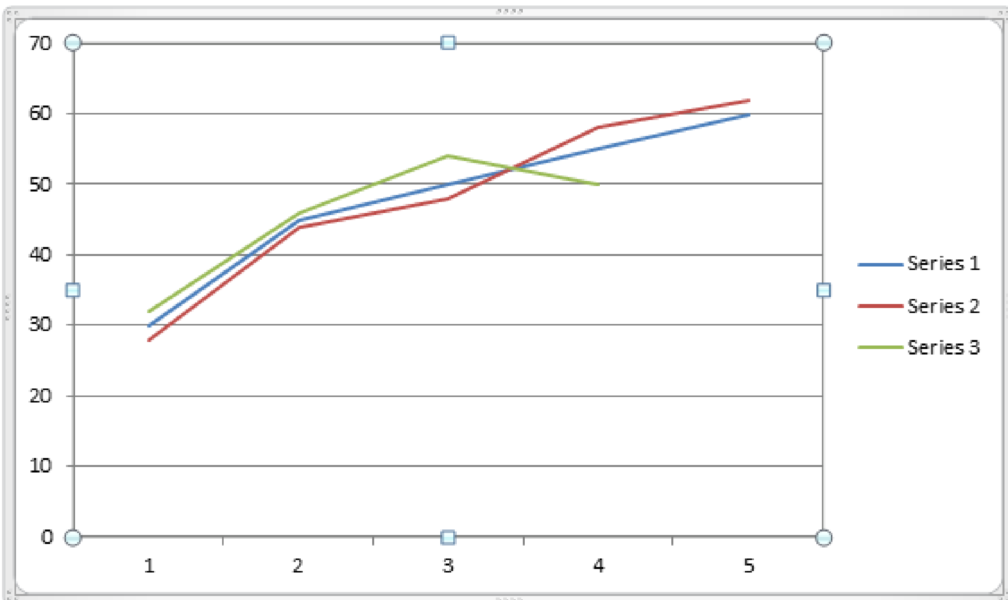
s.no	items	Units	Test-1	Test-2	Test-3	Test-4	Test-5	Test-6
1	load	Kw	0	1	2	3	4	5
2	Speed	Rpm	1550	1539	1527	1514	1509	1501
3	Time taken fo sec	Sec	35	29.3	25.5	21.5	19.9	174
4	Monometer readings	Mm	15.2	15.2	15.2	15.2	15.2	17.8
5	Cooling water flow rate	Rpm	4.6	4.6	4.6	4.6	4.6	15.2
6	Total fuel consumption	Kg/hr	0.425	0.507	0.583	0.692	0.747	4.6
7	Specific fuel consumption	Kg/kw hr	158.699	0.7661	0.455	0.3882	0.3398	0.836
8	Break power	Kw	0.00269	0.663	1.2827	1.78312	2.2011	0.3233
9	Friction power	Kw	1.75	1.75	1.75	1.75	1.65	61.05
10	Indicate power	Kw	1.65268	2.413	3.0327	3.53312	3.8511	64.51
11	Mechanical efficiency	%	0.0062	27.47	42.295	50.468	57.15	0.00307
12	Break Thermal efficiency	%	1.36*10-	6.98	22.738	37.049	52.25	0.0276
13	Actual air intake	M^3/mi	0.00307	0.00307	0.00307	0.00307	11.	11.12
14	Theoretical air intake	M^3/mi	0.02862	0.0283	0.02814	0.02794	0.048	0.037
15	Value metric efficiency	%	10.73	10.84	10.9	11.00	11.04	11.12
16	Co	%vol		0.074		0.038		0.037
17	HC	Ppm		13		15		20
18	Co_2	%vol		1.89		2.17		3.5
19	O_2	%vol		18.02		17.5		15.71

GRAPHS

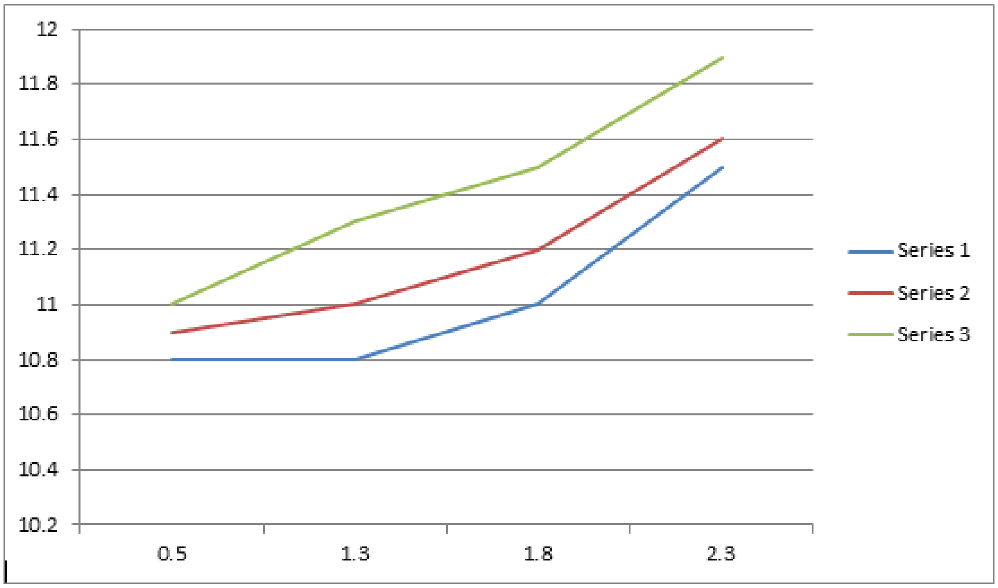
COMPARISION OF load and mechanical efficiency



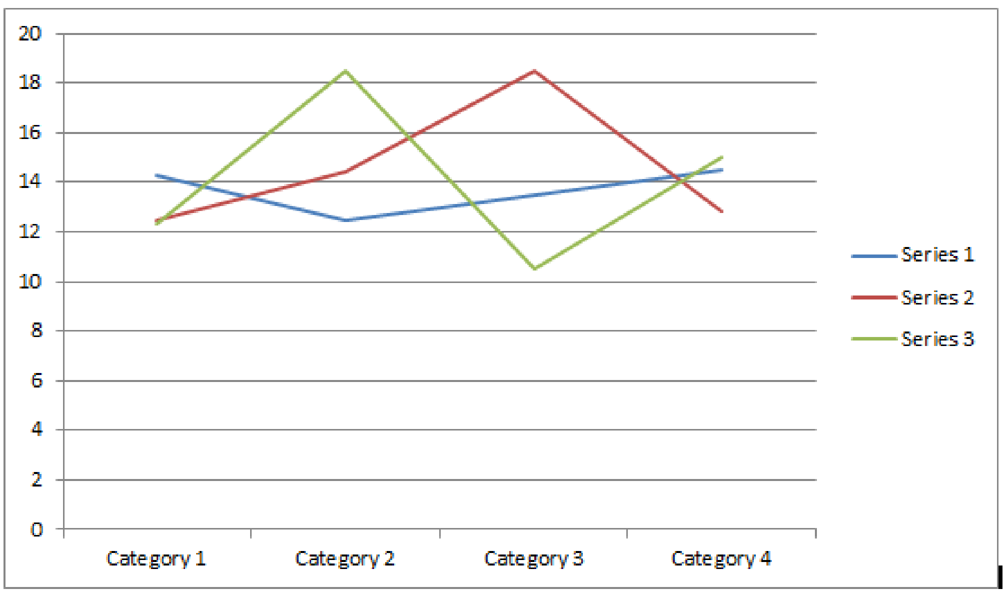
Graph between BP,mechanical efficiency



Graph between BP,volumetric efficiency



Graph between break thermal and BP



5.0 CONCLUSIONS

An experimental investigation was conducted to evaluate the performance and exhaust emissions of three Vegetable oils [Sunflower Oil (Sun Oil), Rapeseed Oil (RapO), and Cottonseed Oil (cotton oil)] and their blends with Diesel Fuel (DF) and compare the results with the reference fuel (DF). The work was conducted in a fully instrumented direct injection agricultural tractor engine. The conclusions extracted in terms of engine performance and exhaust emissions were as follows.

(i)All vegetable oil fuels provided as fuels to the engine had resulted in normal operation without problems during the short-term experiments.

(ii)The 20/80 blends showed unstable results with unclear trends, in comparison to higher oil content fuels.

(iii)Power, Torque, and BSFC were higher as oil content was increased in the tested fuel.

(iv)RapO-based fuels gave the best results in terms of Power and Torque increment with a simultaneous lower BSFC increase. As a result, engine thermal efficiency was significantly better than when using the other vegetable oils. CotO fuels were on average better than SunO fuels.

(v)NOx emissions were augmented as oil percentage in the fuel was increased.(vi)RapO fuels increased the NOx production less than CotO fuels, leaving SunO fuels last.

(vii)CO2 emissions showed an increase tendency as the oil content was evolved when RapO and CotO fuels were used. SunO fuels gave blurred results on this issue.

(viii)The highest CO2 emissions were produced when CotO fuels were tested, followed by RapO and SunO fuels.

As a main conclusion, the use of RapO illustrated better behavior as alternative fuel to DF in the direct injection agricultural tractor engine of this study.

REFERENCES

1. *P. Panagakis, G. Papadakis, T. Natsis, and S. Kyritsis, "Strategic R&D for better energy efficiency in the agricultural sector," In: CSMC) EPCNJ-C—GD, editor. 1996.*
2. *T. W. Ryan, T. J. Callahan, and L. G. Dodge, "Characterization of vegetable oil for use as fuels in diesel engines," in Proceedings of the International Conference on Plaint Oils as Fuels, pp. 70–81, American Society of Agricultural Engineers, 1982, ASAE no. 49085.*
3. *R. C. Strayer, W. K. Craiq, and G. C. Zoerb, "Engine deposit and pour point studies using canola oil as a diesel fuel," in Proceedings of the International Conference on Plant and Vegetable Oils as Fuels, pp. 347–353, American Society of Agricultural Engineers, 1982, ASAE no. 49085.*
4. *C. D. Rakopoulos, K. A. Antonopoulos, D. C. Rakopoulos, D. T. Hountalas, and E. G. Giakoumis, "Comparative performance and emissions study of a direct injection diesel engine using blends of diesel fuel with vegetable oils or bio-diesels of various origins," Energy Conversion and Management, vol. 47, no. 18-19, pp. 3272–3287, 2006*