International Journal of
Advances in Scientific Research and Engineering (ijasre)

E-ISSN : 2454-8006

Vol. 3. Special Issue 1, August-2017

Experimental Investigation on Use of Coconut Oil as Lubricant in Two Stroke SI Engine

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ABSTRACT

Lubrication circuit is one of the most important ones in the engine, as engines cannot run smoothly for more than few minutes without lubricating oil ,the serious drawback of now day petroleum based lubricating oil is emission. This problem may be overcome by the using vegetable oils such as coconut oil as it shares most of the salutary properties of other vegetable oils like lubricity, high flashpoint of 225° C which is more than 2T oil. This paper focuses on evaluation of performance of coconut oil as a alternative lubricating oil and its effect on the engine performance, experiments are conducted with standard injection parameters, at constant speed , and at different loads ,various parameters like Brake power, specific fuel consumption, total fuel consumption, Thermal efficiency & emission were studied, with the results so obtained the performance curves were drawn and compared to ascertain the suitability of using coconut oil as lubricant in two stroke SI engine, and experimental results show that there is less emission and reduced Total fuel consumption.

Keywords: *Lubrication Circuit, Vegetable Oils, Thermal Efficiency, Emission.*

1. INTRODUCTION

Increased concerns about environmental damage caused by mineral oil based lubricants, has created a growing worldwide trend of promoting vegetable oil as base oil for automobile lubricants. Coconut oil, which is abundantly available in southern states of India, is reportedly being widely used as two stroke engine lubricant (2T oil) [1].

Vegetable oil formed a major share in the total usage of lubrication, by that time, the rapid industrialization made the requirement of lubricants very high, putting pressure on the price and availability of lubricants from vegetable and animal origin coconut oil found mention as a lubricant amongst other widely used vegetable oil era, though coconut oil is more stable than many other vegetable oils it was not widely used due to its high coagulation temperature.

An environmental evaluation of coconut oil lubrication revealed that it consumes low energy, generates hardly any waste material and has no emission, in fact to impart oiliness to mineral oil based lubricants, a small percentage of vegetable or animal oil was added as oiliness additive, later many organic, inorganic and polymer additives for mineral oil based lubricants were developed to meet the operating requirements , in connection with this the present work is an attempt to evaluate the suitability of using coconut oil as lubricant in two stroke SI Engines

2. EXPERIMENTAL

Experiments were carried out on a two stroke SI engine which was coupled to eddy current dynamometer, an Infrared gas analyzer, RPM sensor is coupled to determine engine RPM, thermo couple is used to measure cylinder head temperature and exhaust manifold temperature. In a measuring jar for one liter of petrol 30mL of 2T oil is added and mixed well and in another measuring jar for one liter of petrol 30mL of coco nut oil is added and mixed well and kept ready for test run.

Engine Specification: experiments were carried out on a 145cc Baja two stroke SI engine which has the following specification (refer Table 1.1).

Table 1.1 Engine specification

Type	Two Stroke Air cooled
Number of cylinders	one
Bore* Stroke	57mm*57mm
Engine displacement	145.45cc
Compression ratio	8.8:1
Maximum power	6.12 bhp@5200rpm
Maximum torque	0.99 kgf-m @3500rpm
Ignition timing	22^{o} $\pm 2^{o}$ BTDC

Measurement systems: to conduct the performance test the engine is coupled with eddy current type dynamo meter (refer Table 1.2)

Table 1.2. Technical specification of Dynamometer

Model	636001
SR No	B01EK002
Rating	3KW (Max)
Torque	2kg-m at 3000rpm
Tachogen	AC/100rpm
Coil DC(Max)	85V to 35V
Resistance at 20^{o} c	20Ω

For conducting emission test in the present work Infrared Exhaust gas analyzer is used (Refer Table 3)

Table1.3 Infrared Exhaust gas analyzer Specification

Type	TD 2040
Machine No	9209 NGA148
YEAROF MFG	1992
CO Measurements	0-4000ppm
resolution	10ppm
PPM measurement range	0-9990 ppm
Voltage	220-240 V, 50Hz
Power requirement	70W

3. TESTING:

Initially the engine is operated using the fuel mixed with coconut oil and for three different speeds and different loading conditions the readings are tabulated, and the same procedure is repeated using the fuel mixed with 2T oil , with the reading obtained the following parameters were calculated to evaluate the performance of the engine.

1. Brake power
2. SFC
3. Mass flow rate
4. Thermal efficiency
5. Emission test

4. RESULTS & DISCUSSION

After conducting the experiment by plotting the results the following observations can be made.

Thermal Efficiency: thermal efficiencyof an engine is defined as the ratio of the power output to that of chemical energy input in the form of fuel supply[3]. It is the true indication of the efficiency with which thermal energy input is converted in to mechanical work, in the present work it can be observed from the graph(Refer Fig 2a,2b,2c) that thermal efficiency is slightly high when coconut oil is being used as lubricant compared to 2T oil as lubricant.

Cylinder block temperature: engine temperature mainly depends on the flash point of the lubricating oil, coconut oil has the flash point of 225 ° c and the 2T oil has 140° c. in the graph plotted between Cylinder block temperature v/s BP & Exhaust manifold temperature v/s BP (Ref Fig 5a, 5b, 5c)it is observed that temperature of cylinder block is little higher in case of coconut oil as compared to the 2T oil, in the present investigation it is the one factor which is giving negative effect which has to sorted out by using appropriate additive to the coconut oil..

Carbon Monoxide Emission: CO is a product of incomplete combustion due to insufficient amount of oxygen or insufficient time in cycle for complete combustion, but the above reason is same for both coconut oil and 2T oil by the graph it is observed that CO emission is less in case of coconut oil as lubricant(Refer Fig 3a,3b,3c).

Hydrocarbon Emission: unburned hydrocarbon is the result of incomplete combustion, the pattern of hydro carbon emission is closely related to many design and operating variables. But the above parameter remains unchanged during experiment for both coconut oil and 2T oil, from the graph it can be observed that HC emission is less in case of coconut oil compared to petroleum based 2T oil(Refer Fig 1.4a,1.4b,1.4c).

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Advances in Scientific Research and Engineering (ijasre)
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Specific fuel consumption: it is the amount of fuel consumed per unit power developed per hour, from figures (Refer Fig 1.1a, 1.1b, 1.1c). it can be observed that the SFC in case of coconut oil is less compared to 2T oil, SFC mainly depends on the friction between piston and cylinder lining hence from the above investigation it can be observed that when coconut oil is used as lubricant it offers better lubrication, which intern results in more mileage when coconut oil is used than the 2T oil

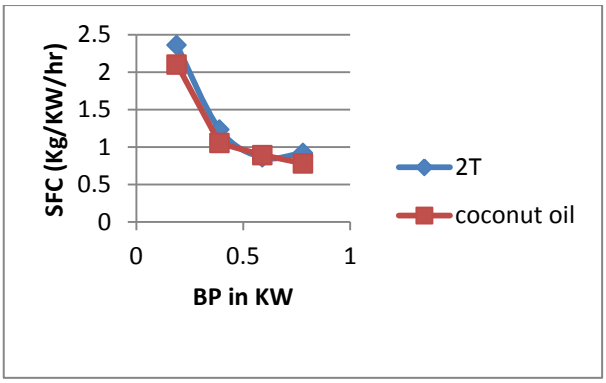

Figure1.1a. BP v/s SFC (3000rpm)

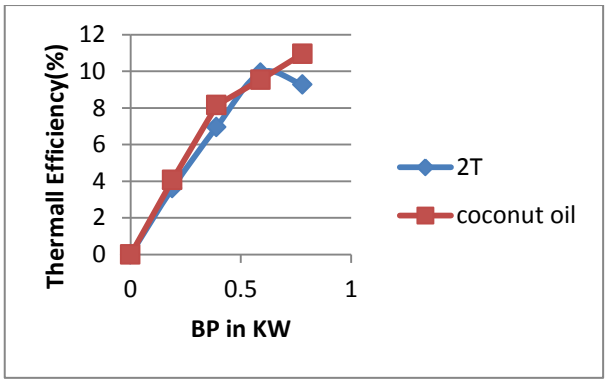

Figure1.2a. BP v/s Thermal Efficiency (3000rpm)

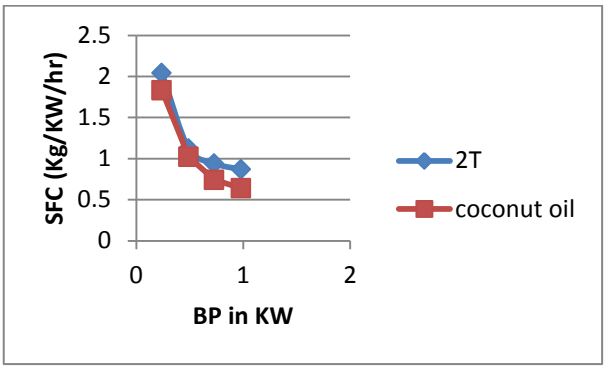

Figure1.1b. BP v/s SFC (3600rpm)

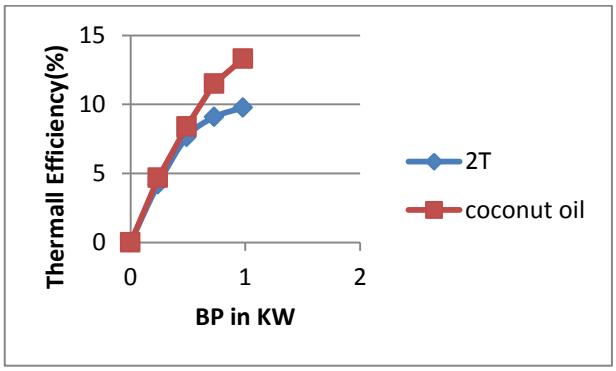

Figure 1.2b. BP v/s Thermal Efficiency (3600rpm)

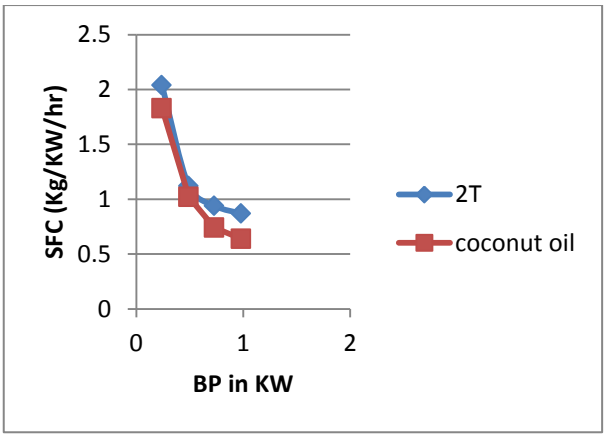

Figure1.1c. BP v/s SFC (4000rpm)

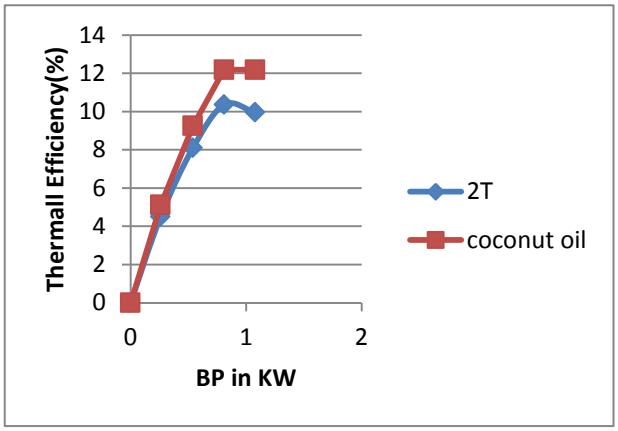

Figure 1. 2c. BP v/s Thermal Efficiency (4000rpm)

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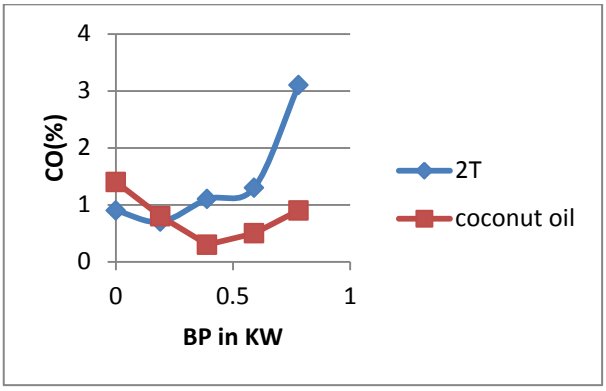


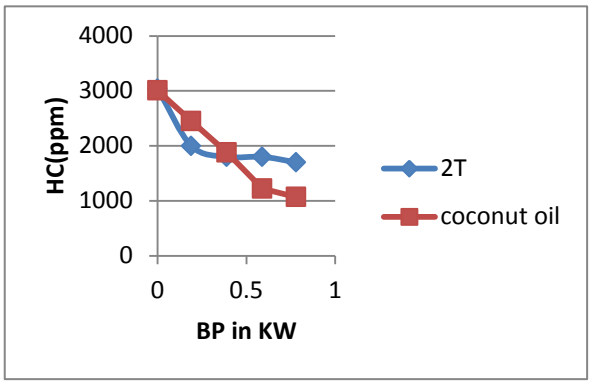
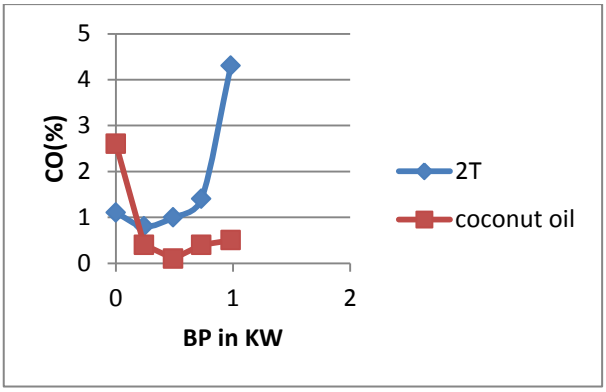


Figure1.3a. BP v/s CO % (3000rpm)Figure 1.4a. BP v/s HC in ppm (3000rpm)



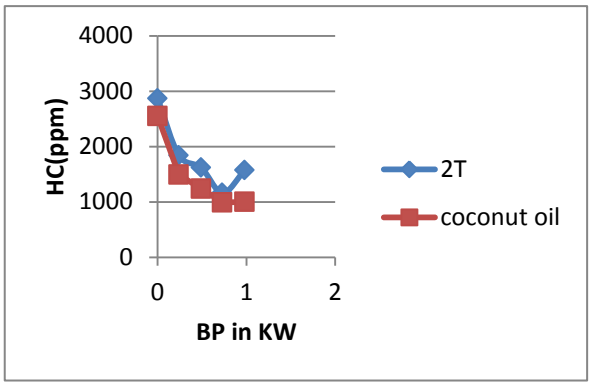
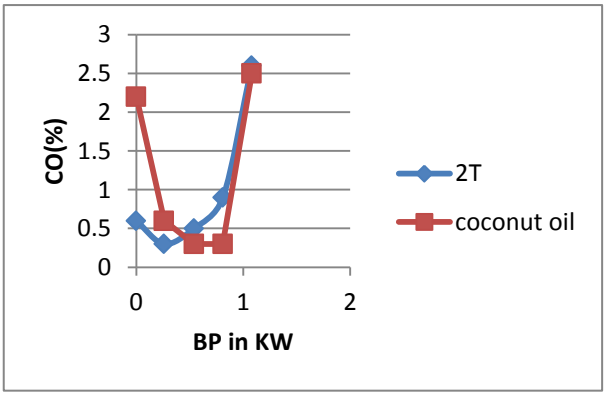


Figure1.3b. BP v/s CO % (3600rpm)

Figure 1. 4b. BP v/s HC in ppm (3600rpm)



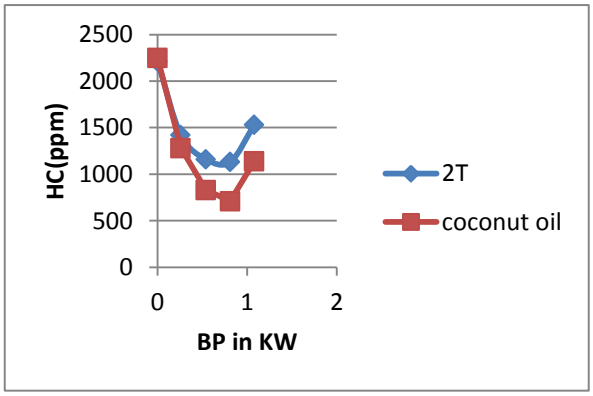


Figure 1.3c. BP v/s CO % (4000rpm)

Figure 1. 4c. BP v/s HC in ppm (4000rpm)

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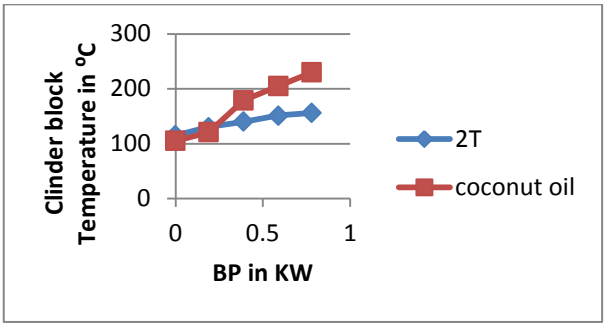

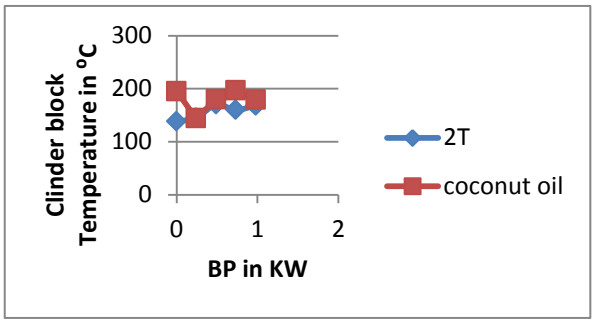

Figure 1. 5a. BP v/s cylinder block Temp (3000rpm)Figure 1. 5b. BP v/s cylinder block Temp (3600rpm)

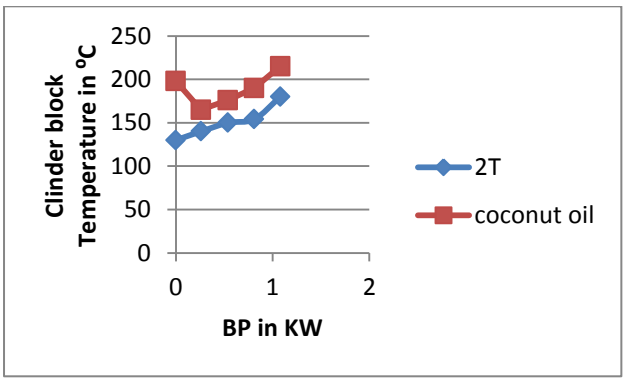

Figure 1. 5c. BP v/s cylinder block Temperature (4000rpm)

5. CONCLUSIONS

Based on the experimental results obtained following conclusions can be drawn

1. Specific fuel consumption is less when coconut oil is used as lubricant

2. The CO and HC emission is reduced when coconut oil is used as lubricant

3. Thermal efficiency is slightly increased in case of coconut oil as lubricant

4. Cylinderblock temperature is slightly higher when coconut oil is being used compared to 2T oil which is a drawback.

5.The another disadvantage is coconut oil cannot be used in winter season since the pour point of coconut oil is very high compared to 2T oil. Drawbacks of using coconut oil as lubricant may be overcome by making use of some additives which enhance its property as lubricant.

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