Curcuma Longa Leaf Oil As An Alternate Fuel-Engine Analysiswith The Addition of Nano Egg Shell Powder As A Catalyst

K.Sanjeeviprakash[1], R.Surendran[2], K.Ramesh[3]
[1]Dept of Thermal Engineering
[1]GCT-Cbe
[2, 3]APME,GCT-Cbe

Abstract- *This analysisis carried out to examine and investigate the performance characteristics of Curcuma longa plant leaf oil with NESP , when blended with the commercial diesel fuel. The performance, combustion, emission and the heat balance analysis were carried out in a single cylinder, constant speed, 4 stroke DI diesel engine for at various load conditions. The curcuma longa leaf oil with NESP was manufactured by steam distillation using Clevenger apparatus and is blended with diesel in three different compositions varying from 10%,20%,30% .It is evident that the experimental work is carried out between 100% pure diesel and diesel blended with various compositions of curcuma longa leaf oil with NESP brake thermal efficiency increases from 1 to 2% percentage under load conditions from 3kg, 6kg, 9kg, 12kg for Curcuma longa leaf oil with NESP. Brake specific fuel consumption of Curcuma longa leaf oil with NESP-diesel blends was closely equal to that neat diesel fuel. The best combustion characteristics were achieved with the Curcuma longa leaf oil with NESP - diesel blends and there is an almost unique results of in-cyllinder peak pressure. The CO,CO2,NOx,HC emissions were remarkably reduced due to the addition of Curcuma longa leaf oil with NESP compared with diesel*

Keywords- curcuma longa,diesel,nano egg shell powder,ballmilling,efficiency

I. INTRODUCTION

Due to the lessening of fossil fuels, we wants to go for an additional resource which is useful for betterment for our future. Because the petroleum crisisis in arabicnation and globally there is rapid increase in costs especially in India which is very dependent on these fuel requirements. Increased number of automobile vehicles has proportionately increased the effect of greenhouse gases. This has review more and more benefit in the use of vegetable oils as a replacement for fossil fuel. Biodiesel is one of the vital sources of renewable energy and are accessible in great quantity especially in agricultural nationlike as India and Indonesia. Their manufacture also make the atmosphere "greener". Vegetable oils be able to be transesterified to biodiesel which isansubstitute fuel for diesel engines with no any modification.Biodiesel is defined as "A fuel comprised of mono alkyl esters to long chain fatty acids derived from vegetable oils or animal fats". Biodiesel is a non-toxic, biodegradable, and renewable diesel fuel and can be used as blends with diesel fuels. Biodiesel has many advantages compared to diesel fuels. It has morecetane number than diesel fuels, and contains no aromatics, almost no Sulphur and 10-12% oxygen by weight. Biodiesel fuelled engines produce less CO, HC and particulate emissions than diesel fuelled engines. They also get better lubrication, which results in the longer engine c life of the components as well.In thisresearchcurcuma longa leaves being used to prepare curcuma longa leaf oil. The neat curcuma longa leaf oil is blended with that of diesel for enhancing performance in a direct injection diesel engine. The performance, emission and combustion characteristics of the newly developed fuel are compared and analyzed with pure diesel & individual biodiesel.Oilslike aspongamia and eluppai did not turnout positive during transesterification to produce biodiesel. These when analyzed it was noted that certain oils has high degree of saponification. Saponification is the alkaline hydrolysis of the fatty acid esters.Fuels come from variety of sources

II. METHODOLOGY

Curcuma longa leaf oil is produced with the use of conventional steam distillation process.When steam distillation is used in the preparation and extraction of essential oils, the botanicalplant(curcuma longa leaves material is placed in a still and steam is forced over the material. The warm steam helps us to release the aromatical molecules from the curcuma longa plant material because the steam forces open the pockets in which the oils are kept in the plant material. The molecules of these volatile oils then escape from the plant material and evaporate into the steam.The temperature of the steam wantss to be carefully controlled - just enough to forces the plant material to lets go of the essential oil, yet not too hot as to burn the plant material or the

essential oil.The steam which then contains the essential oil, is passed through a cooling system to condense the steam, which forms a liquid from which the essential oil and water is then separated.The steam is produced at greater pressure than the atmosphere and therefore boils at above 100 degrees Celsius which facilitates the removal of the essential oil from the plant material at a faster rate and in so doing prevents damage to the oil. The other methods of preparing Vegetable oil for automotive applications can be produced by any one of the following methods. They areCold pressing, Solvent extraction, Pyrolysis of waste ,Expeller extraction.

Fig 1:Curcuma longa Plant

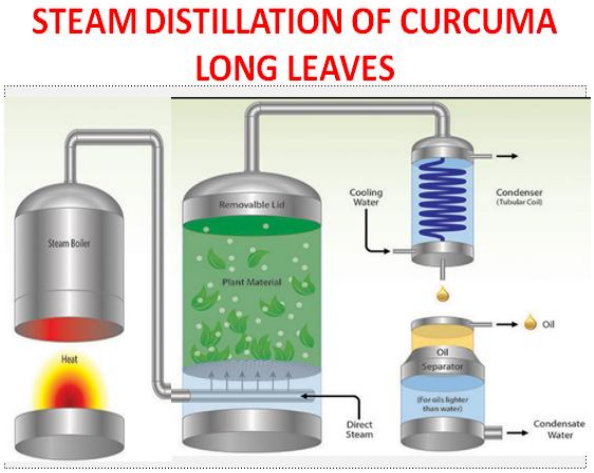

Fig 2: Steam distillation of curcuma longa(curcuma longa) leaves

NANO EGG SHELL POWDER:
BIO CATALYST

Nano egg shell powder has been manufactured by the use of ball milling equipment. The egg shell has collected and its dried and its crushed into the required size. After crushing the crushed egg shell is fed into the ball milling equipment. The repeated movement of balls made the crushed egg shell to be ground. After attaining the required size of 15 nm, the nano egg shell powder have been collected from the ball milling equipment. The nano egg shell powder contains combinations of various metal oxides along with percentages as Calcium oxide 93 % Cerium oxide 3% Cesium oxide 1% other metal oxides 3%.

CURCUMA LONGA LEAF OIL PROPERTIES:

PARAMETER	DIESEL ASTM	TURMERIC LEAF OIL
DENSITY(kg/m³)	815-860	886.5
KINEMATIC VISCOSITY(cSt)	2.4-4.1	2.7289
FLASH POINT(°C)	47.5	60
FIRE POINT (°C)	51	90
CETANE NUMBER	40-55	51
CALORIFIC VALUE(KJ/kg)	42300	42310

ENGINE SPECIFICATIONS:

ICEngine set up under test is Research Diesel having power 3.50 kW @ 1500 rpm which is 1 Cylinder, Four stroke , Constant Speed, Water Cooled, Diesel Engine, with Cylinder Bore 87.50(mm), Stroke Length 110.00(mm), Connecting Rod length 234.00(mm), Compression Ratio 17.50, Swept volume 661.45 (cc)

Fig 3VCR Test Engine Setup

III. TEST RESULTS

Test engine is tested by using the various blends of diesel and curcuma longa leaf oil. The performance test is conducted in computerisedic engine with TLO10D90,TLO20D80,TLO30D70 BLENDS with 1g NESP.

BRAKE POWER:

Brake power is the power output of the drive shaft of an engine without the power loss caused by gears, transmission, friction, etc. It's called also pure power, useful power, true power or wheel power as well as other terms. This formula is written as:

Brake power = T * w.....where; T: is the torque required of wheels of the vehicles to move and w: is the angular velocity of wheels.

Indicated power = BP + friction power

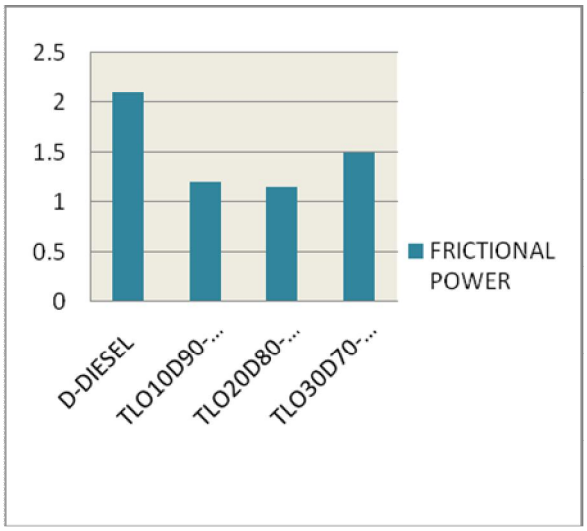

Fig 4 BLEND Vs BRAKEPOWER

SPECIFIC FUEL CONSUMPTION.

It is the rate of fuel consumption divided by the power produced. It may also be thought of as power-specific fuel consumption, for this reason. BSFC allows the fuel efficiency of different engines to be directly compared.

SFC = TFC/BP in Kg/kw-hr

The graph obtained from the experimental results clearly shows that the specific fuel consumption of TLO30 D70 would be very low than other blends and diesel. The blends like as TLO10D90, TLO20D80 almost behave like as the commercial diesel fuel.

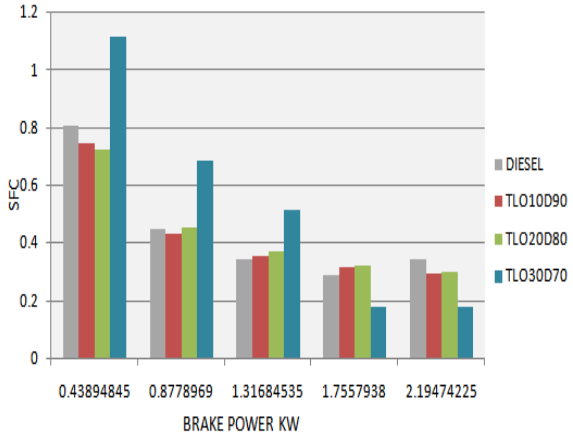

Fig 5 BRAKE POWER Vs SFC

THERMAL EFFICIENCY

Brake Thermal Efficiency is defined as break power of a heat engine as a function of the thermal input from the fuel. It is used to evaluate how well an engine converts the heat from a fuel to mechanical energy.

BTE = (BP x 3600 x 100)/(TFCXCV) %

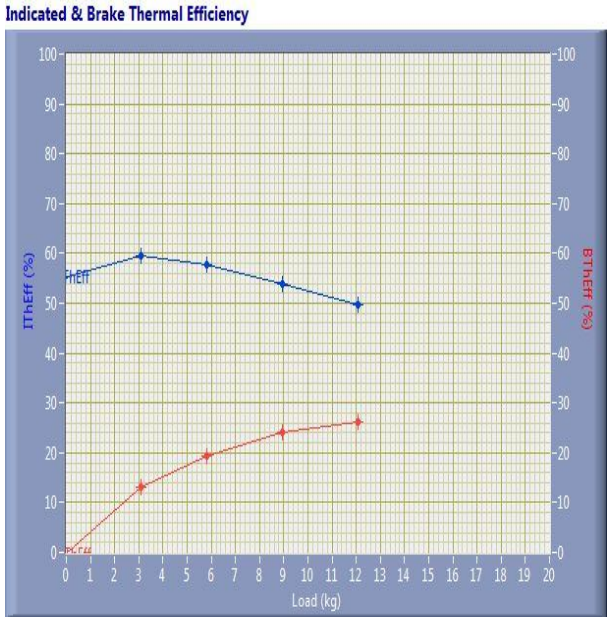

Fig6 BTE of TLO10D90+1g NESP

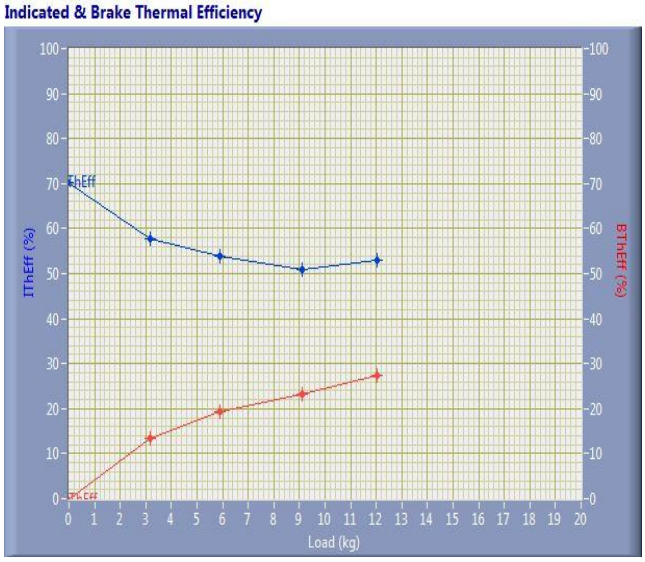

Fig7 BTE of TLO20D80+1g NESP

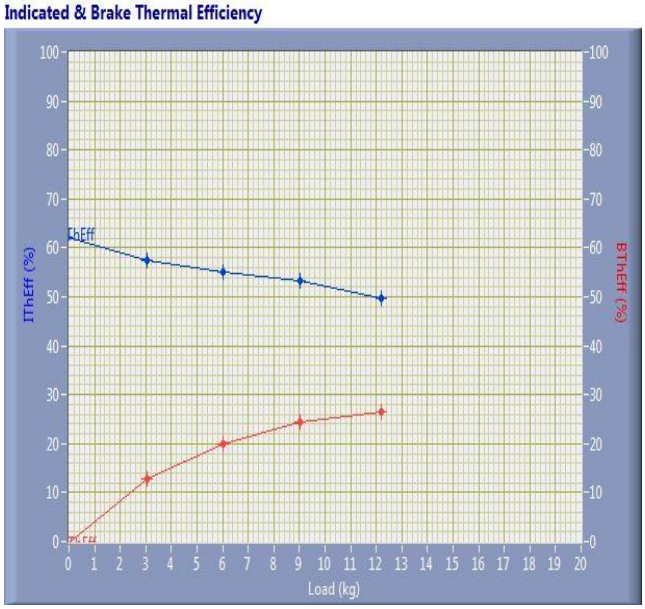

Fig8 BTE of TLO30D70+1g NESP

Among all the blends available blends like as TLO20D80 and TLO30D70 provides maximum efficiency than the blend like as TLO10D90. But TLO20D80 provides more better results than TLO30D70.

TORQUE, Mechanical &Volmertic Efficiency

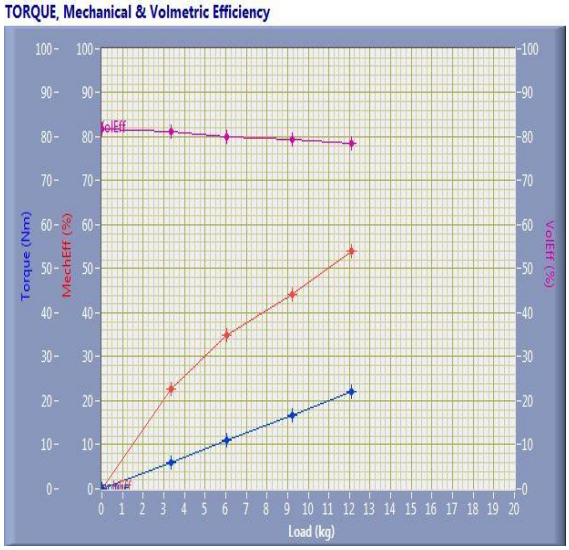

Fig9 TLO30D70+1g NESP

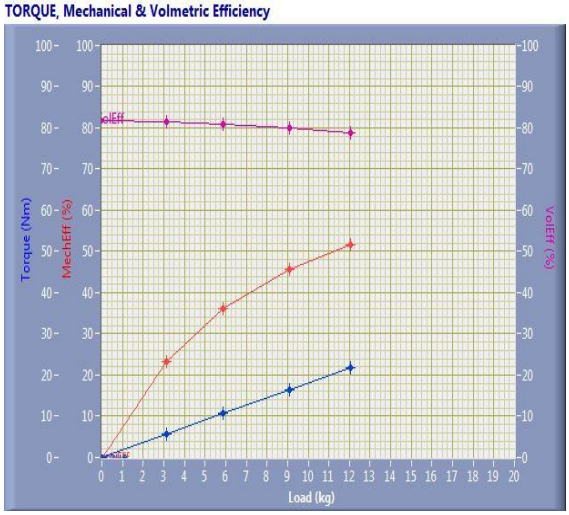

Fig 10 TLO30D70+1g NESP

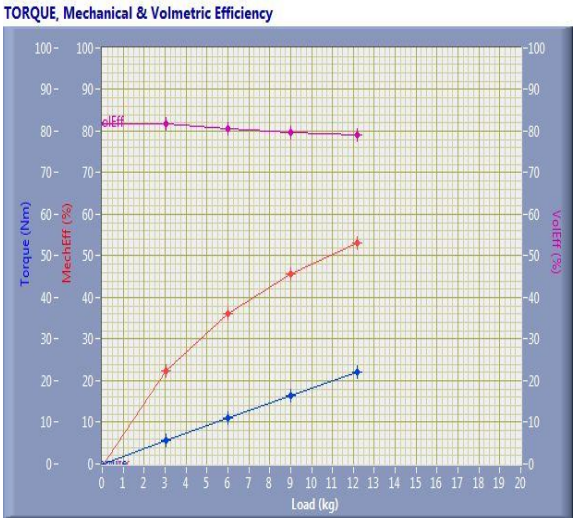

Fig11 TLO30D70+1g NESP

The above results shows that better results.

IV. CONCLUSION

The above experimental results concludes that curcuma longa leaf oil with addition of nano egg shell is the best alternate to conventional diesel fuel. The nano egg shell powder enhances the complete combustion by itself supplies enough amount of oxygen because it contains various metal oxide combinations(heterogenous bio-catalyst).

TERMINOLGY

TLO-Curcuma longa Leaf Oil
D-Diesel
NESP-Nano Egg Shell Powder

REFERENCES

[1] Lin Lin, Cunshanzhou, VittayaoadungSaritporn, Xiangqian Shen, Mingdong Dong. Opportunities and challenges for biodiesel fuel. Appl Energy 2011;88:1020–31.
[2] Fugia Wu, Jianxin Wang, Wenmiao Chen, ShijinShuai. Effects of different biodiesels and their blends with different oxygenated additives on emissions from a diesel engine. SAE, Publication No. 2008-01-1812.
[3] Chen Hu, Wang Jianxin, Chen Wenmiao, ShuaiShijin. Analysis of oxygenated biomass fuel blends on a diesel engine. Fuel 2008;87:3462–8.
[4] Purushothaman K, Nagarajan G. Experimental investigation on a C.I. engine using orange oil and orange oil with DEE. Fuel 2009;88:1732–40.
[5] Hu Chen, Jianxin Wang, Wenmiao Chen, ShijinShuai. Effects of ethanol in esterethanol– diesel blended fuels on fuel spray behavior and PM emission. SAE, Publication No. 2006-01-0236.
[6] MasoudIranmanesh, Subrahmanyam JP, Babu MKG. Potential of diethyl ether as a blended supplementary oxygenated fuel with biodiesel to improve combustion and emission characteristics of diesel engines. SAE, Publication No. 2008-01-1805.
[7] Mohanan P, Kapilan N Reddy RP. Effect of diethyl ether on the performance and emission of a 4 - s di diesel engine. SAE, Publication No. 2003-01-0760.
[8] T.Shudo, T.Nagano, M.Kobayashi. Combustion characteristics of waste pyrolysis gases in an internal combustion engine. International Journal of Automotive Technology 4(1) 2003 1–8.