PERFORMANCE AND EMISSION CHARACTERISTIS OF DIESEL ENGINE FUELLED BY PROSOPIS JULIFLORA OIL.

R.Sasikumar[1], G.Sankaranarayanan[2]
[1]Research Scholar, Sathyabama University, Chennai, India,
[2]Supervisor, Sathyabama University, Chennai, India

Abstract : This paper goes for investigating the order and outflows normal for diesel engine fuelled by Prosopis Juliflora oil. The PJSO (Prosopis Juliflora Seed Oil) to be specific PJSO10, PJSO20, PJSO 30, PJSO 40 and PJSO100 were set up by blending individually 10%, 20%, 30%, 40% and 100% of the PJSO with 90%, 80%, 70% 60% and 0% of diesel by volume. Fills were tried in a mono barrel diesel engine for their execution as fuel. Engine test results demonstrated equivalent enactment for all the PJSO with BD (base diesel). At the decided power yield the brake warm productivity was found as 27.6%, 25.2%, 27.0%.24.7% and 23% individually with PJSO10, PJSO 20, PJSO 30, PJSO 40 and PJSO100 where as it was 33.0% with BD. There is a generous is check in smoke and NOx outflows with the emulsions of PJSO as likened to BD at all power yields. It was resolved that PJSO picked up from Prosopis Juliflora can be utilized around 30% by volume as halfway standby of diesel by making emulsions with tantamount introduction with diesel. To utilize PJSO as sole fuel, the fuel and engine need additional modifications.

Keywords: Prosopis Juliflora Seed Oil, Engine execution, Base Diesel& Emissions.

I. INTRODUCTION

Utilization of biomass vitality as trade fuel for pressure start engine finds exceptionally appealing and has better degree particularly in un industrialized and under built up states because of the quick decrease, cost and conservational contamination from non-renewable energy sources. Mechanical participation oil discovers basic and indistinguishable brilliant technique in extricating oil from Prosopis Juliflora. Examinations revealed that blends of Prosopis Juliflora got from mechanically separated and blended with diesel occasioned in similar warm proficiency and discharges with diesel. Prosopis Juliflora is a tree incited from Mexico and South America. Prevalently in the Southern zones of India the convenience of Prosopis Juliflora seeds is high. It finds no valuable applications. Creating bio oil from these seeds can offer make of vitality from squander. This strategy can lessen the waste transfer. Also, the climate can be rationed as spotless.

II. Production and Characteristics of Prosopis Juliflora Biodiesel

2.1 Transesterification Process

The examinations were directed in a little scale setup, which comprised of a 1500 ml jar and the blend unsettled by an attractive stirrer at consistent speed of 500rpm. A specimen of 500 ml of Prosopis Juliflora was situated in a Round base carafe. The Prosopis Juliflora was warmed to 70°C gradually until dissolved and mixed with dissolvable. The response temperature for Prosopis Juliflora biodiesel make shifted from 60-70°C. In elective measuring utensil, methanol was blended with [1.75gm/L] KOH impetus. This blend was then extra to the warmed Prosopis Juliflora and enthused persistently for 2hrs. The blend was then evacuated to a extractor and glycerol was admissible to discrete. Ensuing to troublesome off the glycerol, Prosopis Juliflora biodiesel was washed to take out overabundance of methanol. At long last, the grease Prosopis Juliflora biodiesel was refined to dispense with the lingering dissolvable and water. Schematic outline of biodiesel house plant is appeared in Figure 1. Properties were considered to know its fittingness as fuel for diesel engines. A portion of the properties of the bio oil {are outfitted below} in Table1.

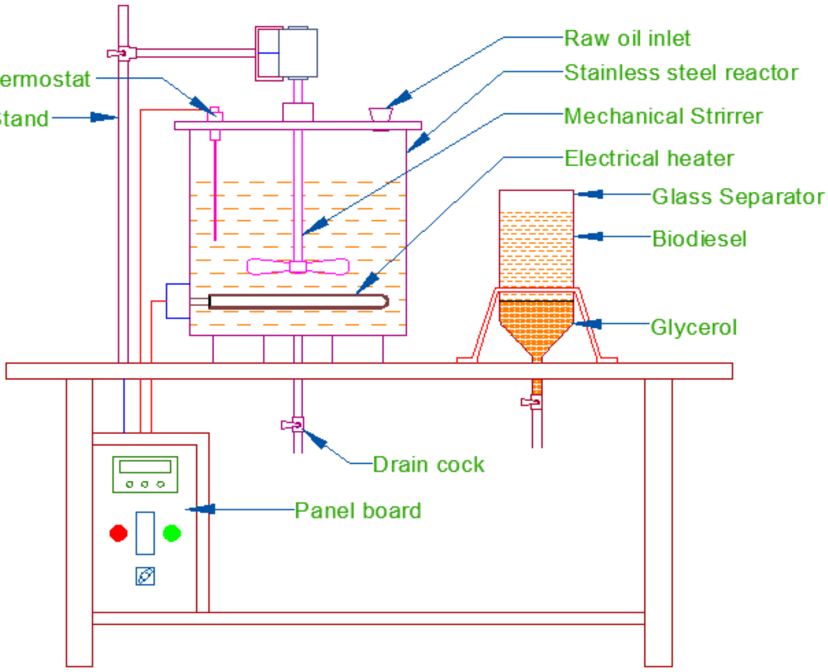

Figure 1 Schematic diagram of Biodiesel Plant

Properties	Diesel	PJSO 10	PJSO 20	PJSO 30	PJSO 40	PJSO 100
Density (kg/m^3)	840	868	895	922	949	1060
Flash Point (^oC)	52	70	79	88	97	112
Fire Point (^oC)	58	79	87	95	103	120
Calorific Value (MJ/kg)	44.8	43.8	42.2	41.6	39.0	22.6
Viscosity (Cst)	4	5.2	6.1	7.0	7.9	8
Water Content (%)	0	2.8	5.6	8.4	11.2	27.5
PH Value	5.6	5.3	5	4.7	4.4	4.9

Table 1.Properties of Fuels

Prosopis Juliflora was composed by changing the diesel and bio diesel in adjusted extents to locate the homogeneous and stable. It was discovered that the blend of 10%, 20%, 30%, 40% and 100% by volume of PJSO individually with 90%, 80%, 70%, 60% and 0% by volume of diesel discovered steady and homogeneous for a long passé of time (one week). Examinations were performed on a sole barrel diesel engine utilizing the Prosopis Juliflora (PJSO 10, PJSO 20, PJSO 30, PJSO 40 and PJSO 100) of 10%, 20%, 30%, 40% and 100% by volume of PJSO to training the outflow, introduction and burning conduct of the engine. Results were connected with customary diesel (BD) and investigated.

2.2 GC-MS Analysis

A Greasy corrosive methyl esters design was controlled by gas chromatography. From Figure. 4 it is seen that there are five noteworthy pinnacles show the different critical methyl esters introduce in the biodiesel. The primary crest in the GC range shows the methyl hexadecanoate and methyl 14-methyl pentadecanoate in the second pinnacle. Methyl cis, cis-9, 12-octadecadienoate and methyl cis, cis-10, 13-octadecadienoate are demonstrated in the third pinnacle of the chromatogram while the fourth pinnacle was methyl cis-9-octadecenoate.The fifth pinnacle was perceived as methyl octadecanoate and methyl 16-methyl-heptadecanoate. All the five segments isolated by GC are likely methyl palmitoleate, methyl linoleate, methyl palmitate, and methyl stearate and methyl ester. This assets that the principle unsaturated fats as of now exhibit in the mahuamethyl ester are palmitic corrosive, palmitoleic corrosive, oleic corrosive, linoleic corrosive and stearic corrosive. The individual esters were resolved from the maintenance time, noted over the pinnacle of every compound, with the standard database. More profound investigation of their development uncovers that both are unsaturated hydrocarbon, plausibly with longer hydrocarbon chain separation and trademark oxygen in their development, in any semblance of other contemporary biodiesel.

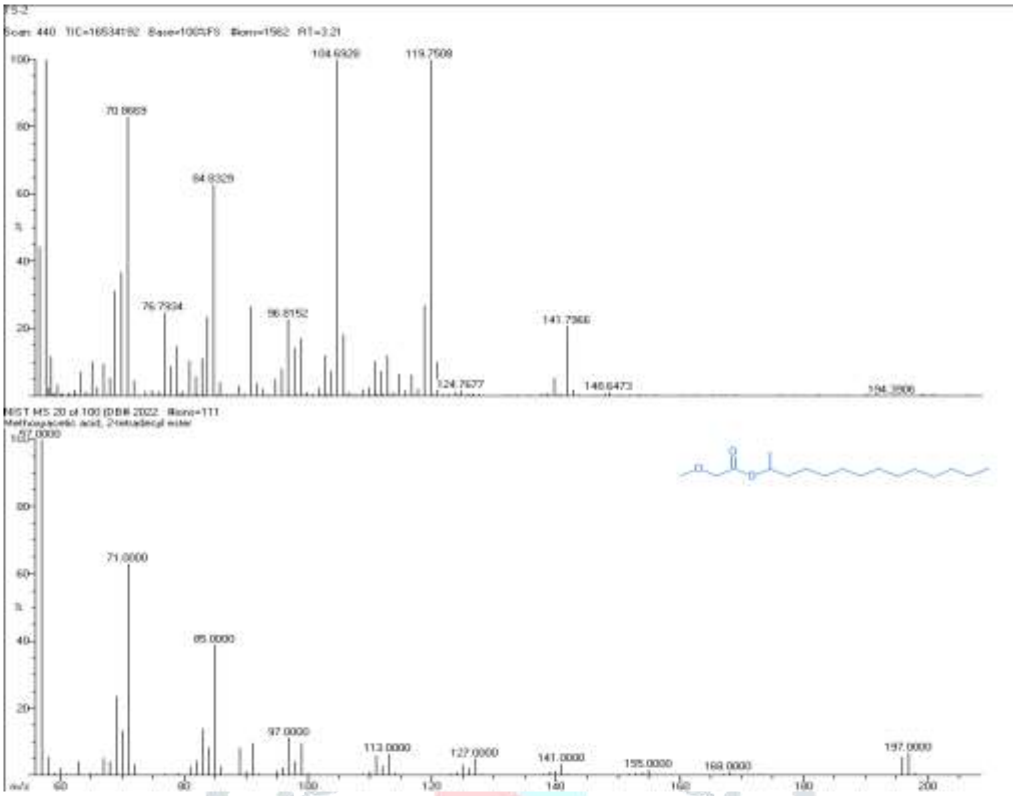

Figure 2 GC-MS analysis of Prosopis Juliflora biodiesel (B100)

III. EXPERIMENTAL SETUP AND EXPERIMENTS CONDUCTED

A Single barrel (KIRLOSKAR-AV1), 4-Stroke, water-cooled, coordinate infusion diesel engine building up a power yield of 5.2 kW at 1500 rpm was utilized. A whirlpool current dynamometer was reused for charging the engine. The test engine framework can be seen in Fig.3. The fuel stream rate was clearly measured on the volumetric base debilitating a burette and stop watch. An infrared AVL Five gas fumes analyzer was utilized for clean computing HC, CO and NO in the fumes. Dark carbon smoke stages were commended by utilizing a standard AVL smoke meter. Tests were led for 6 unique loads, for example, 0%, 10%, 20%, 30%, 40% and 100% of the outrageous power yield with the settled engine speed of 1500 rpm. Every one of the tests was admissible out with the infusion timing of 23obefore TDC (improved static planning) for all the checked powers. The engine was thermally balanced out beforehand taking all estimations. Understandings for engine speed, fuel stream, wind current, were recorded for getting execution limitations. Fumes gas analyzers were institutionalized before making estimations. Perceptions were made for smoke, NO, HC and CO to investigate the discharge qualities.

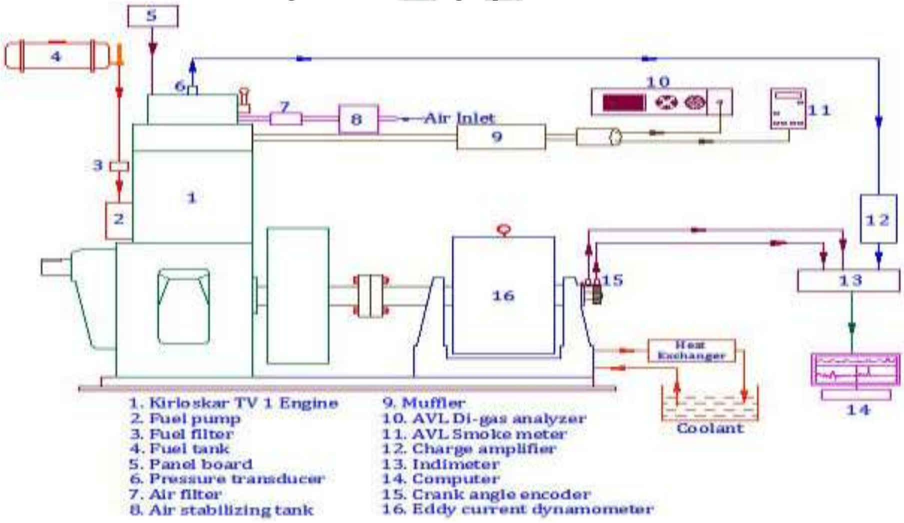

Figure 3 Schematic diagram of the experimental setup

IV. RESULT AND DISCUSSION

The results of BTE (brake warm effectiveness) at unique power yields for BD and the PJSO are demonstrated in Fig.2. With acceleration in engine power yield there is a development in BTE for every one of the powers. It is seen that PJSO 10 stemmed in BTE in practically identical design as BD process at all working environment. The outrageous BTE was found as 30.0% with BD and 27.6%, 25.3%, 27.1%,24.7 %and 23.8% separately with PJSO 10, PJSO 20, PJSO 30, PJSO 40 and PJSO 100at the extraordinary power yield of 5.2kW. The reduction in BTE with the PJSO is primarily because of the ascent in SFC as a final product of high consistency, thickness and lower warming estimation of the PJSO. The lesser vitality substance of Prosopis Juliflora brought about additional fuel to be devoured for the particular power and brought about second rate warm effectiveness PJSO 10 demonstrated the BTE near diesel at all power yields because of the lower SFC as coordinated to other, for example, PJSO 10, PJSO 20, PJSO 30, PJSO 40 and PJSO 100)

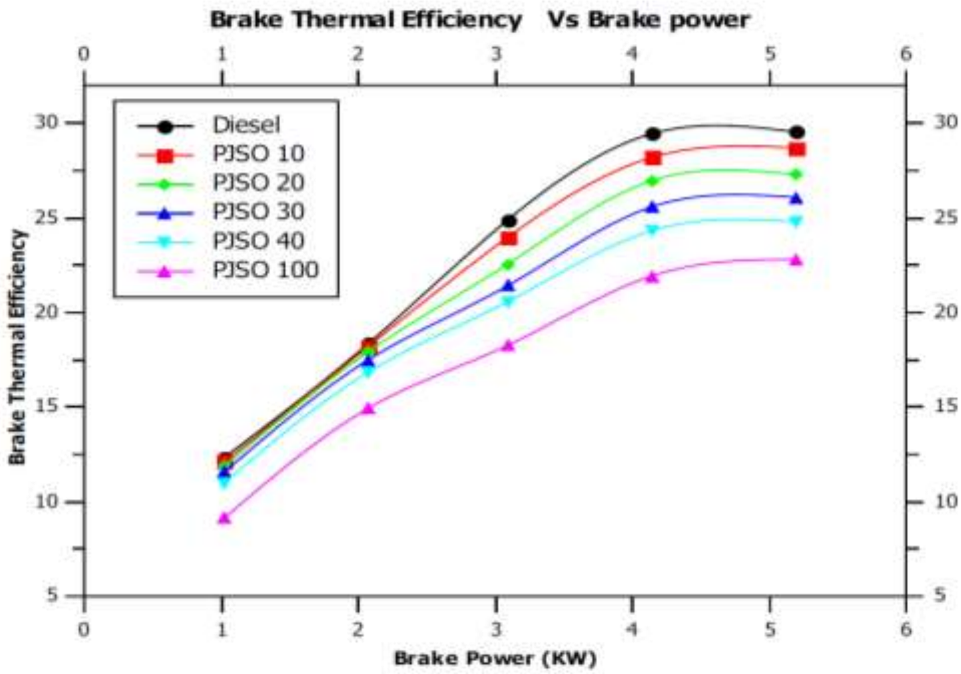

Figure 4 Brake thermal Efficiency with Brake power

The smoke outflow caused from consuming of BD and the PJSO is determined in figure 5. Smoke level expanded with increment in engine power. In diesel engines the smoke emanation is because of the expansion in measure of fuel infused with increment in engine power. The variety of smoke thickness for various Prosopis Juliflora oil mixes every one of the cases is diminishing when contrasted with sole fuel. B30 mixes demonstrate bring down smoke thickness than different mixes. It is seen from the diagram up to 77.6% load smoke thickness is step by step expanded and lessened barely at greatest load. It is intriguing to take note of that Prosopis Juliflora oil brings about lower smoke level from sole fuel at most extreme brake energy of the engine. The reason is Prosopis Juliflora oil gives finish ignition at higher brake energy of the engine. It is invigorating to see that the smoke discharge was found as substandard for all the of PJSO 30 (aside from PJSO 30) at all power yields as measured up to BD operation. In diesel engines smoke is composed because of poor atomization of the infused fuel which causes development of enormous beads amid infusion. Expansive beads, inadequate time and absence of oxygen bring about strong dark carbon particles in diesel engines. The diminishing in smoke discharge with the suspensions of PJSO can be clarified by the nearness of water in the fuel. The water bead momentum in the blends prompts vicious detonation because of warming which brought about optional atomization of the drop and brought about reduced smoke generation PJSO 30 demonstrated important decrease in smoke as related to different emulsions at all power yields.

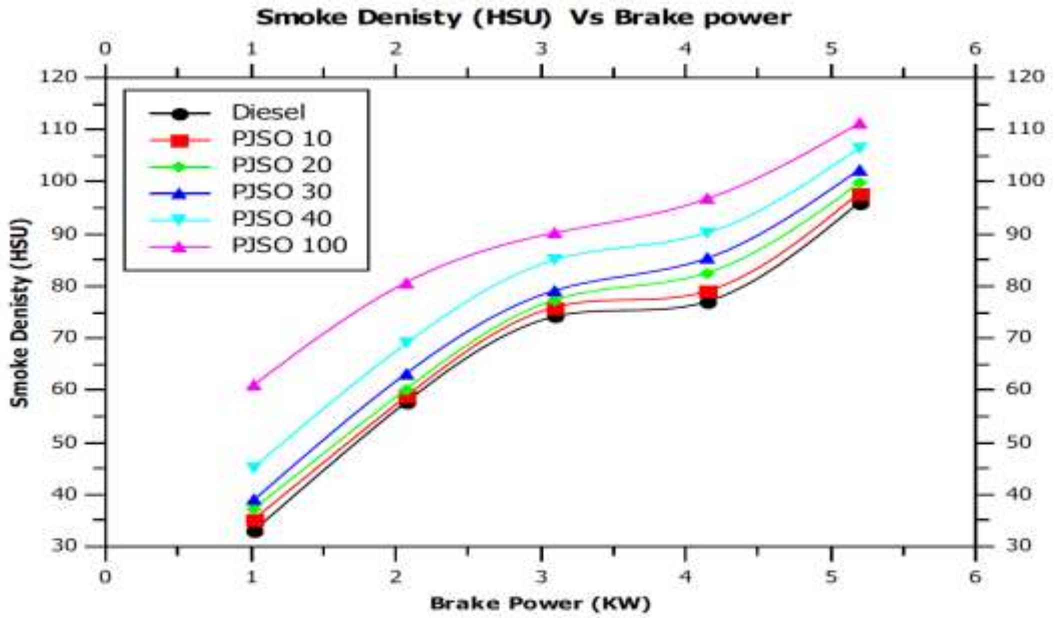

Figure 5 Smoke Densities with Brake Power

THE VARIETY OF THE NOX DISCHARGE IS APPEARED IN FIGURE 6. NOX PLANNED BECAUSE OF HIGH PRESSURE TEMPERATURE AND ACCESSIBILITY OF OXYGEN. IT IS SEEN THAT, THE SLICK PROSOPIS JULIFLORA OIL PRODUCES BRING DOWN NOX DISCHARGE WHEN CONTRASTED WITH DIFFERENT MIXES. THE NOX EMANATION FOR FLAWLESS PROSOPIS JULIFLORA BIODIESEL IS 752 PPM AT GREATEST LOAD. IT IS WATCHED THAT 73 PPM CONTRAST IS THERE IN THE NOX EMANATION FOR PROSOPIS JULIFLORA OIL MIXES AT THE MOST EXTREME BRAKE ENERGY OF THE ENGINE. THE LESSENING IN NOX DISCHARGE WITH PROSOPIS JULIFLORA OIL IS CHIEFLY CONNECTED WITH THE DIMINISHED PREMIXED COPYING RATE FOLLOWING THE DEFER PERIOD. THE NOX (OXIDES OF NITROGEN) OF THE ENGINE WORKED WITH BD AND DISTINCTIVE EMULSIONS OF PJSO IS POSSIBLE IN THE FIG.6. THE PJSO OCCASIONED IN CONSIDERABLE DIMINISHMENT IN NOX RELEASES WHEN CONTRASTED WITH BD. PJSO 10 BROUGHT ABOUT LEAST NOX EMANATION OF ALL ENERGIZES AT ALL POWER YIELDS. AT THE EXTRAORDINARY POWER YIELD OF 5.2KW THE NOX OUTFLOW WAS FOUND AS 679 PPM, 720 PPM, 706 PPM, 742PPM AND 752 PPM SEPARATELY WITH PJSO 10, PJSO 20, PJSO 30, PJSO 40 AND PJSO 100 WHILE IT WAS 1120 PPM WITH BD. THE DECREASE IN NOX EMANATION WITH THE POWERS IS BECAUSE OF THE LOWER AIR TO FUEL PROPORTION OF THE CHARGE FOR THE GIVEN ENGINE POWER YIELD. IT CAN STAY COMPREHENDED FROM THE FIG.4. THE COMPARATIVE POWER GENERATION OF THE ENGINE EMULSIONS OF PJSO

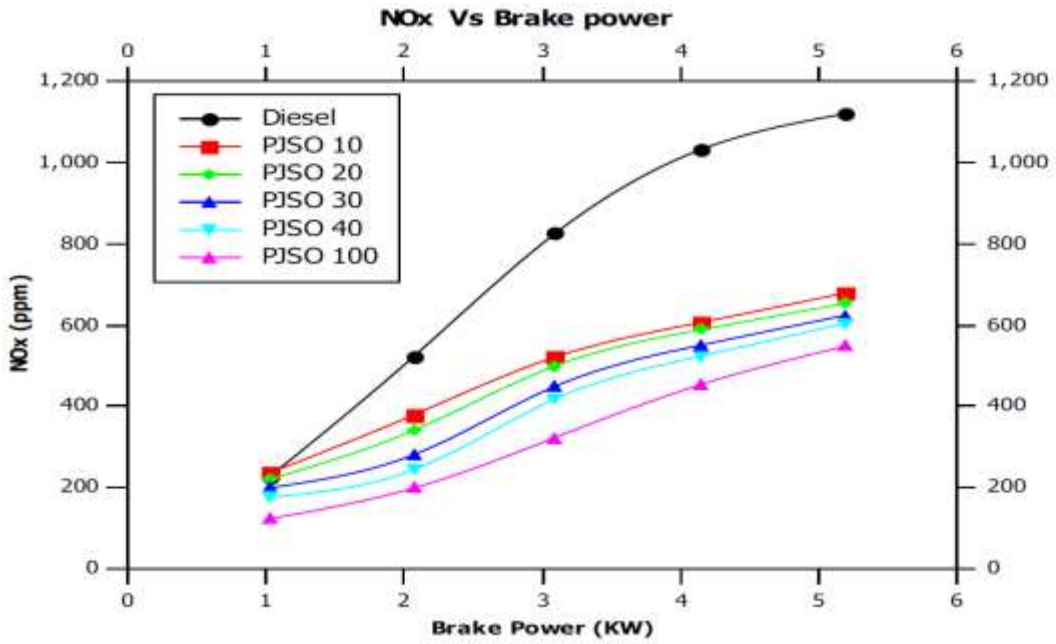

Figure 6 Oxides of Nitrogen with Brake Power

The variety of hydrocarbon emanation with brake control for PJSO 10, PJSO 20, PJSO 30, PJSO 40 and PJSO 100 is appeared in the figure 6. It is seen that all the checked fills brought about higher hydrocarbon discharges at all working conditions when contrasted with BD operation. At the most extreme power yield, the HC (Hydrocarbon) outflow was observed to be 47ppm, 47ppm, 45ppm, 54ppm and 59ppm individually with PJSO 10, PJSO 20, PJSO 30, PJSO 40 and PJSO 100. It was noted as 144 ppm with BD. The principle inspiration for the HC discharges with the emulsions of PJSO is because of the considerable inert warmth of vanishing of water exhibited in the fuel which resulted in fire dropping to take condo at the ignition chamber dividers. Figure 7 demonstrates that the uniqueness of hydrocarbon radiation with divergent blends of Prosopis Juliflora oil. It is seen that perfect Prosopis Juliflora oil unburned hydrocarbon outflow diminishes when contrasted with sole fuel. However PJSO 30 and PJSO 20 Prosopis Juliflora oil increment the hydrocarbon outflow. The reason is inadequate burning of fuel amid the ignition.

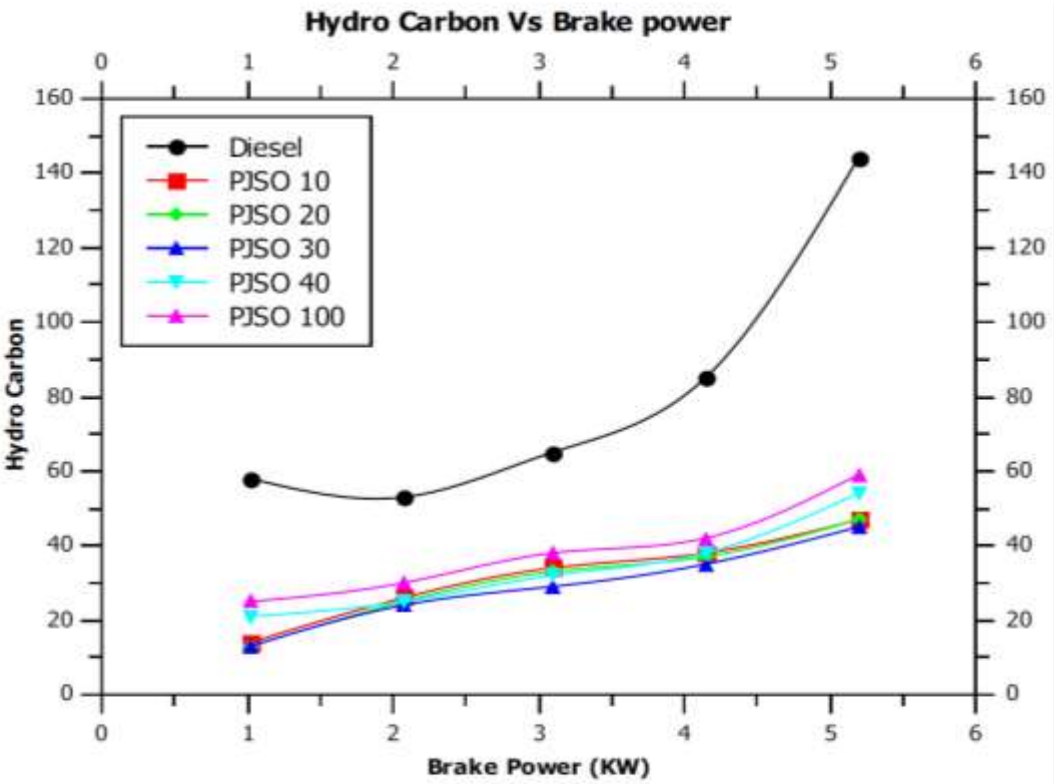

Figure 7 Hydro Carbon with Brake Power

FIGURE 7 DEMONSTRATES THE CONSEQUENCES OF CO (CARBON MONOXIDE) OUTFLOWS WITH PJSO 10, PJSO 20, PJSO 30, PJSO 40 AND PJSO 100AND BD AT ADJUSTED POWER YIELDS. THE PJSO BROUGHT ABOUT HIGHER CO DISCHARGES AS LIKENED TO BD AT ALL POWER YIELDS. THE OUTRAGEOUS CO OUTFLOW WAS DISCOVERED AS0.08%, 0.1%, 0.08%, 0.08% AND 0.12% INDIVIDUALLY FOR PJSO 10, PJSO20, PJSO 30, PJSO 40 AND PJSO 100 AT THE MOST EXTREME POWER YIELD OF 5.2KW. IT WAS NOTED AS 0.35% WITH BD. THE CO RADIATION IN DIESEL ENGINE IS BECAUSE OF THE FUEL EFFICIENCY WHICH BRINGS ABOUT CONSTRAINED OXIDIZATION OF CARBON PARTICLES IN THE FUEL. IT IS BEFOREHAND CLARIFIED THAT THE EMULSIONS OF PJSO BECAUSE OF THEIR POOR VITALITY CONTENT BROUGHT ABOUT FUEL RIPENESS WHICH HAS PROMPTED DEFICIENT BURNING OF THE FUEL. IT IS SEEN THAT PJSO 100 TRANSMITTED MOST EXTREME CO EMANATIONS AMONG ALL FILLS. FIGURE 7 DEMONSTRATES THAT THE DISTINCTION OF CARBON MONO OXIDE EMANATION WITH VARIOUS MIXES OF PROSOPIS JULIFLORA OIL. IT IS SEEN THAT SLICK PROSOPIS JULIFLORA OIL CARBON MONO OXIDE DISCHARGE DIMINISHES WHEN CONTRASTED WITH SOLE FUEL. HOWEVER PJSO 40 AND PJSO 20 PROSOPIS JULIFLORA OIL INCREMENT THE HYDROCARBON OUTFLOW. THE REASON IS FRAGMENTED BURNING OF FUEL AMID THE IGNITION.

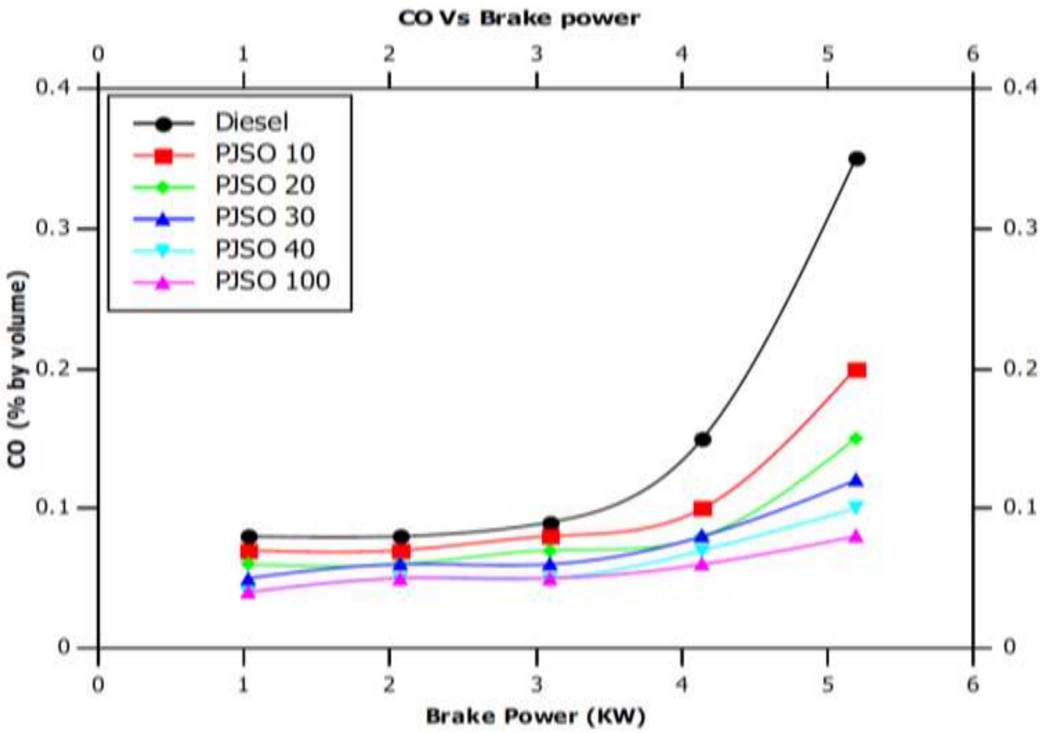

Figure 8Carbon monoxide with Brake Power

4.1 In Cylinder pressure with different blends

The barrel weight in inconsistency of wrench edge is uncovered in figure 9. The pinnacle weight for the Prosopis Juliflora biodiesel and its mixes is lower than that of the diesel fuel because of the poor atomization, which decelerates the ignition and cause for the minor barrel gas weight. Be that as it may, the contrast between the PJSO 10 and diesel fuel is peripheral. It is watched that the event of pinnacle weight is progressed with the expansion of Prosopis Julifloraoil biodiesel, which supplies oxygen and advances the entire burning of fuel. The most extreme in-barrel weight of 61.241bar was found on account of diesel fuel and it was 42.300 kJ/kg for PJSO 100 fuel.

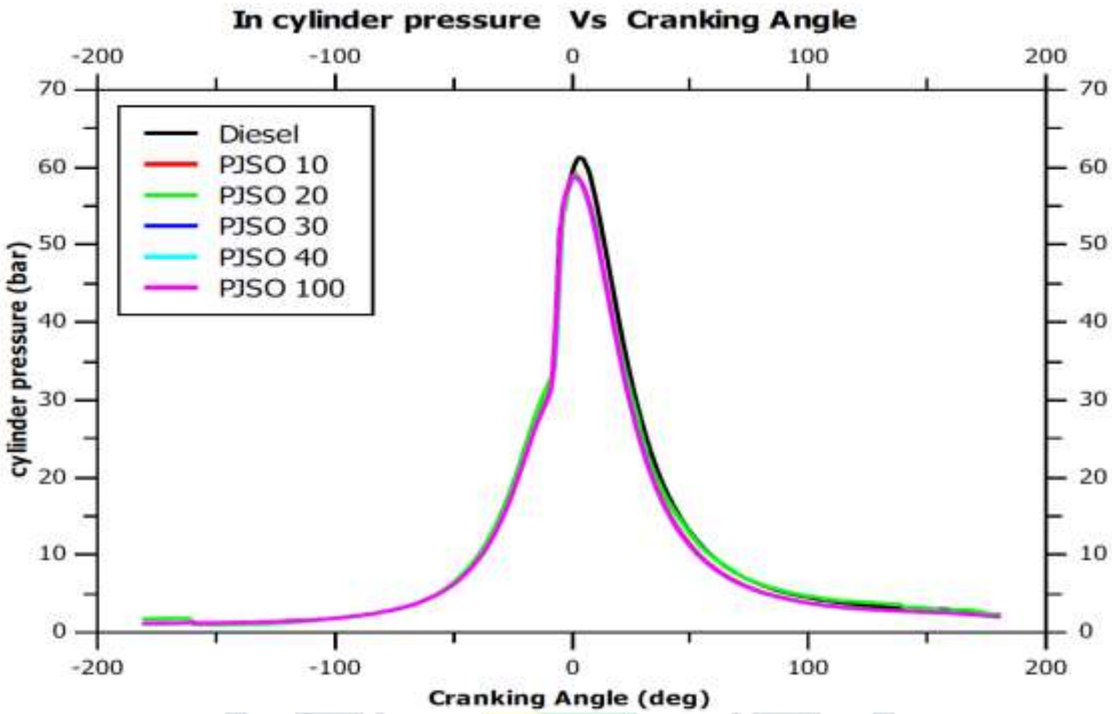

Figure 9 In Cylinder Pressure with Cranking Angle

4.2 HEAT RELEASE RATE ANALYSIS WITH DIFFERENT FUELS:

IT IS UNMISTAKABLY OBSERVED THAT BD BROUGHT ABOUT MOST EXTREME RATE OF WARMTH DISCHARGE AND THE PART OF FUEL SCORCHED AMID THE UNDERLYING TIME FRAME (I.E. PREMIXED START) OF TIME THOUGH THE. PREMIXED BURNING RATE WAS LOWER AND THE DISSEMINATION IGNITION RATE WAS SOMEWHAT HIGHER FOR PJSO 20 AND PJSO40 WHEN CONTRASTED WITH BD. THE DECREASE IN PREMIXED BURNING RATE OF THE EMULSIONS OF PJSO 20 AND PJSO 40 CAN BE CLARIFIED BY THE HIGH CONSISTENCY AND THICKNESS OF THE POWERS WHICH BROUGHT ABOUT IGNITION TO BE MORE IN THE DISSEMINATION BURNING STAGE. B10 AND B30 DEMONSTRATED LOWER CREST ESTEEMS WHEN CONTRASTED WITH BD.

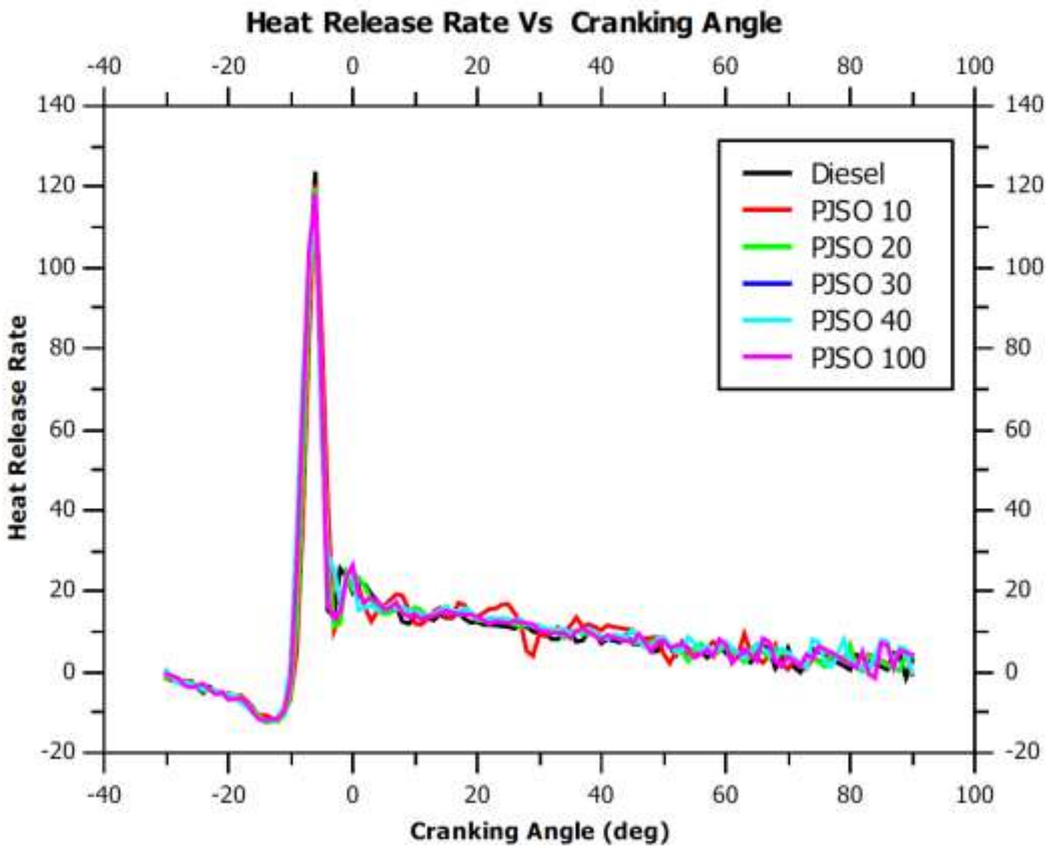

FIGURE 10 VARIATION OF HEAT RELEASE RATE WITH CRANKING ANGLE.

V. CONCLUSIONS

In light of the trial comes about the accompanying conclusions are arrived:

1. The brake warm effectiveness of the Prosopis Juliflora oil is lower than the sole fuel.
2. Smoke thickness is higher for Prosopis Juliflora oil up to 75% load, past that negligible lessening in the smoke thickness.
3. Unburned hydrocarbon outflows for PJSO 100, PJSO 40 and PJSO 30 mixes are bring down level.
4. Exhaust gas temperature is higher for PJSO 20 and lower for PJSO 100 when contrasted and sole fuel.
5. NOx outflow is minor for all mixes when contrasted with solitary fuel.

The best mix proportions are PJSO 20 and PJSO 30 in light of the execution, emanation and ignition qualities.

V. REFERENCES

1. Kousoulidou M, Fontaras G, Ntziachristos L, Samaras Z. "Biodiesel mix impacts on regular rail diesel burning and discharges". Fuel. vol. 89 (11), pp. 3442-3449.

2. Kapus P and Ofner H. "Improvement of fuel infusion hardware and burning framework for DI diesels worked on di-methyl ether". SAE 950062, 1995.
3. B Mahr. "Future and Potential of Diesel Injection Systems", Conference on Thermo and Fluid-Dynamic Processes in Diesel Engines. THIESEL, 2002.
4. Sazhim SS, Feng G and Heikal MR. "A model for fuel shower entrance". Fuel. vol. 80, pp. 2171-2180, 2001.
5. Pierpont DA and Reitz RD. "Impacts of Injection Pressure and Nozzle Geometry on OJ. Diesel Emissions and Performance". SAE 950604, 1995.
6. Timoney DJ and Smith W. "Impacts of Fuel Injection and Air Motion Energy Sources on Fuel-Air Mixing Rates in a DI Diesel Combustion System". SAE 960035, 1996.
7. Hariharan VS and Vijayakumar Reddy K. "Impact of infusion weight on diesel engine execution with Sea lemon oil". Indian Journal of Science and Technology. Vol. 4, pp. 907-909, 2011.
8. Purushothaman K and Nagarajan G. "Impact of infusion weight on warm discharge rate and emanations in CI engine utilizing orange skin powder diesel arrangement". Vitality Conversion and Management. Vol. 50, No. 4, pp. 962-969, 2009.
9. Kuti OA, Zhu J, Nishida K, Wang X and Huang Z. "Portrayal of splash and burning procedures of biodiesel fuel infused by diesel engine normal rail framework". Fuel. Vol. 104, pp. 838-846, 2013.
10. Rosli Abu Bakar, Semin and Abdul Rahim Ismail. "Fuel infusion weight impact on execution of direct infusion diesel engines in light of investigation". American Journal of Applied Sciences. Vol. 5 (3), pp. 197-202, 2008.
11. Mu-Jung Kao, Chen-Ching Ting, Bai-Fu Lin, Tsing-TshihTsung. "Watery AluminumNanofluid Combustion in Diesel Fuel". Diary of Testing and Evaluation. Vol. 36 (2), pp. 1-5, 2007.
12. Yixin Zhu a,b , JianchuXua,b, QiaohongLia,b, Peter E.Mortimera,b "Examination of elastic seed yield in Xishuangbanna and estimation of elastic seed oil based biodiesel potential in southeast Asia" Energy 69 (2014) pp 837 – 842
13. Fang-Xia Yanga, Yin-Quansua, Xiu-Hong Lia, QiangZhanga, Run-CangSunb,c* "Planning of biodiesel from IdesiaPolycarpavar. Vestita organic product oil" Industrial Crops and Products 29 (2009) pp622 – 628
14. R.Sathish Kumara, K.Sureshkumara, R.Velrajb "streamlining of biodiesel creation from ManilaraZapota (L.) Seed oil utilizing Taguchi strategy" Fuel 140(2015) PP90 - 96
15. JibrailKansedo, KeatTeong Lee*, Subhash Bhatia "Cerberaodollam (ocean mango) oil as a promising non-palatable feedstock for biodiesel creation." Fuel 88(2009) pp1148 – 1150.
16. Mortadha A. Ali1,* Tahseen A. Al-Hattab1, Imad A. Al-Hydary2" Extraction of Date Palm seed oil (Phoenix Dactylifera) By Soxhlet Apparatus." International Journal of Advances in Engineering and Technology, June 2015 ISSN 223311963
17. Ogunsuyi H.O, "Corrosive and Base CatalysedTransestrification of Mango (MangiferaIndica) Seed Oil to Biodiesel" IOSR Journal of Applied Chemistry (IOSR-JAC) Volume 2, Issue 2 (Sep-Oct. 2012), PP 18-22.
18. Yathish. K.V, "Biodiesel Production From Custard Apple Seed (AnnonaSquamosa) Oil And Its Characteristics Study"International Journal of Engineering Research and Technology (IJERT) Vol. 2 Issue 5(May – 2013).
19. NakornTippayawong and PhichetChumjai, "Portrayal and Performance of Biofuel from Passion Fruit Processing Residues" Proceedings of the World Congress on Engineering and Computer Science 2012 Vol II WCECS 2012, October 24-26, 2012, San Francisco, USA.
20. Singh.R.N,"SPRERI experience on comprehensive way to deal with use all parts of Jatrophacurcas natural product for vitality" Thermochemical Conversion Division, Sardar Patel Renewable Energy Research Institute, VallabhVidyanagar 388 120, Gujarat, IndiaReceived 1 February 2007; acknowledged 21 October 2007 Available online 20 February 2008, PP 1868– 1873 .
21. Silitonga.A.S ,"Experimental examination on execution and fumes outflows of a diesel engine fuelled with Ceibapentandra biodiesel mixes" Volume 76, December 2013, PP 828– 836.
22. OrkunOzener ,"Effects of soybean biodiesel on a DI diesel engine execution, outflow and burning characteristics"Volume 115, January 2014, PP 875– 883.
23. Masimalai, Senthilkumar, and Venkatesan Kuppusamy. "A complete evaluation on execution conduct of a CI engine utilizing bio oil emulsions (PJSO10, KSO10 and CSO10), 2015.