

# Effect of Injector Opening Pressures on the Performance of Diesel Engine Fuelled With Acid Oil Methyl Ester



Nagesh S.B, Chandrashekhar T.K, Banapurmath N.R

**Abstract:** Acid oil for the present take a gander at was acquired from Karnataka district, sunflower non-open limited and Agro Tech individual controlled, an adjacent vegetable oil refining gadgets which produce around 450 metric huge amounts of Acid oil in venture with a year. Corrosive oil that is a subordinate of vegetable petroleum processing plant tasks is a plausible source as its far shabby and without trouble accessible in broad amounts as an unutilized result. Acid oil because of its oxygenated nature and chain kind setup, it has gas homes that are stand-out than diesel gas. Warming qualities are scarcely lower while the thickness and start esteem are higher than diesel fuel. On the off chance that the thickness of Acid oil is diminished and carried nearer to diesel fuel, it might also be utilized as elective diesel fuel. Since the regular transesterification way does never again create an ideal final product, a fresh out of the box new type of "ED3R" esterification framework progressed on the establishment is contracted, wherein ED alludes to Extractive Distillation and 3R alludes to Rectification, Refluxing and Reusing.

**Keywords:** Acid Oil Methyl Ester (ACOME), Injection procedure, Emission characteristics.

## I. INTRODUCTION

From the accurate writing assessment done, it was found that ACOME reasonableness for CI motor and the accompanying impact of various Injections building up strain in this biodiesel fuelled motor transformed into hardly referenced. Henceforth the target of the present exploratory work is to investigate the general execution, ignition and outflow attributes of CI motor fueled with ACOME with particular injection beginning pressure.

## II. FUELS USED IN THE EXPERIMENTAL

Acid oil dominantly comprises of the extensive chain loosened unsaturated fat mix along the edge of little amounts

of mineral acids (1-2%), free dampness (five-eight %), phospholipids and sterols (eight-ten %) which all give a trademark stinky scent and darkish brown shading to the Acid oil. Acid oil because of its oxygenated nature and chain kind design, it has gas houses that are unprecedented than diesel fuel. Warming qualities are somewhat declining while consistency and start esteem are superior to diesel fuel. In the event that the consistency of corrosive oil is decreased and taken towards diesel gas, it could likewise be utilized as trade diesel fuel. As the conventional transesterification framework does now not deliver any ideal final product, another kind of "ED3R" esterification strategy developed at the foundation is procured, in which ED alludes to Extractive Distillation and 3R alludes to Rectification, Refluxing and Reusing.

### A. Experimental framework and methodology

Exploratory arrangement utilizes for the present examination is portrayed in Figure.1. At first, test evaluations had been executed on CI motor to streamline IT, at exceptional stacking conditions a. The motor was constantly worked at 1500 rpm. The Compression Ratio of 17.45 ended up utilized with hemispherical burning chamber and injector of 3 holes. Three mm hole measure. The readings recorded handiest after the motor accomplished a solid situation. Likewise, analyses have been led to enhance IOP with a five-hole injector, keeping improved Ignition Timing. Particulars of the CI motor investigate apparatus utilized for the test take a gander at appearing in work area 2. Motor cooling changed into finished with the guide of applying circling fluid (water) through the coats of the motor and chamber head. A piezoelectric transducer (Make: PCB Piezotronics, model: HSM 111A22, goals: 0.139 mV/k Pa) fitted to the chamber head transformed into connected to degree the in-chamber fuel pressure. The beginning of infusion moved toward becoming obtained dependent on static gas IT. The test establishment of the CI motor is demonstrated in Figure. 1. The specs of the motor are outfitted in work area three. Fumes gas structure all through the relentless state activity was estimated by utilizing a smoke meter demonstrated in Figure. 2.

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\* Correspondence Author

**Nagesh S.B\***, Department of Mechanical Engineering, Channabasaveshwara institute of Technology, Gubbi, Karnataka, India

**Chandrashekhar T.K**, Department of Mechanical Engineering, Mangalore institute of technology, mudibidri-574227, Karnataka, India

**Banapurmath N.R**, Department of Mechanical Engineering, B.V.B. College of Engineering and Technology, Hubli, Karnataka, India

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Figure. 1 Smoke meter



Figure. 2 Exhaust Gas Analyzer (EGA)

### III. RESULTS AND DISCUSSIONS

#### A. Maximizing of IOP

Research on essential generally execution and emission qualities of the engine have been practiced on the ordinary diesel engine the utilization of ACOME at unmistakable infusion pressures. The injector starting pressures have differed from 205 bar to 260 bar. Variable burden evaluations had been performed at these infusion pressures working the engine at 1500 rev/min. At each heap, air float rate, ACOME float expenses, fumes gas temperatures, HC, CO, smoke and nitric oxide outflows had been recorded. Based absolutely at the results, the most brilliant infusion pressures were analyzed changed into fixed for ACOME. At last, execution, discharge and ignition parameters with the ACOME had been in the examination. The motor was worked handiest at maker particular injector opening pressure (IOP) of 204 bar on diesel mode. The impact of injector building up pressure (IOP) and outstanding spout geometry which incorporate three, four, and five holes in the static infusion timing of 270 BTDC, IOP of 240 bar is given inside the accompanying charts.

#### B. IOP and variety nozzle geometry on BTE

The brake power impact on brake thermal efficiency at exceptional injector initiating pressure (IOP) and selective spout geometry is demonstrated in Figure. 1. Among the majority of the IOPs analyzed, the most noteworthy brake warm execution goes off at 240 bar. This is because of the reality at better infusion pressures atomization, splash qualities and blending with air is higher, which realize advanced ignition. Too high an IOP (260 bar) will cause

deferred infusion refuting the increase because of better IOP. BTE was resolved to be 25.25% at 80% burden with five-empty spout and at an IOP of 24 M Pa. in any case, BTE for 3-opening and 4-hole spouts have been observed to be 24.80% and 24.56% individually at 23 M Pa. Basically based at the results, BTE changed into found to be high with five-empty injector spout geometry and IOP of 24 M Pa. The engine tasks at an IOP of 24 M Pa, the contrary spouts (three-hole and four-hole) were likewise seen to be better individually. It's far obvious that the development inside the assortment of openings may also build the fuel-air mixing charge.

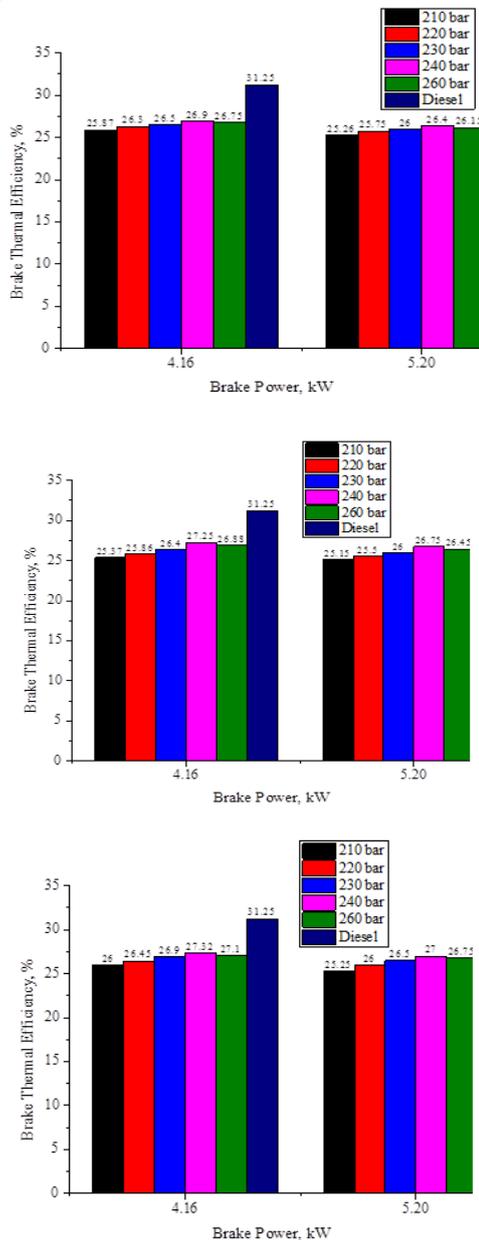


Figure 3.1 Show the 3, 4, 5 holes with 30mm IOP and Nozzle geometry on BTE vs. Brake power

#### C. Smoke opacity

Figure 3.2 suggests the effect of IOP and exceptional spout geometry on smoke obscurity with brake control. Smoke grade had been found to decrease with IOP as blend development ventured forward.



The base smoke stage is obvious with the IOP of 239.5 bar. At 80 % burden, the smoke level wound up situated to tumble from 53 HSU to 46 HSU while the IOP ended up extended from 210 to 240 bar with 5 openings injector. These qualities said have been exceptional than diesel task. It's miles seen that five-opening injector improved the gas-air mixing charge and in this manner guarantees advanced ignition with diminished smoke discharges.

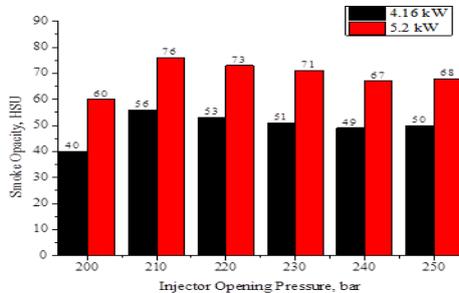


Figure 3.2 Show Smoke Opacity for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

**D. HC Emission**

Figure 3.3 shows the impact of Injector initiating pressure and spout geometry on HC emission with brake vitality. An impressive drop in HC is found at 240 bar IOP because of better burning. Increasingly reasonable atomization can even prompt a declining start put off. This could decorate the general execution of the motor with ACOME, which normally have a superior start delay as a result of their better consistency. Advancement inside the shower will cause a reduction in real put off. The advanced splash can even reason higher burning and warm proficiency at full burden. HC diminished from 107 to 101 ppm in the wake of developing the IOP from 205 to 240 bar at 80% quality yield. The best IOP of 260 bar finishes in an expansion inside the HC degree more than likely as it prompts a markdown inside the brake warm proficiency. Furthermore, a totally exorbitant injector building up strain will prompt a sizable bit of the burning going on inside the dissemination segment coming about because of the little start defer. Too high an IOP (260 bar) will prompt postponed infusion refuting the advantage on account of higher IOP. Further HC discharges decreased when injector spout holes raised from three to five at IOP 24MPa.

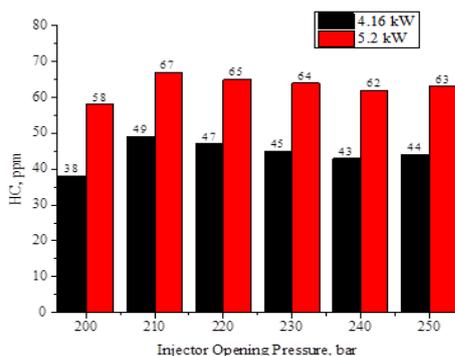


Figure 3.3 Show Unburned Hydrocarbon Emissions for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

**E. Carbon monoxide (CO) emission**

Figure 3.4. Demonstrates the effect of Injector beginning pressure and spout geometry on CO emission with brake power. Watched advancements for CO outflows had been much similar to HC emission, with decline CO discharges happening at 240 bar infusion starting strain and 5 hole injector.

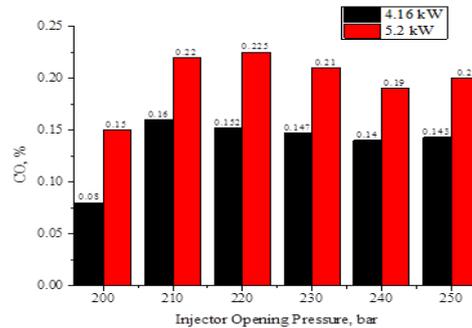


Figure 3.4 Show Carbon Monoxide Emissions for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

**F. NOx Emission:**

Nitric oxide emissions stretched out with the development in IOP because of speedier burning and better temperatures came to in the cycle as appeared. Prevalent burning winning inward motor chamber and better temperatures came to inside the cycle are responsible for extended NOx. For 5-holes out with indistinguishable hole measure, the NOx raised as the brake warm execution is more prominent and higher premixed ignition was resolved at those conditions.

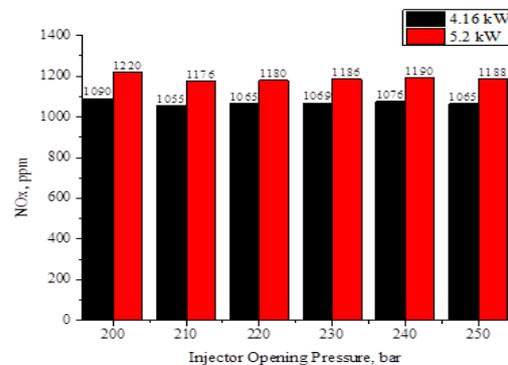


Figure 3.4 Show NOx emission for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

**G. Ignition Characteristics:**

**1. IOP on High Pressure**

Figure 3.5 shows the impact of Injector opening pressure on high pressure with brake control for diesel and ACOME activity individually utilizing the 5-hole injector. Lower high pressure has come about with ACOME activity at all Injector opening pressures contrasted with biodiesel because of its lower vitality content. It could be because of the joined impact of longer start delay, lower adiabatic fire temperature and slowly consuming the biodiesel.

This could be ascribed to fragmented ignition because of the inappropriate blending of fuel mixes, a decrease of air entrainment, and higher consistency of biodiesel. All through the burning, the high pressure of ACOME expanded with increment in fuel infusion pressure. The expansion in high pressure was seen when the IOP fluctuated from 21MPa to 24MPa as appeared in figure 6. Past 24MPa the high pressure was brought due down to the nullification impact. Lower pressure and temperature toward the start of infusion results with the lower IOP and consequently the high pressure brought down.

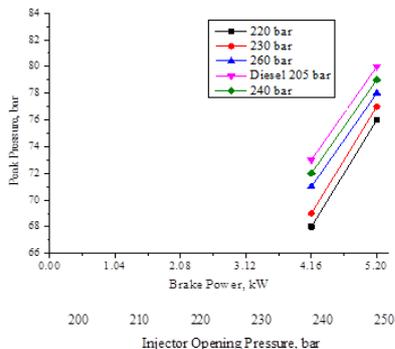


Figure 3.5 Show IOP on High Pressure for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

2. Ignition Delay

Figure 3.6 indicates the effect of Injector building up pressure on Ignition delay length with brake energy for diesel and ACOME activity separately the utilization of the 5-opening injector. The start put off is determined dependent on the static infusion timing. Start put off diminished with the burden and reached out with biodiesel task. ACOME affirmed longer start delays when contrasted with diesel. notwithstanding, while the Injector beginning pressure is quickened the start defer decreased in light of the fact that the extended brake warm execution gives propelled burning to ACOME task.

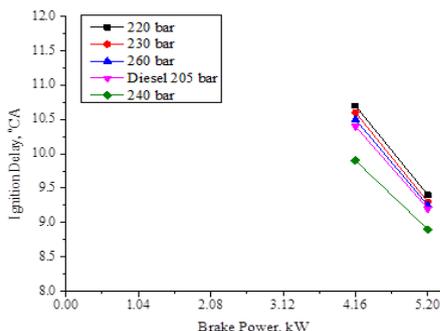


Figure 3.6 Show Ignition delay for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

3. Ignition Timing

Figure 3.7 suggests the effect of Injector building up pressure on Ignition length with brake energy for diesel and ACOME task separately the use of the five-hole injector. Moved toward becoming determined based absolutely at the period between the beginning of burning and 90% aggregate warm dispatch. The burning time frame raised with development inside the quality yield with the two powers and injector beginning pressure also that is because of the development in the amount of gas infused. Better ignition span is situated with

ACOME than diesel in light of the more drawn out dispersion burning area. It can be a direct result of the better thickness of biodiesels prompting wrong air-fuel mixing and wants a more drawn out time for blending and hence following in deficient ignition with longer dispersion burning portion. With the quickened Injector opening pressure the ignition term diminished.

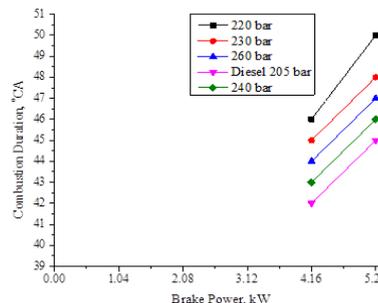


Figure 3.7 Show Ignition Duration for 5 holes, 0.3 mm with injection timing at 27 °C BTDC

IV. CONCLUSION

From the comprehensive test tests led on fuelled diesel motor running with 17.45 pressure proportion and 1500 rpm the resulting ends have been drawn:

At IOP of 240 bar, CR of 17.45, three opening injectors and a motor speed of 1500 rpm following are closed. ACOME controlled motor activity with the chief motor working parameters cherish it of 270 BTDC, IP of 240 bar, and five openings injector indicated regular better motor execution in expressions of higher BTE with decreased emissions.

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## AUTHORS PROFILE



### **Nagesh S.B**

Having 8 Year experience in Teaching, doing (PhD) on I C engine Under VTU Belagavi. Area of teaching and research interest is Heat and mass Transfer, I C Engine, Fluid Mechanics etc.



### **Chandrashekhara T.K**

Currently, working as Professor in Mangalore institute of technology and engineering, Moodbidri. Received Doctor of Philosophy in Mechanical Engineering from Visvesvaraya Technological University (VTU) and having 30 years of Research and Teaching experience published 30 International Journals and attended 30 conferences.



### **Banapurmath N.R**

Currently, working as Professor of School of Mechanical Engineering B.V. Bhoomaraddi College of Engineering and Technology and Professor and Head at Centre for Material Science (CMS), K. L. E. Technological University (Previously known as B.V. Bhoomaraddi College of Engineering and Technology) Hubballi. 24 years of Research and Teaching experience published International Journals: 152, International conference: 82, National conference: 23, 7 Patents (filed), 13 Book and Book chapter publications. Several funded projects from State and Central Govt. of INDIA. Produced PhD. 10, M.Tech. 30