STUDY OF DUAL BIODIESEL FUELLED LHR DIESEL ENGINE SUPPORTED BY TURBOCHARGER SYSTEM

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Abstract. This is the universe of car vehicles and its populace is expanding step by step. They are fuelled with petroleum derivatives which are getting drained and once for all there is chance for them to get wiped out as well. They even reason genuine ecological and conservative dangers. So a stage is taken ahead through this exploratory work looking for an option biodiesel. This test think manages the utilization of eucalyptus oil mixed with Manilkara zappota methyl ester in LHR motor bolstered by turbocharger and its execution, outflow attributes were contrasted with that of customary motor and LHR motor without turbocharger.

1. INTRODUCTION:

After the development of mechanical upset, the interest for vitality has turned into an inescapable part in serving the humankind in the late nineteenth century [1]. Petroleum derivative fills in as a fundamental asset for vitality and assumes a crucial part in any nation [2]. The way that the petroleum derivatives are non-sustainable and can end up wiped out one day has occupied every one of our brains for the hunt of substitutes that could help the situation from deteriorating. It is likewise similarly critical to keep up an adjust in the biological community by rise to reliance on every one of the assets accessible on the earth rather altogether devouring a solitary kind of fuel. Another central point that thumps our brain is that the petroleum products are the reinforcement for contamination particularly air contamination. Association of concerned researchers has expressed that "traveler vehicles and substantial obligation trucks are the primary wellsprings of contamination which incorporates ozone layer exhaustion, particulate issue and other brown haze framing discharges "It has moreover uncovered that the transportation contributed most of CO and NO\textsubscript{X} Along with almost quarter of HC created toward our air in the way 2013. The cost of the substitute combustible furthermore standoff tense fixation which has chooses its usage. While considering factors like restore limit, cost and lower radiations the biodiesel wanders itself as an ideal substitute fuel.
for oil or diesel. Biodiesel is described as "the mono alkyl esters of long chain oily oils or animal fats, for used in weight begin engines [3]. Because of the wealth of diesel fuel which was bring down in taken a toll similarly, vegetable oils increased less consideration with the exception of in the midst of climb in oil costs and oil deficiencies. Resolute work by scientists, for example, Martin Mittlebach advanced improvement of biodiesel oil industry in mid 1990's. It is ecofriendly and non-biodegradable. As it is gotten from vegetable oils, it is sustainable and can diminish the emanations of nursery gasses.

There are a couple of ways to deal with convey biodiesel from vegetable oil. One compelling and most by and large used procedure for expelling biodiesel from vegetable oil is transesterification method [4,5]. Transesterification oil of vegetable obtain driven in 1853 by analysts (E.Duffy and J.Patrick) stable before the diesel engine ended up utilitarian [1]. This system yields three humbler atoms which are bring down in consistency and remain easy to devour in diesel engine. These strategy oil reacts upon alcohol inside seeing a force which is acidic or fundamental in environment. KOH is the reasonable force used which is stomach settling agent in nature [6]. Transesterification method constitutes as a base for the formation with present day biodiesel, whose trade name is unsaturated fat methyl ester. The capability of the diesel engine can be upgraded by covering the start chamber with suitable assurance of masterful materials and this sort of engine is called low warmth expulsion engine [7-9].By reason of 2/3 of the glow essentialness is lost to the exhaust and coolant and only a solitary third is utilized to procure supportive work, the use of LHR engine grows the warm profitability of the engine [10].

In this investigation, an analysis has been led to think about the execution and discharge qualities of turbocharger bolstered LHR motor fuelled with MZME-eucalyptus oil mix.

2. METHODOLOGY/BIODIESEL PREPARATION

2.1 EUCALYPTUS ESSENTIAL OIL

Eucalypt ovata is dominantly found in India. The eucalyptus essential oil is expelled from its leaves through steam refining method. The important acclaimed one is the cineole based liquied oil. analysis portrays that cineole based eucalyptus essential oil keeps the parcel issue upon ethanol along with oil stimulates. These Eucalyptus oil has a low centane value number. Hence lessens agency cold stream properties.

2.2. TRANSESTERIFICATION METHOD

This is the method incorporates utilization of NaOH [1% w/w of oil] as a driving force. Methanol (5:1 molar extent to sapota oil) was mixed with NaOH in a thin neck flogan. The mix was shake all around alright to separate NaOH in methanol. Around one liter these sapota seed oil was combined to the mix. The flask was warmed to a temperature until 65oC on a warm bowl outfitted upon an appealing actuator approach. Following two hours the reaction was ended along with the substance obtain allowed to come down. This realized the course of action of two layers. The top layer obtain methyl ester and the last 1 obtain glycerol and that generous texture. The glycerol obtain removed from the container over a waste gate or valve. The straggling leftovers of the mix ob warmed to a heat of 100 °C to oust water and wealth
alcohol. The resultant obtain sapota methyl ester, the 1 we require as bio diesel oil. These exploratory examination the similarity with Manilkara zapota seed as biodiesel oil ancient tentatively researched utilizing a LHR engine.

3. LHR ENGINE

As expressed before low warmth dismissal motor is the one in which chamber head, cylinder, barrel divider and valves are covered by a protection called warm boundary covering. This is done keeping in mind the end goal to limit the warmth misfortune to the motor coolant and fumes [18-20]. LHR guarantees high warm effectiveness, bring down emanations, bring down fuel utilization and evasion of cooling framework from the engine [21]. Earthenware layer like TiO2, Al2O3, mullite, CaO/MgOZrO, YSZ are utilized in motors as TBC [22-24]. PSZ and YSZ are the better mainstream TBC material which great preferred standpoint in execution [25-27]. The boundary frame has 2 layers. One is known as bond coat and another one is known best layer. The security coat fills for the need with decreasing the warm anxieties made mid way the best coat along with the substrate because of distinction in efficient warm development. The security coat likewise shields the substantive of decomposition and erosion [28]. By and large metallic amalgams are utilized as TBC. Numerous examination works and studies have been done on LHR motor since 1970. A few specialists found a change in the warm proficiency, NOX outflow decrease, increment in debilitate vitality accessibility, diminishment in warm misfortune [19,27,29-33] then again a few analysts negate the way that there was no change in warm effectiveness [34,35]. Plasma shower technique is the generally utilized warm splashing strategy to layer TBC in the engine. It’s very potential in on line softening the substrate.

These investigation the diesel engine was changed over toward LHR engine through covering with the PSZ along with the motor’s ignition, execution and outflow attributes act contemplated.

Because of increment in burning chamber temperature the start delay is diminished which thusly has ordinary ignition. In this way the oxygen substance along with the temperature into the cavity is sufficiently more NOx development. It comes turbocharger which has diminishes NOx because of diminished equivalent of oxygen in the burning cavity.

**TABLE 1.0 Shows Specification of the Engine**

| DETAILS                  | SPECIFICATIONS                  |
|--------------------------|---------------------------------|
| Type of four stroke      | kirloskar make, compression, ignition. |
|                          | Direct injection and water cooled. |
| Estimated power and speed | 5.2 kw and 1500rpm              |
| No.of cylinder           | Single cylinder                 |
| Compression ratio        | 17.5:1                          |
Bore and stroke   87.5 mm and 110 mm  
Design of loading  Eddy current dynamometer  
Dynamometer arm length  0.185 m  
Type of injection  Mechanical pump nozzle injection  
Suction valve open  4.5 degree before TDC  
Suction valve closing  35.55 degree after TDC  
Closing valve opening  35.55 degree before BDC  
Closing valve closing  4.5 degree after TDC  
Injection timing  before TDC  23 degree  
Injection pressure  220 bar  
Lubrication oil  SAE 40  

4. Test SETUP

The testing motor is a Kirloskar TV1 demonstrate single chamber four stroke water-cooled diesel motor creating 5.2 kW at a acceleration of 1500 rpm. The determinations with the engine specified underneath in the Table 1. The engine obtain specifically set and associated with a AG10 demonstrate waterlogged vortex flow dynamometer [MakeSa] Test Plant Pvt. Ltd.] with a controls framework. The instruments important to quantify essential parameters, for example, wind current, wrench point, ignition weight, fuel stream, temperatures and load are additionally given the setup. The signs from different estimating instruments were specifically interfaced to a PC through an information obtaining arrangement of rapid nature. Notwithstanding the fuel tank, a different 5 liter limit tank is joined to the motor for the bio-diesel and its mixes.

5. TURBOCHARGER

A turbocharger region unit is a kind of constrained acceptance framework. A turbocharger unit is involved two fundamental parts: A turbine and a pressure, and its motivation are to broaden the volumetric proficiency of the burning chamber. The mechanical gadget of the turbocharger utilizes air from the surrounding environment and will expand its thickness through the turning sharp edge sections. The resultant high thickness wind current at that point enters the motor burning chamber to consolidate with the fuel. A turbocharger comprises of two chambers associated by center lodging. The two chambers contain a turning motor haggle mechanical gadget wheel associated by a pole that goes through the middle lodging it’s a rotational motor driven constrained acceptance gadget that will build an inward burning motor effectiveness and power yield by compelling extra air into the ignition chamber. Which implies the
charging compressor is driven by fumes the gas driven rotational motor. The fume from the barrel goes through the turning motor sharp edges, making the rotational motor turn.

### TABLE 2.0 Fuel Specifications after and before Transesterification

| Properties                     | Test Method | Diesel | Manilkara zapota oil | Eucalyptus oil | MZME |
|--------------------------------|-------------|--------|----------------------|----------------|------|
| Density @ 15°C (kg/m³)         | ASTM 145    | 840    | 890                  | 895.5          | 867  |
| Kinematic viscosity @ 40°C (Cst) | ASTM 121    | 2.9    | 35                   | 2              | 4.5  |
| Flash Point (°C)               | ASTM 128    | 54     | 162                  | 58             | 152  |
| Fire point (°C)                | ASTM 127    | 64     | 250                  | 64             | 158  |
| Gross heating value (kJ/kg)    | ASTM 134    | 42700  | 35570                | 43270          | 42000 |
| Cetane number                  | ASTM 345    | 49     | 42                   | 18             | 52   |

6. TESTING PROCEDURE

The motor execution kept up steady with no alteration on the motor. The turbocharger framework connection was associated with the fumes pipe of the test motor. At first the motor was performed utilizing diesel and afterward it was later utilized by bio fuel mixes following 20 minutes. At the point when, the fuel is cautioned the motor was keep running for around 10 minutes to get steady condition with the new fuel before estimations were taken. The motor was stacked from 0 kg to 15 kg continuously in ventures of 3 kg by controlling the current provided to the vortex current Dynamometer. Amid the heap changes in the motor the rack position of fuel pump is acclimated to control the provided fuel with the goal that a steady speed is kept up as 1500 rpm. The readings had been recorded at surrounding condition and furthermore when the motor was settled and has achieved consistent state condition. The examinations are rehashed for three times and normal estimation of the readings were taken, and utilized for figurings to expand the proficiency of the acquired outcomes. Finally of the motor test, the fuel was changed back to standard diesel and the motor was continued running for some time before close down to flush out the test
fuel from the fuel line and the infusion framework. The information have been gathered in which motor keep running for 10 minutes yet esteem is taken at the most recent 4 minutes. The smoke limit is estimated by utilizing smoke meter. The carbon monoxide, carbon dioxide, un consumed hydrocarbon and oxides of nitrogen these are the fumes gases which have been taken from the fumes pipe line and it is investigated by utilizing a fumes gas analyzer.

7. RESULTS AND DISCUSSION

7.1 BREAK PARTICULAR VITALITY UTILIZATION

BSEC is the proportion between the vitality got by consuming the fuel for a hour and the real power got at the wheels. The above diagram portrays the different consequences of BSEC regarding change in comparing brake powers for various test energizes in LHR motor upheld by turbocharger and regular diesel motor. On breaking down the graph, we construe that at full load condition BSEC for LHR MZME30Eu70+10% turbocharger is lesser when contrasted with all other test powers in diesel motor and LHR Engine. It is certain that MZME30Eu70+10% turbocharger in LHR motor is 4%, 9%, 3% and 10% lesser than diesel, MZME30Eu70 utilized in customary motor and LHR motor separately.

7.2 BREAK PARTICULAR FUEL UTILIZATION

Break particular fuel utilization is discovered 10% turbocharger along with MZME30Eu70 mix the BSFC diminishes upon the expanding capacity. These ideal structure with the turbocharger or in addition where as expanded or diminished BSFC can differ as indicated by the rates with turbocharger. Another purpose behind the expansion modern BSFC expected affecting LHR engine and that broadly accepted considering the warmth protecting effects this enhances the calorific value estimation fuel of the liquid. It has a tendency to abbreviate the start lag and the period of burning also. Hence the efficiency is improved.

7.3 BREAK WARM EFFECTIVENESS

It is apparent from the chart that BTE has expanded on account of MZME30Eu70 with add 10% turbocharger modern LHR engine at the same time contrasted with entire another test powers. Its might do expected with this turbocharger that goes about on the point of a preheater for delta new charge. Consequently the incomplete hydro carbon in the fumes build up singed into barrel among the nearness coming from inexhaustible oxygen. It thus climbs the calorific value of estimation fuel. Considering the engine utilized obtain LHR unity, warmth get away with the encompassing obtain additionally diminished and that is likewise an explanation behind higher BTE.

7.4 FUMES GAS TEMPERATURE

EGT comes about demonstrate that it is lesser if there should arise an occurrence of MZME30Eu70 add with 10 percentage turbocharger at the same time contrasted with MZME30Eu70 add without turbocharger modern LHR engine.
7.5 CO EMANATION

CO emanations for different test powers are appeared in chart. It is derived from the chart that CO is discharged in higher focus on account of MZME30Eu70 add with 10 turbocharger rate where as contrasted with MZME30Eu70 add without turbocharger in LHR engine. This expansion in carbon monoxide observed to be 11 percentages at maximum load condition. Also, these undeniable purpose behind this climb is the turbocharger framework. that this oxygen focus into the ignition cavity is bring down because turbocharger prompts non-uniform burning. Subsequently the fragmented burning produces a greater amount of CO in the air. Among the test fills, after diesel in ordinary motor, the higher CO outflow is found on account of MZME30Eu70+10% turbocharger.

7.6 HC EMANATION

The chart demonstrates the unburnt hydrocarbons outflow at different burdens for comparing test energizes. At higher burdens the oxygen content lessens radically inside the burning chamber due to turbocharger. Along these lines the accessible oxygen content in the barrel isn't adequate for the entire ignition of the fuel. Notwithstanding this the HC focus continues expanding in the burning chamber because of UHC from the turbocharger into the barrel.

7.7 NOX EMANATION

The chart demonstrates the results of NOx outflow for various test powers. The positive effect of utilizing turbocharger is thought about mostly NOx emanation. At bring down burdens the NOx discharge can be direct however at higher burdens it produces observable decrement when MZME30Eu70+10% turbocharger in LHR motor are utilized. This is on the grounds that at higher burdens the oxygen level diminishes definitely. As we probably am aware oxygen is one of the fundamental explanations behind NOx emanation and diminishment in its sum can lessen oxides of nitrogen. Another reason is because of lower fire temperature.

8. CONCLUSION

Turbocharger framework is an efficient methodology to decrease NOX discharges. During this check ponder, endeavors were made perceive data results of turbocharger once joined with LHR engine fuelled with MZME and essential oil within the organization of MZME70 Eu30+ ten turbocharger. Its outcomes continue contrasted with totally different energizes and a conclusion was created. It absolutely was watched that turbocharger framework diminished NOx emanation primarily on account of MZME70 Eu30 with 10 turbocharger rate in LHR engine. For a similar liquid oil combine into LHR engine BSEC, BSFC, EGT were identified to diminish for more burdens and BTE had identified to increment by reason of turbocharger. Ten turbocharger percentage obtain indicated diminishment in-thing NOX emanation. HC, CO and fog emanations were expanded for MZME30Eu70 with ten turbocharger rate in LHR engine. In addition, increment in (CO & HC) and smoke are often diminished by once treatment methods of the fumes.
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