PAPER ID – OT16

PERFORMANCE OF ETHANOL BLENDED GASOLINE FUEL IN SPARK IGNITION ENGINE

Dhirajsingh Hajare,
Mechanical Engineering Department (Sandwich Pattern)
Indira College Of Engineering And Management, Pune
Hanumant Jagdale
Mechanical Engineering Department (Sandwich Pattern)
Indira College Of Engineering And Management, Pune

ABSTRACT

The Growing energy needs and environmental concern worldwide have propelled the interest insearch and utilization of renewable and eco-friendlyfuels.Various substitutes are available to be used engines with the possibility of reducing harmful emissions. In this work, gasoline is taken as a reference which is blended with ethanol. Physical properties relevant to the fuel were determined for the four blends of gasoline and ethanol. A four-cylinder, four strokes, varying rpm, Petrol engine connected to eddy current type dynamometer was run on blends containing 5%,10%,15%,20% ethanol and performance characteristics were evaluated. In this paper it is shown that the higher blends can replace gasoline in an SI engine, results showed that there is a reduction in exhaust gases and increase in Mechanical efficiency, Specific Fuel Consumption and air-fuel ratio on blending. We can conclude from the result that using 10% ethanol blend is most effective and we can utilize it for further use in SI engines with little constraint on the material used to sustain little increase in pressure.

KEYWORDS:- Spark Ignition Engine, Ethanol, mechanical efficiency, specific fuel consumption, Gasoline etc.

INTRODUCTION:-

Rapidly increase in fuel prices and oil consumption along with the deficiency of petroleum-based fuels have accelerated an interest for the search of an alternative, renewable sources of fuel like biodiesel and alcohol-based fuels. In recent years ethanol is has become widely used renewable fuel with up to 10% by volume blended into gasoline for regular engines or up to 85% for use in Flex-Fuel vehicles designed to run with higher concentrations of ethanol. Ethanol can also be used as a neat fuel in spark-ignition engines or blended up to 40% with Diesel fuel for use in compression-ignition engines.Ethanol is biodegradable, less pernicious to groundwater, and has an octane number much higher than gasoline as well as having a safer effect on vehicle emissions. Environmental issues regarding the emissions of hydrocarbon, carbon dioxide, carbon monoxide, nitrogen oxides and particulate matter from petroleum-based fuels such as gasoline and diesel are of serious concern worldwide. These emissions do not only havean adverse effect on the human body but also harmful to the environment as they vital role information of the greenhouse effect, acid rain and global warming. Therefore there is an acute need for renewable and environment-friendly alternative fuels such as ethanol (alcohol), natural gas, and biodiesel. Today, the transport sector is a major contributor to net emissions of greenhouse gases, of which carbon dioxide is particularly important. The carbon dioxide emissions originate mainly from the use of fossil fuels; mostly gasoline and diesel oil in road transportation systems, although some originate from other types of fossil fuels such as natural gas and Liquefied Petroleum Gas (LPG). If goals for reducing net emissions of carbon dioxide are to be met, the use of fossil fuels in the transport sector has to be substantially reduced. This can be done, to some extent, by increasing the energy efficiency of engines and vehicles and thus reducing fuel consumption on a volume per unit distance travelled basis. However, since the total transportation workload is steadily increasing such measures will not be sufficient if we really want to reduce the emissions of carbon dioxide.

LITERATURE SURVEY:-

AccordingN. Seshaiah et altested the variable compression ratio spark ignition engine designed to run ongasoline with pure gasoline, LPG (Isobutene), and gasoline blended with ethanol 10%, 15%, 25% and 35% by volume. Also, the gasoline mixed with kerosene at 15%, 25% and 35% by volume without any engine modifications has been tested and presented the result. Brake thermal and volumetric efficiency variation with brake load are compared. CO and CO_2 emissions have been also compared for all tested fuels. It is observed that the LPG is a promising fuel at all loads lesser carbon monoxide emission compared with other fuels tested. Using ethanol as a fuel additive to the mineral gasoline, (up to 30% by volume) without any engine modification and without any loses of efficiency, it has been observed that the petrol mixed with ethanol at 10% by volume is better at all loads and compression ratios.

Juozas Grabys investigated engine performance and pollutant emission of an SI engine using ethanol-gasoline blended fuel and pure gasoline. The results showed that when ethanol was added, the heating value of the blended fuel decreases, while the octane number of the blended fuel increases. The results of the engine test indicated that when ethanol-gasoline blended fuel was used, the engine power and specific fuel consumption of the engine slightly increase; CO emission decreases dramatically as a result of the leaning effect caused by the ethanol addition; HC emission decreases in some engine working conditions; and CO_2 emission increases because of the improved combustion.

Bang-Quan He, Jian-Xin Wang investigated the effect of ethanol blended gasoline fuels on emissions and catalyst conversion efficiencies in a spark ignition engine with an electronic fuel injection (EFI) system. The result showed that ethanol can decrease engine-out regulated emissions. The fuel containing 30% ethanol by volume can drastically reduce engine-out total hydrocarbon emissions(THC) at operating conditions and engine-out THC, CO and NO_x emissions at idle speed, but unburned ethanol and acetaldehyde emissions are effective in reducing acetaldehyde emissions; but the conversion of unburned ethanol is low. Tailpipe emissions of THC, CO and NO_x have a close relation to engine-out emissions, catalyst conversion efficiency, engine's speed and load, air/fuel equivalence ratio. Moreover, blended fuels can decrease brake septic energy consumption.

P. A. Hubballi and T. P. Ashok Babuinvestigated experimentally the effect of Denatured spirit (DNS) and DNS-Water blends as fuels in a four cylinder four stroke SI engine. Performance tests were conducted to study Brake Thermal Efficiency (BThE), Brake Power (BP), Engine Torque (T) and Brake Specific Fuel Consumption (BSFC). Exhaust emissions were also investigated for carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x) and carbon dioxide (CO_2). The results of the experiments revealedthat both DNS and DNS95W5 as fuels increase BThE, BP, engine torque and BSFC. The CO, HC, NO_x and CO_2 emissions in the exhaust decreased. The DNS and DNS95W5 as fuels produced the encouraging results in engine performance and mitigated engine exhaust emissions.

Hakan Bayraktarstudied the effects of ethanol added to gasoline on an SI engine performance and exhaust emissions are investigated experimentally and theoretically. In the theoretical study, a quasi-dimensional SI engine cycle model, which was firstly developed for gasoline-fuelled SI engines was adapted for SI engines running on gasoline-ethanol blendsExperimental results showed that among the various blends, the blend of 7.5% ethanol was the most suitable one from the engine performance and CO emissions points of view. However, theoretical comparisons showed that the blend containing 16.5% ethanol was the most suited blend for SI engines.

Performance of I.C Engines

Fuel-air (F/A) or air-fuel (A/F) ratio (lambda): The relative proportions of the fuel and air in theengine are very important from standpoint of combustion and efficiency of the engine. This is expressed either as the ratio of the mass of the fuel to that of the air or vice versa.

A/F ratio = (Air Flow) / (Fuel Flow)

Specific fuel consumption (SFC): Brake specific fuel consumption and indicated specific fuel consumption,abbreviated BSFC and ISFC, are the fuel consumptions on the basis of Brake power and Indicated power respectively

BSFC = (Fuel flow in kg/hr) / (B.P.)

Mechanical efficiency (η_m): Mechanical efficiency is the ratio of brake horsepower(delivered power) to theindicated horsepower (power provided to the piston):

Mechanical Effn = (B.P. / I.P.) x 100

CONCLUSION:-

From a review of the research paper, it is found that Ethanol blends are quite successful in replacing pure Gasoline in Spark Ignition Engine. Results clearly show that there is an increase in Specific Fuel Consumption because of low calorific Value of Ethanol than Gasoline and also increase in mechanical efficiency. So from the curves, it is seen that 10% ethanol blended Gasoline is the best choice for use in the existing Spark-Ignition Engines without any modification to increase Efficiency. A little consideration has to be taken on the material used as the maximum pressure inside the cylinder is increased by blending. A balance has to be made between Specific Fuel Consumption and efficiency to take care of users using the blend as more fuel will be consumed due to the blending of ethanol with gasoline.

No Load Condition

1. Lambda increases from 1 to 1.2 as blending increased up to 15%.It increases by 22% at 2500 rpm for 10% blend in comparison to commercial Gasoline.
2. Mechanical Efficiency increases on blending Gasoline. In comparison to commercial Gasoline, it increases by 9% for 10% blend, 8.8% for 15% blend and 4.85% for 20% blend at 5000 rpm.
3. Specific Fuel Consumption increases on blending Gasoline. In comparison to commercial Gasoline, it increases by 7.2% for 10% blend, 8.0% for 15%blend and 18.77% for 20%blend at 2100 rpm.

Constant rpm Condition

1. Lambda decreases on blending at high loads and generally lies between 0.992 to 0.996 for 3000 rpm and 4000 rpm.
2. Mechanical Efficiency increases with blending and is slightly greater at 4000 rpm.At 20kg load, it increases by 11.85% for 10%blend, 5.5% for 15% blend, 10.99% for 20% blend at 3000 rpm and increase by 3.36% for 10% blend, 2.89% for 15% blend and 1.03%for 20% blend at 4000 rpm with respect to commercial Gasoline.
3. Specific Fuel Consumption increases on blending and is generally lower for 4000 rpm. At 20kg load, it increases by 5.66% for 10%blend, 14.55% for 15% blend, 40.16% for 20% blend at 3000 rpm and increase by 0.75% for 10% blend, 2.47% for 15% blend and 20.47 % for 20% blend at 4000 rpm with respect to commercial Gasoline.

REFERENCES:-

(1) He Bang-Quan,WangJian-Xin studied emission characteristics of an efficient engine with ethanol-blended gasoline, atmospheric env 37, (2003), 949-957.
(2) N. Seshaiah, Efficiency and exhaust gas analysis of variable compression ratio spark ignition engine fuelled with alternative fuels, an international journal of energy and environment Volume 1, Issue 5, 2010, 861-870.

(3) GrabysJuozas, the influence of the composition of gasoline-ethanol blend parametersof internal combustion engines, a journal of kones,internal combustion engines vol. 10 , 2003, , 3-4.
(4) Hubballi P.A. and BabuT.P.Ashok, the effect of aqueous denatured spirit on engine performance and exhaust emissions, SAE 2004 -28-0036.
(5) Bayraktar Hakan, experimental and theoretical investigation of using gasoline-ethanol blends in spark-ignition engines, renewable energy 30, (2005), 1733–1747.
(6) Demain, A. L., “Biosolutions to the energy problem,” Journal of Industrial Microbiology & Biotechnology, 36(3), 2009. 319-332.
(7) Pal Amit, Maji S., Sharma O.P. and Babu M.K.G.,“Vehicular Emission Control Strategies for the Capital City of Delhi”, India,January 16-18, 2004, SAE Paper no 2004-28-0051.
(8) Sinor JE, Bailey BK Current and potential future performance of ethanol fuels. SAE Technical Paper 930376, 1993.
(9) Yang H.H., Liu T.C., Chang C.F., Lee E., Effects of ethanol-blended gasoline on emissions of regulated air pollutants and carbonyls from motorcycles, Applied Energy, 89:281-286, 2012.