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Engine Performance and Emission Characteristic for Blend of Petrol and Ethanol with Oxy Hydrogen Gas

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Abstract - Emission from engine exhaust is serious problem from environment point of view. For that search, alternative fuels are supported. . Oxy Hydrogen Gas is expected to be one of the most important alternate fuels in the near future to meet the stringent emission norms. The Oxy Hydrogen Gas advancement is brought about better combustion and reduced emission output in engine. Electrolysis of water can give us hydrogen in type of oxy-hydrogen gas, which can be utilized as an alternative fuel for any internal combustion. The project presents the results of experimentation carry out for studying performance on petrol engine using ethanol blends with oxy hydrogen gas. Electrolysis of water with KOH electrolyte having 2 molar concentrations is completed to create oxy hydrogen gas. OXY HYDROGEN gas is only electrolyte from water having high specific energy per unit weight, good combustion characteristic, and furthermore eco-friendly. Utilizing 5%, 10%, 15% ethanol blend with oxy hydrogen gas bringing about progress in brake power and brake thermal efficiency when compare with engine running with petrol alone, likewise brake specific fuel consumption is reduce with modified fuel system. The CO, HC emission process utilizing gas analyzer devise with modified fuel supply system

***Key Words*: Oxy hydrogen gas, electrolysis process, ethanol, S.I.Engine**

I. INTRODUCTION

As we as a whole know, the petroleum holds are restricted, we are continually attempting to moderate petrol fuels for future and because of this, and there is a need of alternative and innovative fuel. Electrolysis of water can give us hydrogen as oxy-hydrogen gas which can be utilized as an alternative fuel for any engine. Oxy hydrogen gas is an improved combination of 'hydrogen' and 'oxygen' of which hydrogen contains high calorific value oxygen helps combustion process. I present work blending various amounts of oxy hydrogen gas with petrol and ethanol is performed with various concentrations and relating engine performance attributes are investigated. With this, similarity of oxy hydrogen gas as an alternative fuel for internal combustion engine has been checked. Ethanol is an pure substance while fuel is made out of Hydrocarbons. The ethanol contains an oxygen atom so that it can be viewed as a partially oxidized hydrocarbon. It helps in complete combustion. Ethanol blending is a system of adding ethanol to petrol. Due to developing monetary concerns, consumption of ethanol as an engine fuel or as an added substance is gaining quick popularity [11]

A. Ethanol

Ethanol has reactive tendency more than any hydrocarbon fuel, such as gasoline. It is under the family name of alcohol. It has a short carbon chain; the properties of ethanol polar fraction overcome the non-polar properties. Due to the formation of hydrogen bridges in ethanol molecule increase its boiling temperature when compared to gasoline. It is simple and this makes it suitable for spark combustion internal combustion engines operation. The most common use of Ethanol fuel is by blending it with gasoline. Doing so creates a blend that releases fewer emissions into the environment and is considered cleaner in nature. The issues faced environmentally regarding the emissions of hydrocarbon, carbon dioxide, carbon monoxide, nitrogen oxides and particulate matter from petrol based fuels such as gasoline and diesel are of serious concern worldwide leading to the Paris environment agreement. The consequence of these emissions does not only health of human but the environment as well due to the formation of the greenhouse effect, acid rain and global heating. Hence there is a critical need for renewable and environment friendly alternative fuels like ethanol, gaseous petrol, and biodiesel Ethanol is a liquor made through maturation process of plant sugars from rural item and biomass assets. Corn is perhaps the most utilized yield use for its creation. Little level of corn is required for ethanol creation while the rest of consumption for taking care of creatures, making corn petroleum, or different items. A portion of its properties incorporate; Ethanol is an unmistakable, boring substance compound produced using the sugars found in yields like corn, sugar beets and sugar stick. Lately, there are has been various worries about its creation and use, because of the increment in food costs and the necessary enormous process of arable land required for its creation along with the energy and contamination equilibrium of the entire pattern of ethanol creation, particularly that from corn. Despite the fact that there have been disclosures of utilizing cellulose for ethanol creation, commercialization may mitigate a portion of these worries. Ethanol has solid ability to serve successfully in flash start engine as it diminishes the perilous discharge items from the

engine when compared with the customary fuel, which makes it an eco- friendly fuel [2].

B. Hydrogen gas for Engine

Hydrogen fueled engines are those wherein "Hydrogen gas" is utilized to deliver a small amount of force for running the engine. This reduces petrol consumption and increase the performance of engine. Hydrogen gas kit is the latest device used to increase the performance of engine. Combustion of petrol product makes difficult issue environment due to discharge of NOx, CO, CO2, and unburned hydrocarbons. Be that as it may, the consumption of hydrogen in IC engine helps increasing its performance and also reduces pollution, because on combustion water vapor is the only product [12].

II. METHODOLOGY

2.1 OXY HYDROGEN GRNERATION SYSTEM

An ox hydrogen generator like this one, uses electricity from battery throw convert water into hydrogen and oxygen gasses. (Electricity + 2H20 --> 2H2 + O2) Together, these make a fuel that is much more powerful than gasoline, and the only emission released is water.

ox hydrogen generator in used stainless steel, cut precise holes in the tops and bottoms of the plates. The plates are joined in a configuration so that the 2 inner plates are connected to one electrical terminal, and the 2 outer plates connected to the other terminal. The generator plates are assembled in the order of plate, plastic washers, plate, stainless steel jam nuts until 8 plates have been connected. To see a step-by-step of the generator plate assembly

the body mad by PVC transplant pipe and two side PVC cap. The make coil is attached in PVC body and by using PVC solution use and fix and after The electrolyte is distilled water and about 2-4 teaspoons of KOH (potassium hydroxide) mixing with distilled water .made this solutions is using syringes fill and inject in generator chamber and generator full with water. Now connected 12 volt dc battery and give supply to generator then after electrolysis process throw separation hydrogen and oxygen in to water. This is generation of ox hydrogen gas. Oxy hydrogen gas is improve internal combustion and reduce unburned hydro carbon.

2.2 Experimental setup and Methodology

Table -1: Engine Specification

Parameters	Specification
Manufacture	Bajaj Discover
Number of cylinders	Single
Number of stroke	4 stroke
Fuel type	Petrol
Displacement	125cc
Maximum Power	11 N*M
Maximum Speed	5500RPM

In this experiment plan taken one petrol engine, especially given in table 3.1, this engine served cooling system as air-cooled, above all else illustrating as shown by the size of the engine. Through metal angle and joint by using cathode welding. Subsequent to putting a engine on the edge following stage to organize distinctive ornamentation on the frame, for instance, rope dynamometer, fuel tank, measuring cylinder, etc. pulley was welded at the yield shaft of the engine and set dynamometer on this pulley. rope brake dynamometer having a restriction of 10 to 100kg, yet set in 20kg weight (which are fix in all examinations) condition with spring pressure. By using a tachometer set different rpm ranges to changing circumstance of speed increment wire. Assessing fuel use using burette tube related with the carburetor.

As of now adding Oxy hydrogen by arrangement Oxy hydrogen generator and associate with the inlet manifold. In addition, at last assessing spread of gases temperature by infrared thermometer and exhaust gas outpouring like CO,CO_2,HC,O_2 using of the gas analyzer.

III. EXPERIMENTAL PROCEDURE AND INVESTIGATION

The examination will finish on a single chamber, air cooled, and four-stroke petrol engine. In this preliminary taken data with different conditions, for instance, conventional conditions using 100% Petrol,5%ethenol-95%Petrol, and 10%ethanol-90% Petrol. The engine will at first start and be kept in running condition for up to 10 minutes. At the point when it arrived at its steady condition. Starting now and into the foreseeable future, we will set the speed of the engine as 1000 rpm (Tachometer was used) with a fixed weight condition of about 20kg set in the dynamometer. At the point when rpm set, we will see the time by stopwatch required by the engine to consume 10 ml of fuel, and thereafter the Temperature at the Ventilation system will process with the help of an infrared Thermometer or Thermocouple. Assessments for different limits (BP, FC, SFC, BSFC, BTE, etc) will figure by got time and temperature. The assessments will moreover be finished by setting the speed of the engine as 1500, 2000, 2500, 3000 rpm with the same weight condition and the time required by the engine to eat up 10 ml of fuel and vapor gas temperature will be assessed. The huge differentiation of assessment of time and temperature between various rpm was around 10 minutes for instance, after each assessment, the engine will be kept in running condition up to approximately 10 minutes and a while later time and temperature will figure and further calculations of various limits will be done.

finished above attempt in 3 stages, at first taken examining in 100%petrol without and with Oxy hydrogen with different rpm ranges, after that using 5%ethanol-95%petrol without and with Oxy hydrogen in a couple of rpm ranges, and at last change into the fuel condition to 10%ethanol-90%petrol without and with Oxy hydrogen in a couple of rpm ranges. From here on out, taking a gander at all results and wrap up the ideal result. With the record of discharge boundaries like CO,CO_2, HC,O_2 emanation.

IV. RESUALT AND DISCUSSION

4.1 Performance and Emission reading

Table 2- sample of Performance reading
100% petrol for normal condition

RPM	B.P (KW)	FC (kg/hr)	SFC (K/kw-hr)	BSEC (KJ/kw-hr)	BTE (%)	Time (sec)
1000	1.155	0.6264	0.5419	23793.41	15.12	43
1500	1.733	0.75	0.4327	18998.84	18.94	36
2000	2.311	0.9	0.3894	17096.49	21.05	30
2500	2.888	1.038	0.3594	15778.46	22.8	26
3000	3.46	1.227	0.3547	15571.46	23.11	22

5% ethanol without oxy hydrogen gas

RPM	B.P (KW)	FC (kg/hr)	SFC (Kg/kw-hr)	BSEC (KJ/kw-hr)	BTE (%)	Time (sec)
1000	1.155	0.6585	0.57012	25028.7	14.38	41
1500	1.733	0.75	0.4327	18998.84	18.94	36
2000	2.311	0.96	0.4154	18236.26	19.65	28
2500	2.888	1.08	0.3739	16416.89	21.92	25
3000	3.46	1.35	0.39	17128.61	21.01	20

10% ethanol without oxy hydrogen gas

RPM	B.P (KW)	FC (kg/hr)	SFC (Kg/kw-hr)	BSEC (KJ/kw-hr)	BTE (%)	Time (sec)
1000	1.155	0.69	0.5974	26225.97	13.71	38
1500	1.733	0.7941	0.4582	20115.97	17.89	34
2000	2.311	0.96	0.4154	18236.26	19.65	28
2500	2.888	1.03	0.3576	15700.34	22.8	26
3000	3.46	1.5	0.433	19031.79	18.91	18

5% ethanol with oxy hydrogen gas

RPM	B.P (KW)	FC (kg/hr)	SFC (Kg/kw-hr)	BSEC (KJ/kw-hr)	BTE (%)	T
1000	1.155	0.551	0.5419	23793.41	17.18	49
1500	1.733	0.642	0.4327	18998.84	22.1	42
2000	2.311	0.8181	0.354	15542.26	23.16	33
2500	2.888	0.931	0.3594	15778.46	25.43	29
3000	3.46	1.08	0.312	13702.89	26.27	25

10% ethanol with oxy hydrogen gas

RPM	B.P (KW)	FC (kg/hr)	SFC (Kg/kw-hr)	BSEC (KJ/kw-hr)	BTE (%)	T
1000	1.155	0.6136	0.5312	23322.11	15.43	44
1500	1.733	0.729	0.42	18466.87	19.47	37
2000	2.311	0.964	0.4171	18312.24	19.65	28
2500	2.888	1	0.34722	15243	23.68	27
3000	3.46	1.285	0.3713	16300	22.08	21

Table 3- sample Emission reading
100% Petrol for normal condition

RPM	HC	CO	CO2	O2
1000	84	2.08	4.22	12.85
1500	79	2.17	4.29	12.85
2000	107	2.20	4.39	12.68
2500	118	2.22	4.41	12.79
3000	121	2.24	4.43	12.98

5% ethanol without oxy hydrogen gas

RPM	HC	CO	CO2	O2
1000	80	2.10	4.22	12.90
1500	86	2.10	4.27	12.85
2000	110	2.18	4.39	12.62
2500	121	2.24	4.39	12.75
3000	129	2.24	4.35	13.05

10% Ethanol without oxy hydrogen gas

RPM	HC	CO	CO2	O2
1000	80	2.10	4.22	12.90
1500	86	2.10	4.27	12.85
2000	110	2.18	4.39	12.62
2500	121	2.24	4.39	12.75
3000	129	2.24	4.35	13.05

5% ethanol with oxy hydrogen gas

RPM	HC	CO	CO2	O2
1000	80	2.10	4.22	12.90
1500	86	2.10	4.27	12.85
2000	110	2.18	4.39	12.62
2500	121	2.24	4.39	12.75
3000	129	2.24	4.35	13.05

10% ethanol with oxy hydrogen gas

RPM	HC	CO	CO2	O2
1000	80	2.10	4.22	12.90
1500	86	2.10	4.27	12.85
2000	110	2.18	4.39	12.62
2500	121	2.24	4.39	12.75
3000	129	2.24	4.35	13.05

4.2 Sample calculation

Data- weight=20kg,Spring stiffness=1.2
Diameter of pulley=120mm,RPM=1000
(W-S)=18.8kg
(W-S)=18.8*9.81=184.42

$$\textbf{1. Brake power} = \frac{IIDN(W-S)}{60 * 1000} \quad (KW)$$

$$\frac{3.14 * 0.120 * 1000 * 184.428}{}$$

Brake power = ----------

60 * 1000

B. P= 1.155(KW)

2. Fuel consumption (kg/hr)

Mf * 3600

Fuel consumption = ---------- * specific gravity

Time * 1000

3600

Fuel consumption = ---------- * 0.75 =

43000

FC= 0.6264 (kg/**h**

3.Specific fuel consumption (Kg/kw-hr)

Fuel Consumption

SFC = ---------- (Kg/KW-hr)

Break Power

0624

---------- = 054.19 (Kg/KW-hr)

1.155

4. Brake thermal efficiency (%)

B.P * 3600

BTE = ---------- * 100

FC * Cv

1.155 * 3600 4158

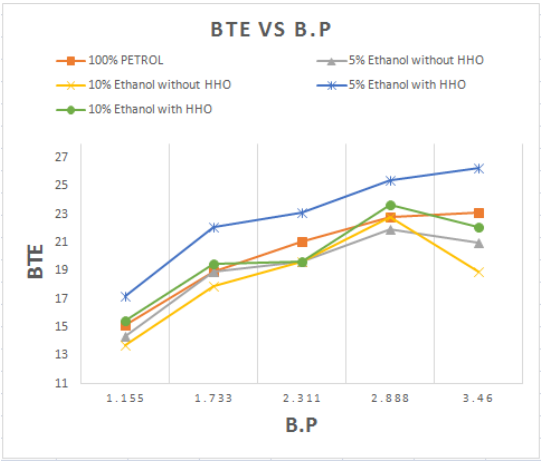
BTE = ---------- * 100 = ---------- * 100

0.6264 * 43900 27498.96

BTE= 15.12 %

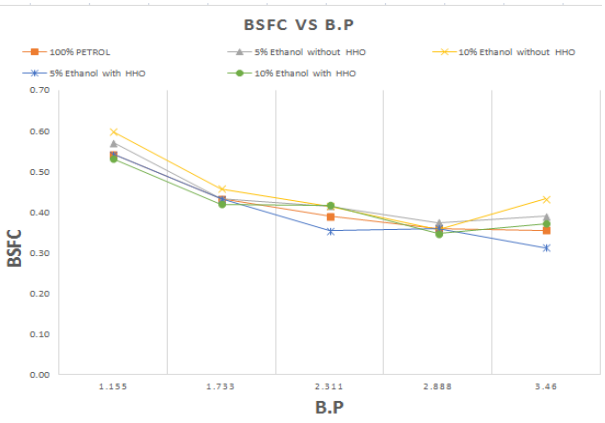
4.3 Performance Characteristic

Brake thermal efficiency VS Brake Power



BTE shows the connection between the output in power and given energy as fuel. It can likewise be expressed as the result of the flow rate of the mass of fuel infused and the lower heating worth. With the Ethanol, its mixes, and utilizing of Oxy hydrogen system, BTE shows variety with change in speed. It shows that when break power esteem is increment BTE additionally an expansion in pure petrol and all the bland of ethanol with and without utilizing of Oxy hydrogen. In the examination BTE of 5%ethanol-95%petrol without Oxy hydrogen(21.92%) ,10%ethanol-90%petrol without Oxy hydrogen(22.8) and 5%ethanol-95%petrol with Oxy hydrogen (25.43%),10%ethanol-90%petrol with Oxy hydrogen(23.68) contrast with all fuel and pure petrol (22.08%) at the 2.8kW brake power. At 5% ethanol blend and utilizing Oxy hydrogen, it is seen that BTE is improve compare to all fuel because of the greater consistency and higher heating value of blend ethanol fuel. BTE for blend ethanol 21.92% when utilizing Oxy hydrogen at the time 23.43% at 2.8kw brake power .so result is found 5% ethanol blend with 95% petrol and utilizing Oxy hydrogen so improve brake thermal efficiency compare to all blend fuel and pure petrol.

Brake Specific Fuel Consumption VS Brake Power



The brake-specific fuel utilization is the fuel stream rate per unit of power output. It is an amount of the effectiveness of the engine in utilizing the fuel provided to deliver work, fig 6.2 shows that adjustment of the BSFC with the particular mixing of

ethanol with the petrol and with utilizing Oxy hydrogen . At the steady load condition about 20kg and variable rpm range. It tells that the particular fuel utilization of the petrol with individual blend seen an reduction with an increment in brake power. Moreover, fuel utilization shows an increment with a high amount of ethanol in the mix and applying Oxy hydrogen gas system. The BSFC of all fills with a brake power of 1.15 kW were as the accompanying 0.54 kg/kW-hr for petrol fuel, 0.57 kg/kW-hr for 5%ethanol-95%petrol without Oxy hydrogen, and for 10%etanol-90% petrol without Oxy hydrogen 0.59 kg/kW-hr0.54 kg/kW-hr for 5%ethanol-95% petrol with Oxy hydrogen, and for 10%etanol-90% petrol with Oxy hydrogen 0.53 kg/kW-hr. shows the least at 100% petrol with 2.8 kW brake power discovered 0.35 kg/kW-hr and 10%ethanol-90%p with Oxy hydrogen having a similar brake power getting 0.34 kg/kW-hr which has lower. Contrasting the BSFC boundary and higher blend of ethanol against pure petrol; ethanol has a higher consistency and burning occurred at all RPM which demonstrates high mass utilization per unit power output. As the RPM builds the increment of temperature has been noticed, which turns down the result of the great consistency of the

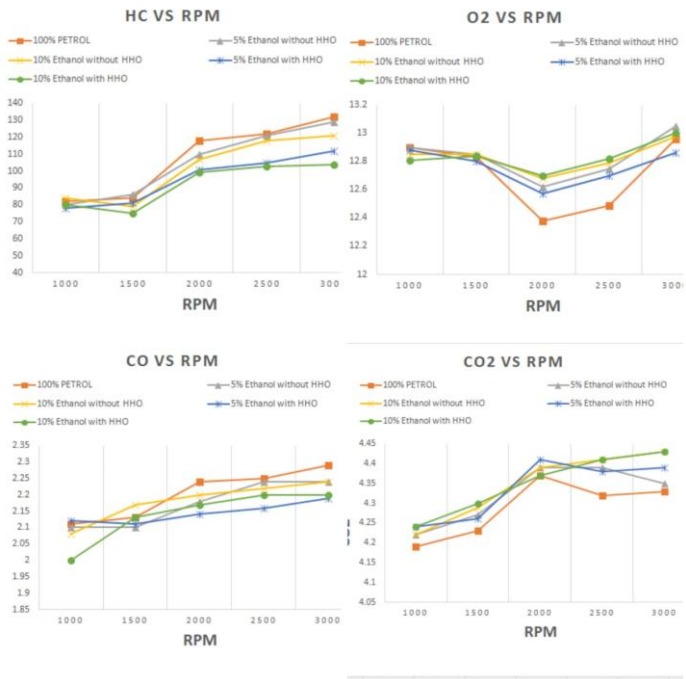
4.4 Emission Characteristic

O_2 VS RPM

The value of O2 emission shown in figure no 6.6. The variation of O2 is not uniform with RPM, there are more variation.10% ethanol with Oxy hydrogen gas has higher value for oxygen.

CO_2 VS RPM

The value of CO2 increase with RPM.5% ethanol with Oxy hydrogen gas has higher value of CO2.10% ethanol with oxy hydrogen gas has lower CO2 value compare to 10% ethanol with Oxy hydrogen gas



HC VS RPM

Fig shows the emanation of unburned hydrocarbons with the progressions of rpm, It was delineated that ethanol has the most noteworthy pace of discharging UBHC with almost when contrasted with pure petrol. While working with Oxy hydrogen because of the increase of oxygen in the inlet charge, Oxy hydrogen builds the UBHC discharges for the ethanol all rpm range. With Oxy hydrogen the oxygen increasable for ignition and the air-fuel blend does combust as expected coming about in higher UBHC emanations. Fig 6.3 shows that when utilizing ethanol UBHC higher than pure petrol yet when utilizing ethanol with oxy hydrogen then its more increments than without oxy hydrogen blend fuel and pure petrol, UBHC varies from 84 with petrol to 75 PPM for 10% Ethanol-90% Petrol WITH Oxy hydrogen, which shows that the decrease in the UBHC when using oxy hydrogen with ethanol 10%ethanol-90%petrol with oxy hydrogen having higher value to the present of oxygen.

CO VS RPM

In comparison, the percentage of CO emission for petrol fuel has linearly increased overall due to increasing engine speed (figure 6.5) While in ethanol, it is found that CO emission has minor different between ethanol and the pure petrol corresponding with the increasing engine speeds under without oxy hydrogen mode. Percentages of CO emission from ethanol were lower than petrol when operating with Oxy hydrogen gas due to some of the oxygen present in the inlet charge and another oxygen provide by Oxy hydrogen that causes complete combustion. These experiments found that percentage of CO emission is reducing when using Oxy hydrogen system using all condition.

CONCLUSION

From the experimental work to measure oxy hydrogen gas on engine performance properties like as Brake thermal efficiency, Exhaust gas temperature, Brake specific fuel consumption and emission properties has been developed. The following results can be listed from experimental work.

1. The brake thermal efficiency improves with Oxy hydrogen gas. Ethanol 5% with oxy hydrogen gas is best results for improving brake thermal efficiency.
2. Brake specific fuel consumption is lower with oxy hydrogen gas.
3. The value of Hydro carbon decreases using Oxy hydrogen gas.
4. The value of CO decreases while employing Oxy hydrogen gas
5. Using Oxy hydrogen gas, Carbon dioxide percentage increases.
6. The value of O2 marginally decreases using oxy hydrogen gas.
7. From the experiments, it can be suggested 5% ethanol with Oxy hydrogen gas HC level is low and result of brake thermal efficiency also good. Mostly parameters results best for 5% ethanol with oxy hydrogen gas.

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