"Performance Test of 4 Stroke 220 cc Single Cylinder Petrol Engine Using Hydrogen Gas Fuel with Petrol"

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Abstract: The paper is all about the usage of fossil fuel in our daily life. This includes the usage of petrol in small SI engines. The usage of same is day by day increasing and the shortage of fossil fuel is increasing accordingly. The extinction of fossil fuel is one side and on the other side the pollution is also increasing on the daily basis and one of the reason for the increasing pollution is the increasing tail-pipe emissions from the vehicles that we use. The research says that every year there is increase in 3.2% of CO_2 in the environment resulting in the greenhouse effect. This paper explains about using the hydrogen gas along with the petrol that we use in normal SI engines which will actually decrease the emissions and also increase the fuel efficiency. This means that the fuel used will be less i.e. the fuel consumption will become low and even the pollution caused due to the tail pipe emissions will decrease. Here for the experiment a conventional 220 cc SI engine is used with petrol and hydrogen as fuel.

Keywords: HYDROGEN FUEL, POLLUTION, EMISSIONS, FUEL CONSUMPTION, CO_2 EMISSIONS

1. INTRODUCTION

Day by day the use of fossil fuels i.e. the use of gasoline as fuel is increasing and thus the pollution also increasing. The greenhouse gases coming from emission of the gasoline engine is really harmful for the environment. This leads to the bed atmosphere and thus leads to research a better fuel for the replacement of the petrol. Hydrogen can beaded along with the petrol which will lead to cleaner combustion. Cleaner combustion will lead to the best environmental results. The hydrogen when used with the petrol leads to better fuel efficiency of as SI engine and thus in this thesis the use of hydrogen gas is done whit the petrol which reduces the pollution as well as the fuel consumption is decreased when compared to the only petrol running SI engine. Among all fuels, hydrogen gas is a long team renewable, recyclable and non-polluting fuel. The idea of using hydrogen into the fuel system which can increase fuel efficiency and decreases air pollution drastically. When hydrogen is used to power a fuel cell, the only byproducts are water and heat on pollutants a fuel cell the emission are significantly reduced when compared with conventional fossil fuel generation technologies.

2. CONSTRUCTION

A single cylinder, air cooled spark ignition engine (Bajaj Pulsar 220cc engine) is used for testing purpose. The motor specification is shown in below. A constant load test and variable speed (1000–3000 rpm) has been performed on this motor. A gas analyzer has been used to estimate the concentrations of NO_X, HC, CO, CO_2, and O_2 in the exhaust stream.

The total trial in regards to the postulation was done in ordinary oil motor. The motor was in a total working state of a BAJAJ fabricated famous PULSAR 220. The motor was not disassembled from the bicycle body and in this manner the trial was done utilizing the functionalities of the stock bicycle. The total procedure and arrangement with respect to the RPM estimation, motor ointment change is demonstrated as follows.

Figure 2.1: PULSAR 220 DTSi

TABLE 1 ENGINE SPECIFICATIONS

ENGINE TYPE	**4 STROKE, SINGLE CYLINDER, OIL COOLED**
BORE*STROKE	**67mm*62.4mm**
ENGINE DISPLACEMENT	**220 CC**
MAXIMUM NET POWER	**19.51 HP @ 8500 RPM**
MAXIMUM NET TORQUE	**19.12 NM @ 6000 RPM**
COMPRESSION RATIO	**9.5 : 1**

2.1 RPM MEASUREMENT

For the correlation of the fuel utilization of motor with the distinctive ointment the LOAD was kept consistent and the RPM of the motor was fluctuated and consequently the RPM was set utilizing the screw handle present adjacent to the carburetor. The RPM was estimated utilizing the inbuilt TACHOMETER present in the bicycle. The TACHOMETER was set to 1000, 1500, 2000, 2500, and 3000 RPM physically for the check of FUEL CONSUMPTION and the AIR FLOW into the carburetor utilizing the diverse motor oils. The accompanying figure shows the arrangement of TACHOMETER on the bicycle.

2.2 FUEL CONSUMPTION MEASUREMENT

The fuel utilization estimation of the SI motor was estimated utilizing the burette arrangement present in the workshop of research focus. The fuel utilization was estimated as for the time. The time taken to consume 10 ml of fuel in each apparatus for example Impartial, 1ST, 2ND, 3RD, 4TH and 5TH apparatus was estimated for all 1000RPM first and the for 1500rpm, 2000rpm, 2500rpm, and 3000rpm individually. The fuel stream pipe was associated with the carburetor on the first end and the second end was associated with the burette. For the fuel stream the handle of the burette was opened and to stop the fuel supply to the motor carburetor the handle of the burette was shut.

2.3 AIR FUEL MEASUREMENT

Alongside the fuel utilization the wind stream to the carburetor was estimated utilizing the MANOMETER arrangement present in a similar research focus. The air bay to the carburetor was associated with the outlet of the air chamber of the manometer. The water filled in the manometer U TUBE shows the deviation as for the wind stream. The perusing of the wind current was taken in all RPM and the separate apparatuses. The bay and outlet pipes were created utilizing the green adaptable funnel as appeared in the figure.

2.4 HYDROGEN GAS KIT INSTOLLATION

Hydrogen gas kit is a device especially designed for the producing hydrogen gas by supplying 12 volts DC current. 12 volts DC current is supplied from the battery which has been already integrated with the vehicle this gas kit contains.

Figure 2.2: Hydrogen Gas Kit Setup

3 OBSERVATION TABLE OF PETROL AND HYDROGEN GAS

Table 3.1: Fuel Consumption for Petrol (Neutral gear)

For Petrol							
GEAR	RPM	FC (sec/10cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
N	1000	21.48	27.93296089	1.491620112	06	37.53	5.40
N	1500	14.9	40.26845638	2.15033557	08	62.47	4.33
N	2000	12.15	49.38271605	2.637037037	10	85.65	3.95
N	2500	11.5	52.17391304	2.786086957	12	99.13	4.09
N	3000	9.35	64.17112299	3.426737968	13	126.91	3.46

Table 3.2: Fuel Consumption for Petrol + Hydrogen (Neutral gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
N	1000	30.72	19.53125	1.04297	06	26.24	7.73
N	1500	20.33	29.513035	1.576	08	45.79	5.91
N	2000	14.2	42.253521	2.25634	10	73.29	4.61
N	2500	12.74	47.095761	2.51491	12	89.48	4.53
N	3000	9.53	62.959077	3.36201	13	124.51	3.53

Table 3.3: Petrol calculations (1st gear)

For Petrol							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
1	1000	22.80	26.315789	1.4052632	8	40.83	6.62
1	1500	15.95	37.617555	2.0087774	11	68.43	5.43
1	2000	12.41	48.348106	2.5817889	12	91.86	4.42
1	2500	11.43	52.493438	2.8031496	15	111.51	4.55
1	3000	10.39	57.747834	3.0837344	17	130.60	4.40

Table 3.4: Petrol + H_2 calculations (1st gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
1	1000	31.40	19.10828	1.02038	8	29.64	9.12
1	1500	21.2	28.301887	1.51132	12	53.77	7.54
1	2000	15.34	39.113429	2.08866	13	77.35	5.68
1	2500	13.18	45.52352	2.43096	16	99.88	5.42
1	3000	12.26	48.939641	2.61338	18	113.89	5.34

Table 3.5: Petrol calculations (2nd gear)

For Petrol							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
2	1000	22.50	26.666667	1.424	12	50.67	8.01
2	1500	14.53	41.293875	2.2050929	13	81.66	5.38
2	2000	12.3	48.780488	2.604878	14	100.11	4.73
2	2500	11.69	51.32592	2.7408041	19	122.71	5.23
2	3000	9.98	60.12024	3.2104208	21	151.11	4.70

Table 3.6: Petrol + H_2 calculations (2nd gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
2	1000	33.57	17.873101	0.95442	13	35.35	12.43
2	1500	20.83	28.804609	1.53817	15	61.19	8.29
2	2000	14.4	41.666667	2.225	16	91.42	5.92
2	2500	12.87	46.620047	2.48951	21	117.18	6.06
2	3000	11.2	53.571429	2.86071	23	140.92	5.52

Table 3.7: Petrol calculations (3rd gear)

For Petrol							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
3	1000	19.80	30.30303	1.6181818	17	68.53	8.39
3	1500	14.7	40.816327	2.1795918	18	94.98	6.41
3	2000	10.78	55.658627	2.9721707	19	133.07	4.83
3	2500	10.95	54.794521	2.9260274	23	144.14	5.39
3	3000	8.85	67.79661	3.620339	26	189.61	4.64

Table 3.8: Petrol + H_2 calculations (3rd gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
3	1000	27.24	22.026432	1.17621	17	49.81	11.54
3	1500	21.48	27.932961	1.49162	18	65.00	9.36
3	2000	14.8	40.540541	2.16486	21	101.90	6.97
3	2500	11.5	52.173913	2.78609	26	145.92	6.02
3	3000	10.6	56.603774	3.02264	29	167.19	5.86

Table 3.9: Petrol calculations (4th gear)

For Petrol							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
4	1000	23.70	25.316456	1.3518987	22	65.13	11.42
4	1500	14.43	41.580042	2.2203742	24	111.73	7.26
4	2000	11.12	53.956835	2.881295	24	144.99	5.60
4	2500	11.94	50.251256	2.6834171	27	143.22	6.37
4	3000	9.89	60.667341	3.239636	31	185.27	5.66

Table 3.10: Petrol + H_2 calculations (4th gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
4	1000	35.53	16.887138	0.90177	21	42.45	16.72
4	1500	22.33	26.869682	1.43484	23	70.68	11.00
4	2000	13.95	43.010753	2.29677	26	120.29	7.31
4	2500	12.74	47.095761	2.51491	29	139.11	7.05
4	3000	11.5	52.173913	2.78609	32	161.88	6.68

Table 3.11: Petrol calculations (5th gear)

For Petrol							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
5	1000	22.32	26.88172	1.4354839	30	80.76	12.56
5	1500	14.72	40.76087	2.1766304	32	126.47	8.55
5	2000	12.74	47.095761	2.5149137	33	148.39	7.52
5	2500	11.2	53.571429	2.8607143	33	168.80	6.61
5	3000	10.2	58.823529	3.1411765	36	193.59	6.29

Table 3.12: Petrol + H_2 calculations (5th gear)

For Petrol + Hydrogen							
GEAR	RPM	FC (sec/10 cc)	FC (cc/min)	FC (kg/hr)	AIR (mmWc)	Vol. Eff.	A:F
5	1000	30.29	19.808518	1.05777	28	57.49	16.46
5	1500	20.94	28.653295	1.53009	30	86.08	11.78
5	2000	15.9	37.735849	2.01509	34	120.69	9.52
5	2500	13.9	43.165468	2.30504	35	140.07	8.45
5	3000	12.2	49.180328	2.62623	38	166.29	7.72

4. CONCLUSIONS

- The impact of using a very small amount of hydrogen and oxygen mixture as an additive on the performance of a single-cylinder SI engine was evaluated.
- The mixture of hydrogen and oxygen was generated or produced by following the electrolysis process.
- The results like performance, fuel consumption and emissions were calculated after mixing the hydrogen gas and oxygen gas with the petrol and normally used.
- The performance test of the same engine was done with both only petrol as fuel and mixture of hydrogen gas and petrol.
- If we talk about the performance, the torque produced was better when the hydrogen gas was used with petrol as fuel.

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