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Study of the Variation of Fuel Consumption with Pure Oxygen in Two Stroke Petrol Engine

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ABSTRACT: The objective of this experimental investigation is to provide the two stroke petrol engine which has higher efficiency along with lower fuel consumption. Lower will be the fuel consumption, engine will be more economical.

KEYWORDS: Pure Oxygen, Fuel Consumption, Brake Thermal Efficiency.

I. INTRODUCTION

Now a day vehicle and their applications are increasing day by day. This leads to an increase of consumption of fuel. Vehicle are playing important role in the daily life, but it has some drawbacks such as pollution. To overcome these drawbacks research is the need of time. This huge demand of fuel cannot be fulfilled, so alternative option is to be founded or research and development is to be done and daily requirement from vehicle is increasing. At this time we want a higher amount of power from lower fuel consumption. The efficiency of Internal Combustion engine is very low, which is not satisfactory. The maximum efficiency that can be achieved is just 50%, which is not enough for today. In the Internal Combustion engine the fuel is burned in the cylinder in the presence of air.

II. RELATED WORK

Mangi Naveen Kumar, G. Abhilash Reddy, G. Manohar Naidu and C. Shirisha (2017) focused on the effect of oxygen in the 4 Stroke Petrol Engine. They did the small adjustment in the carburettor which results in changes in vehicle mileage. It is done by increasing the length of the fuel adjustment screw. The increase order of oxygen amount will cause changes in the performance parameters in the engine cylinder. In this view we made some changes in supplying of oxygen into the engine cylinder, by creating the vacuum chamber. [1]

P. Baskar and A. Senthilkumar (2016) They Enriched Oxygen in the air on a single cylinder, Four stroke diesel Engine and observe the performance characteristics of the engine. An increase in oxygen concentration increases the mixture ratio of specific heats, which in essence increases the potential to convert the mixtures thermal energy to work energy. There is about 4 to 8 percent increase in brake thermal efficiency throughout all levels of oxygen enrichment. The increase in exhaust gas temperature with increased load and oxygen concentration was due to increase in the

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reaction rate, flame velocity and increased heat release rate as compared to heat loss rate. The exhaust gas temperature for all oxygen concentrations were increased considerably. [2]

Waleed Momani (2009) In this study the effects of feeding more oxygen to the combustion mixture is studied experimentally. It was found from tests applying on an engine that excess oxygen has positive results in decreasing concentration of both CO and HC's. CO concentration in the oxygen injection test is much less than that at without oxygen injection at the two cases: With load and without load tests and at nearly all engine speeds. [3]

Yan Shi et al. (2015) Oxygen-enriched combustion of internal combustion engine is one of the main ways of energy saving. Oxygen-enriched combustion can increase the fuel combustion in calorific value, heat efficiency and work capacity, comparing with ordinary air combustion with the same quality. At the same time, the theoretical calculation proved that the oxygen-enriched combustion can eliminate the generation of CH, CO and other pollutants. They conclude that the peak pressure and the peak temperature, oxygen concentration of 24%, can make the combustion pressure rise rate increase, and the heat release rate increase, at the same time, the lowest rate of combustion cycle change in the internal combustion engine, and got the maximum power capability of the internal combustion engine. [4]

MARUFUR RAHMAN (2012) He worked on the "Internal Combustion Engine Performance Characteristics". Single-cylinder 4-stroke SI engine was tested on an engine dynamometer at LSBU. Engine torque, fuel flow, airflow, and exhaust gas temperature were measured at 7 different engine speeds, all full-load. In this he calculated BP, Specific fuel consumption, Speed and drawn Energy balance Diagram, speed vs torque graph etc. [5]

Andrew Charles Van Blarigan (2012) He worked on "An Experimental Based Investigation of Oxy combustion in an SI Engine". Oxy combustion is the process in which nearly pure oxygen and fuel are burned in a diluent of exhaust gas, which is recirculated from the exhaust to the intake, referred to as exhaust gas recirculation (EGR). Experiments were carried out a single-cylinder, variable compression ratio CFR engine on which the intake and exhaust systems were redesigned to include a large, steady-state EGR loop. Dry EGR has been found to have significantly higher knock resistance than air, allowing operation at higher compression ratios (CR) which can ultimately produce higher thermal efficiencies than air operation when combusting a low octane fuel. [6]

III. EXPERIMENTAL PROCEDURE AND SETUP

In this experimental work the speed of the engine, time taken for 10 ml of fuel consumption, Load on Load setup and temperature reading at various stages is taken. The Experiment work is as follows:-

1. In the first stage, the oxygen cylinder is connected to the test rig of two stroke petrol engine and run the engine.
2. By varying the load, the Speed of the engine is noted.
3. At the various load condition, the time taken for 10 ml of fuel combustion is noted.
4. At this various load condition temperature of inlet water, water outlet calorimeter, gas inlet and gas outlet are taken.
5. Finally the Brake power, Specific Fuel Consumption and Brake thermal efficiency is calculated at different load condition on the engine.

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Specification of the engine

Items	Specification
Make	Bajaj
Stroke	66.7 mm
Bore	70 mm
Capacity	150 cc
Rated R.P.M	3000 rpm
Fuel	Petrol
Sp. Gr. of petrol	0.716
Calorific Value of petrol	47100 kJ/kg

IV. EXPERIMENTAL RESULTS

The test is performed by varying the load from 2 to 8 kg. In this experimental work, by using a different load condition of the engine with and without pure oxygen has been done.

4.1 LOAD CALCULATION

$$W_{\text{net}} = \text{Net load} = [(S_1 - S_2) + W_0] * 9.81$$

Where,

S_1 = Weight on hanger 1

S_2 = Weight on hanger 2

W_0 = Dead weight = 1 Kg

The net load is calculated with the help of dead load and weight on hangers in Table 1 with air.

Table 1: Spring load and net load in case of air

S.No.	S_1 (kg)	S_2 (kg)	W_{net} (N)
1	4	0.5	44.14
2	6	1.6	52.97
3	8	0.4	82.75

The net load is calculated with the help of dead load and weight on hangers in Table 2 with pure oxygen.

Table 2: Spring load and net load in case of pure oxygen

S.No.	S_1 (kg)	S_2 (kg)	W_{net} (N)
1	4	0.6	43.164
2	6	0.5	63.76
3	8	0.3	85.34

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4.2 SPEED, TORQUE AND BRAKE POWER

Torque is calculated with the help of load and speed of the engine in Table 3 with air.

Table 3: Speed and Torque in case of air

S.No.	Speed (rpm)	Torque (N.m)	BP (kW)
1	170	43.30	0.770
2	168	51.96	0.914
3	160	82.75	1.386

Torque is calculated with the help of load and speed of the engine in Table 4 with pure oxygen.

Table 4: Speed and Torque in case of pure oxygen

S.No.	Speed (rpm)	Torque (N.m)	BP (kW)
1	363	42.34	1.609
2	344	62.55	2.253
3	332	83.71	2.910

The Figure 1 shows that the speed of the engine is increased in case of pure oxygen compared to the air. This means that the engine is running fast in case of oxygen.

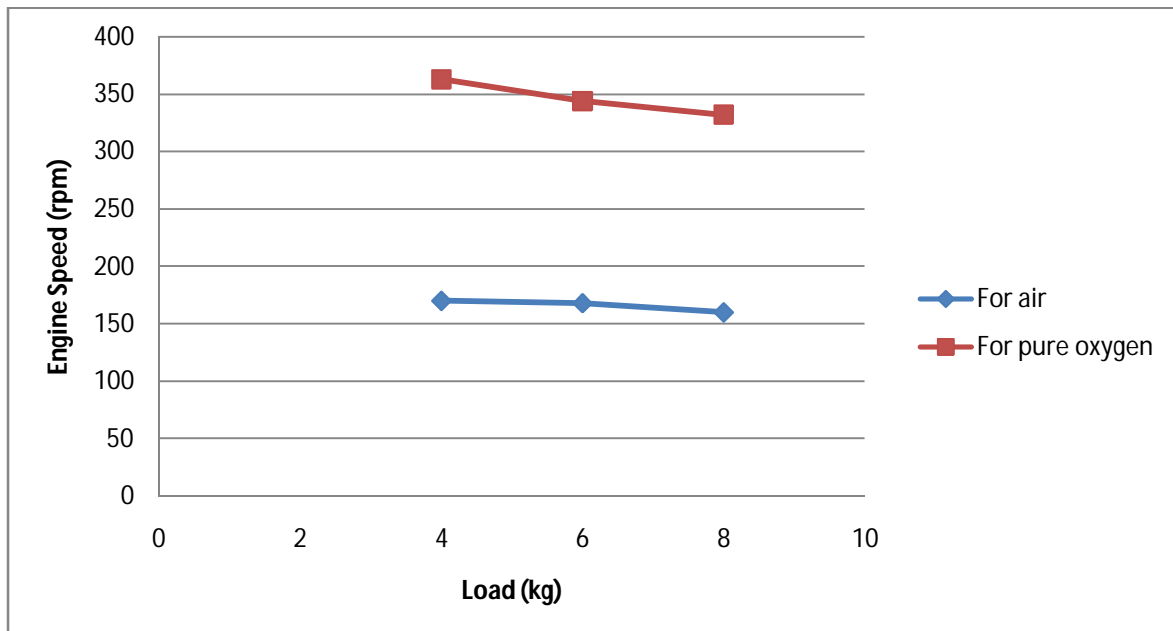


Fig 1: Load and Engine speed for air and pure oxygen

The Figure 2 shows that the Torque is increased in case of pure oxygen compared to the air with respect to applied load (S_1).

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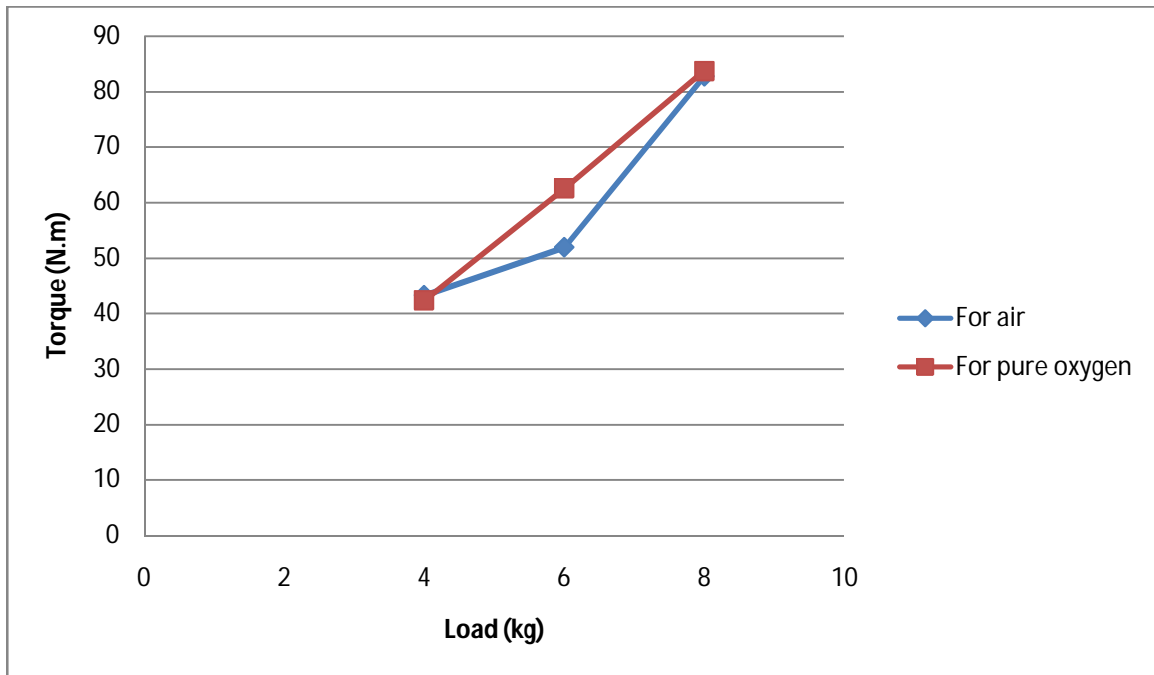


Fig 2: Load Vs Torque for air and pure oxygen

The fig 3 shows that the Brake Power is increased in case of pure oxygen compared to the air with respect to applied load (S_1).

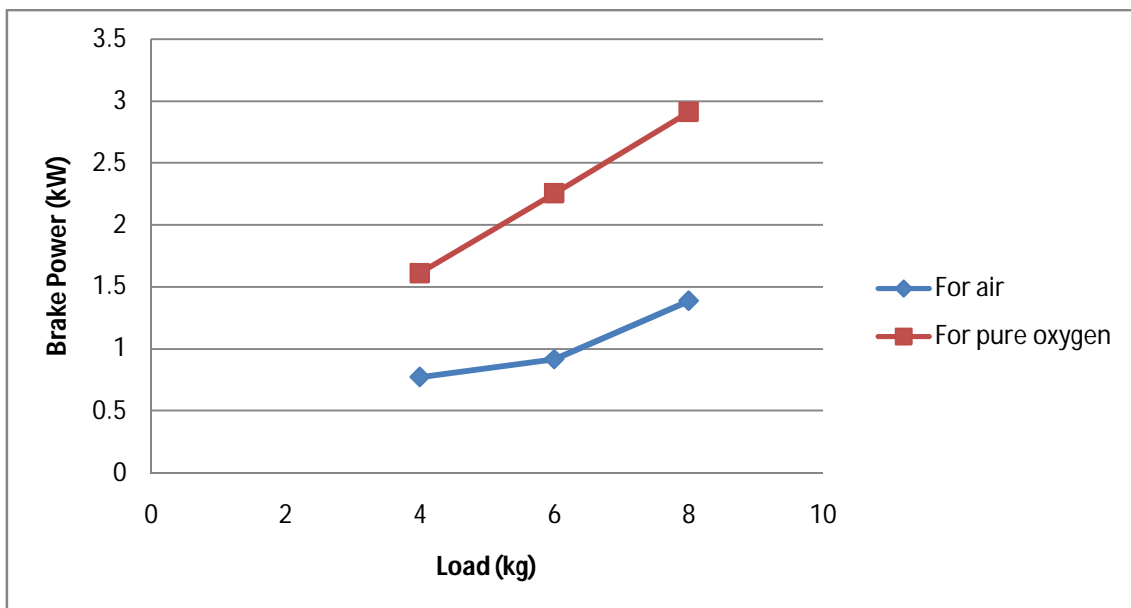


Fig 3: Graph shows the relation between BP and Load (S_1) for air and pure oxygen

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4.3 BRAKE THERMAL EFFICIENCY

The calculation of Fuel consumption, Specific fuel consumption, Engine heat and Brake thermal efficiency with the help of time period for fuel consumption, brake power in Table 5 with air.

Table 5: Engine Heat and Brake Thermal Efficiency for air

S.No.	Time Period for Fuel Consumption t_f (Sec)	Fuel Consumption (kg/hr)	Specific Fuel Consumption (kg/kWh)	Engine Heat (kW)	$\eta_{BT}(\%)$
1	46	0.586	0.761	7.66	10.04
2	50	0.539	0.589	7.05	12.96
3	52	0.518	0.373	6.784	20.45

The calculation of Fuel consumption, Specific fuel consumption, Engine heat and Brake thermal efficiency with the help of time period for fuel consumption, brake power in Table 6 with pure oxygen.

Table 6: Engine Heat and Brake Thermal Efficiency for oxygen

S.No.	Time Period for Fuel Consumption t_f (Sec)	Fuel Consumption (kg/hr)	Specific Fuel Consumption (kg/kWh)	Engine Heat (kW)	$\eta_{BT}(\%)$
1	48	0.561	0.348	7.34	21.92
2	57	0.473	0.209	6.18	36.40
3	69	0.390	0.134	5.11	57.03

Fig 4 shows that the Brake thermal efficiency is increased in case of pure oxygen compared to the air with respect to applied load (S_1). This means that the heat supplied by fuel is reduced in case of pure oxygen.

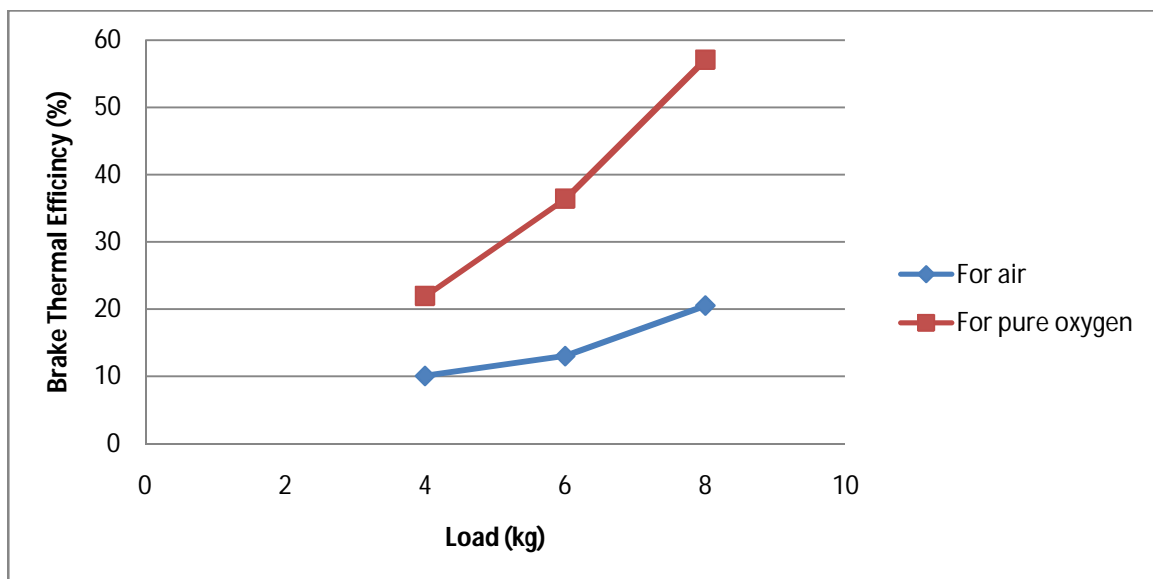


Fig 4: Graph shows the Brake Thermal Efficiency of the engine for air and pure oxygen

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V. CONCLUSION

The study evaluates the use of pure oxygen in the engine. The amount of oxygen largely influenced the performance of the engine. It is evident from these results that oxygen could enhance the performance of the engine if used at the right level of replacement. The study shows that the consumption of fuel is also decreased. Oxygen increases the speed of the engine to great extent. Brake power and thermal efficiency are also increased to the significance level. Finally, we conclude that the replacement of air from pure oxygen is the best method to increase the efficiency of the engine and reduce the amount of the fuel as compared to conventional method.

VI. FUTURE SCOPE

Experimental investigation can be done on internal combustion engine with preheated pure oxygen by using exhaust energy recovery with the heat exchanger for increasing efficiency of the engine and reduce the specific fuel consumption.

REFERENCES

- [1] Mangi Naveen Kumar, G. Abhilash Reddy, G. Manohar Naidu and C. Shirisha, "PERFORMANCE TEST ON 4-STROKE PETROL ENGINE WITH PURE OXYGEN", International Journal of Mechanical and Production Engineering Research and Development , Vol 7, Issue 3, 113-120, Jun 2017.
- [2] P. Baskar and A. Senthilkumar, "Effect of oxygen enriched combustion on pollution and performance characteristics of a diesel engine", Engineering Science and Technology, an International Journal, Volume 19, Issue 1, pp. 438-443, March 2016.
- [3] Waleed Momani, "The Effects of Excess Oxygen to mixture on the Gasses Emission of a Gasoline Engine" American Journal of Applied Science, Volume 6, Issue 6, pp 1122-1125, 2009.
- [4] Yan Shi, Yongfeng Liu and Shengzhuo Yao, "Simulation Study of Oxygen-enriched Cylinder Combustion in the Zero Emission Internal Combustion Engine", 5th International Conference on Education, Management, Information and Medicine", pp 303-307, 2015.
- [5] MD MARUFUR RAHMAN, "Internal Combustion Engine Performance Characteristics", Thermofluids and Turbomachinery Assignment, London south bank university, 2011-2012.
- [6] Andrew Charles Van Blarigan, "An Experimental Based Investigation of Oxycombustion in an SI Engine", University of California, Barkeley, uc Berkeley Electronic Thesis and Dissertations, pp.1 -142, 2012.
- [7] B. Saravanan, N. Sakthivel, T. Venkatesh, K. Vigneshwaran, and D. Vimal, "Experimental Investigation of Oxygen Enriched IC Engine", International Journal of Innovative Research in Science Engineering and Technology, vol. 6, Issue 3, pp.4280-4285, March 2017.