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Fuel Efficiency Improvement & Knocking Reduction System Using 2-Stroke Petrol Engine By Coolant Injection

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Abstract— In internal combustion engines, the water injection, also known as an anti-detonant injection, is spraying water into the cylinder or incoming air-fuel mixture to cool the combustion chamber of the engine, allowing for greater compression ratios and eliminating the problem of engine knocking. This effectively reduces the air intake temperature in the combustion chamber. The reduction of the air intake temperature allows for higher ignition timing to be employed, which ultimately increases the power output of the engine. Depending on the engine, improvement in power and fuel efficiency can also be obtained by injecting water. Water injection may also reduce carbon monoxide emissions. The purpose of this experiment is to investigate the effect of water injection on the engine performance, exhaust gas temperature, and exhaust emission of the S.I. engine, water is injected in specific quantities with compressed air. Single cylinder, two-stroke, air-cooled, 100 cc petrol engines were used in this experiment. Obtained data will compare to calculate the performance of specific fuel consumption, which will get without a water supply to a petrol engine based on performance. The performance test is conducted to find out the fuel efficiency and is compared with conventional engine present also emission is to be carried out to find CO (carbon monoxide) emissions.
Keywords— anti-detonate injection, engine knocking, fuel efficiency, water injection, two-stroke.

I. INTRODUCTION

Today's petrol engine is well established and has been used broadly in the last century for different applications. These include aircraft, automobiles, electrical generators, and multipurpose industrial engines. Coolant injection produces to reduce the pre-detonation in the combustion chamber and fuel consumption was studied extensively. The experiment work that was carried out on a single-cylinder engine established a coolant injection system, different coolant quantities supplied constantly with air to the engine. Data has been recorded over some time. Significantly, fuel and energy consumption rate increased with small amounts of coolant addition, coolant injection represents a new way to avoid detonation and control Nos formation in S.I. Engine. Several different methods of coolant addition have been developed. These studies have shown that further reduction of harmful emissions is still possible. The project work aims to investigate experimentally the effect of the coolant injection to reduce the fuel conception and temperature of a petrol engine. Water injection at the consumption dates lower back to the 1930s, during which engine makers had to search out a couple of kinds of knock suppression for craft engines at excessive electricity. Capturing the knock suppression problem allowed the usage of superchargers at excessive altitudes for craft engines. Supercharging the associate engine may be a technique of extracting additional energy from the engine. Supercharging obviously will increase the pressures and temperatures at some purpose of combustion and measures for economical cooling and knock suppression should be effectively taken.

II. 2-STROKE ENGINE PRINCIPLE

A 2-stroke engine is an engine that completes the entire cycle in 2 stroke phase. Stroke means the sudden movement of the piston which is converted into a rotary motion of the crankshaft. This rotation is coupled with a gear system and differential, which ultimately turns the wheel.

The engine contains 3 openings - Inlet, Exit, and Transfer ports.

There are 4 processes in a petrol/diesel IC Engine- Injection of fuel, Compression, Ignition, and Exhaust.

In 4 stroke engine, these 4 processes happen in 4 different strokes. Here, the introduction of fuel and compression happens in the first stroke and the next 2 processes in the other.

- In the first stroke of the piston, the piston moves from top to bottom. When the piston is at the top position, the inlet port is open for the fuel mixture to enter. The piston descends and blocks the inlet port and its further descent pushes the air-fuel mixture into the transfer port.
- Now, the piston moves from bottom to top. The air-fuel mixture coming out of the transfer port is present in the cylinder and this is compressed by the piston, which moves in an upward direction.

In a petrol engine, after compressing the mixture, it is ignited by the spark plug and the mixture undergoes combustion.

In a diesel engine, the mixture is compressed to a greater pressure at which the mixture self-ignites. The gases, produced after combustion expands and pushes the piston downwards and the cycle repeats itself. The working of a 2 stroke engine. Some info about this type of engine: • In every stroke, the crankshaft rotates halfway as opposed to 4 stroke engine where it rotates one-quarter. hence, for a given volume of cylinder, a 2-stroke engine develops more power than 4 stroke engine. • The combustion is not complete and very noisy. • It consumes much more amount of the fuel and hence, less fuel-efficient.

III.PROJECT PRINCIPLE

The Pressurized fuel is given to the input supply of this carburetor. The pump is used to suck the coolant from the coolant tank and is given to the carburetor. The carburetor is controlled by the control unit. The air-fuel mixture is supplied from the carburetor already used in the petrol engine. Here, the HT coil is used to generate a spark in the spark plug. The engine power production is referred to as brake mean effective pressure (BMEP), which is measured by taking the average effective pressure of the cylinder as they progress through the intake, compression, ignition, and exhaust strokes. The added power comes as a result of greater pressure, but a higher temperature inside the cylinder accompanies greater pressure. Thus These higher temperatures can lead to detonation, referred to as engine knock, both of which are cases where the fuel-air mixture burns in an undesirable manner and can be destructive to an engine. To combat knock and pre-ignition as power increases, a richer air-to-fuel ratio is normally required. If the addition of extra fuel doesn't provide enough knock protection, then a higher octane fuel which is more resistant to knock and pre-ignition may be used. When the knock limit of higher-octane fuel is reached, this is where a coolant injection system presents an appealing option.

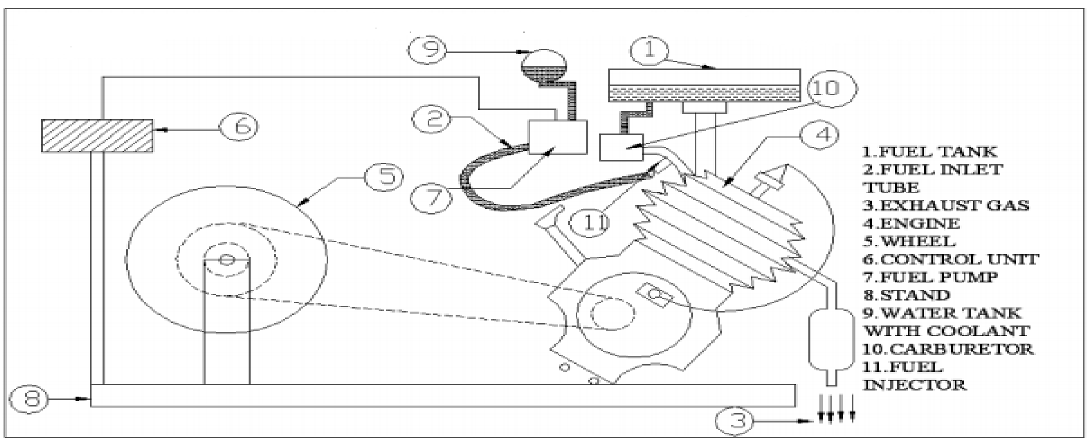

Fig 1 . Fuel Efficiency Improvement and Knocking Reduction System.

IV. VALVE TIME DIAGRAM.

In two stroke petrol engine as we all know the engine cycle completes in 2 strokes i.e. expansion stroke and compression stroke. The fuel intake and combustion exhaust occurs respectively during these 2 strokes.
Theoretical valve timing

A. Expansion Stroke

At the beginning of the expansion stroke the piston which is at TDC starts moving towards BDC due to the compression of air fuel mixture (petrol engine) and during compression stroke and the power output is obtained.
The air-fuel mixture enters through the inlet port during the expansion strokes as the piston moves from TDC to BDC during this stroke.
The expansion stroke continuous till the piston reaches BDC.

B. Compression Stroke

At the end of the expansion stroke, the piston which is at BDC starts moving towards TDC and the compression of air-fuel starts along with the exhaust of residual through exhaust port due to the movement of piston from BDC to TDC.
The piston closes both the inlet port and exhaust port due to its movement from TDC to BDC which in turn raises the pressure inside the combustion chamber.
At the end of compression stroke i.e. when the piston reaches TDC combustion of the air fuel mixture takes place, and the cycle repeats.

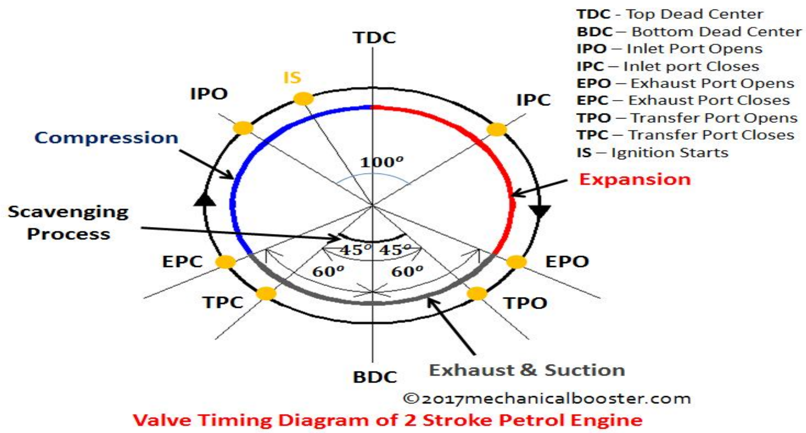

Fig 2 . Fuel Valve Time Diagram

V. COMPARISON

TABLE 1. Different proportion of Coolant Vs Exhaust temperature

Volume Flow Rate of Coolant Injection (ml/Min)	Mass% of Coolant Mixture	Exhaust Gas Temperature
0	0	800
1.88	35.8	759
2.048	36.6	739
2.119	37.4	725
2.168	38	709
2.233	39.1	689
2.328	39.6	670
2.402	41.6	654
2.485	42.2	642
2.569	42.5	628
2.672	43.6	611
2.804	45.2	590
2.902	46.1	579
3.906	52.5	468
4.133	53.9	419
4.405	55.4	368

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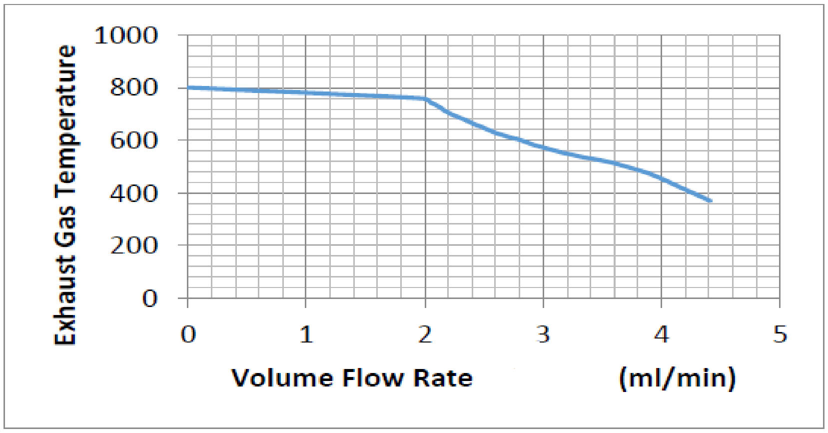

Fig 3. Different Changes in Exhaust gas temperature.

VI. CONCLUSIONS

The present project work has provided experimental research that investigates the effects of water injection on the engine performance, fuel consumption, and exhaust gas temperature for a four-stroke SI engine, the following conclusions were investigated from the experiment.

A. The exhaust gas temperature decreases as the mass of the water to fuel ratio increases.

B. In the exhaust gas the level of CO (carbon monoxide) decreases as the mass of water to fuel ratio increases.

C. The consumption of fuel decreases as the mass of water to fuel ratio increases.

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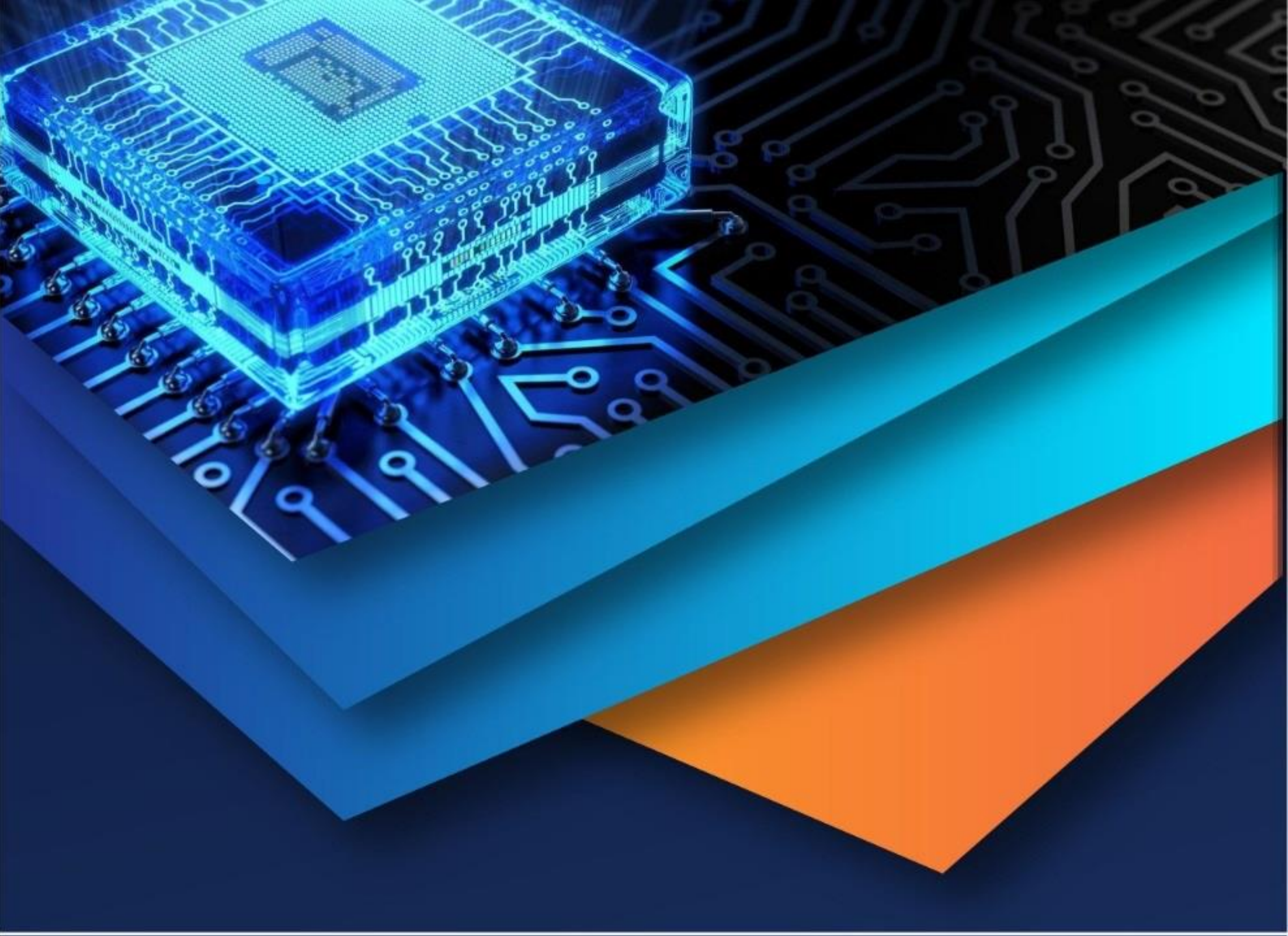

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