EXPERIMENTAL RESEARCH OF OIL TEMPERATURE CONTROL SYSTEM IN MOTORCYCLE ENGINES

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Abstract - *The article presents the results of experimental research of oil temperature control system in motorcycle engine as a means of implementation of the refrigeration system in the oil filter of the engine. The effect of cooling in the motorcycle engine oil by the refrigeration system was determined experimentally. In most of the sport motorcycles or which are above 200cc there is a certain amount of heat dissipation in the rider's leg. It is proved, that the application of this system with the recommended design parameters and operating modes, ensures the engine's smoothness and a reduced amount of heat dissipation in the rider's leg. The cooling system consists of an evaporator coil, condenser coil, and a compressor. The main motive of this cooling system is to maintain the engine oil temperature at an optimum level thereby maintaining the oil viscosity. This system also controls the engine overheating and also enhances the heat dissipation from the combustion chamber. In this setup, the cooling system uses an external power source for functioning. If this system is implemented successfully, then there will be a reduction in the wear and tear of the engine internal parts due to the optimum level of engine oil viscosity. As a result of the various test (with R134a and R12), there is a substantial amount of reduction in engine oil temperature compared to the conventional system. This setup has demonstrated that it is possible to use this concept in real-time applications if it is redesigned according to the engine specification.*

***Key Words*: Engine oil temperature control, cooling system, optimum viscosity, vapour compression refrigeration system.**

1. INTRODUCTION

In most of the sports motorcycle or which are above 200 cc there is a certain amount of heat dissipation in the rider's leg which will cause a heat burn and inconvenience while riding. The high-performance motorcycle engines consist of a high compression ratio, so there is always large amount of heat dissipation to the rider's leg. The prolonged use of these kinds of motorcycles will make the rider uncomfortable to ride in urban areas. In order to solve this problem, a vapor compression refrigeration system is implemented in order to cool the engine oil or to maintain the engine oil temperature to an optimum level. A suitable compressor and refrigerant is selected. The evaporator coil is redesigned until the cooling effect is achieved. And also this is an attempt to reduce the engine overheating and to avoid engine seize and also to reduce the wear and tear of the engine's internal components. If the system is implemented properly then there will be a lot other benefits like extended life period, extended engine oil service, and there will be less heat radiation to the rider.

2. EXPERIMENTAL SETUP

2.1 Engine

The Victor GL engine manufactured by TVS is selected for my project. The main reason for this engine is because of the oil filter position. In the Fig 2.1 the oil filter cap is near to the crank case and also it is easily accessible. If the oil filter is placed beneath the crank case then it will be difficult to access the area and for machining purposes. The evaporator coil will be wound over the engine oil filter.

Fig -2.1: TVS – victor GL engine

2.2 Modifications in engine oil circulation

The normal engine oil circulation without any alteration in the engine. Generally the oil is pumped from the oil sump and passes through the oil filter and then reaches all other parts of the engine in order to lubricate them and also to dissipate heat from the combustion chamber. The fig 2.2 shows the normal engine oil circulation without any alteration in the engine. Generally the oil is pumped from the oil sump and passes through the oil filter and then reaches all other parts of the engine in order to lubricate them and also to dissipate heat from the combustion chamber.

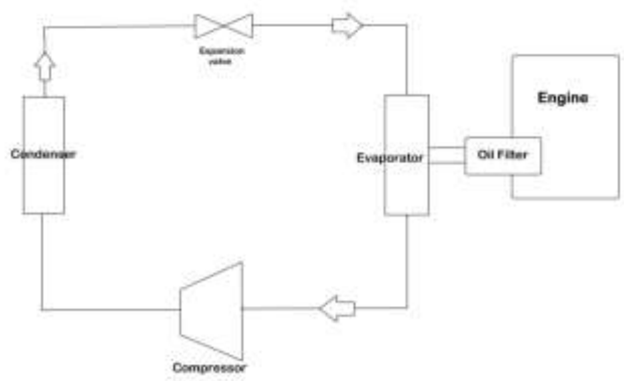

Fig – 2.2: Schematic diagram

2.3 Modification in engine oil filter and evaporator coil

If the diameter of the coil is increased then there will not be sufficient space to accompany the coil. In order to fit the coil inside the oil filter the oil filter should be redesigned. The evaporator coil can also be fitted by machining the oil filter case. Boring the oil filter case is not appreciable hence the oil filter is redesigned.

Fig -2.3: oil filter with evaporator coil

Dimension of the evaporator Coil

• Diameter of the coil	5.5mm
• No of windings	9
• Internal Diameter of the winding	35mm

The evaporator coil diameter is identified through trial and error method because in conventional vapor compression refrigeration system the ambient temperature of the evaporator coil will be always less compared with the condenser coil. But in this condition the evaporator coil is placed in an environment which is hotter than the condenser coil. In this setup it is used to accelerate the heat dissipation. The engine oil obtains heat from various factors like combustion chamber, frictional heat by the internal components and also it loses from various conditions like conduction through the engine components and convection through the ambient air flow. So considering these factors the evaporator coil is designed by trial and error method. This work is mainly demonstrated to find out whether the concept is working or not. The redesigned evaporator coil is implemented in the experimental setup and the test was conducted once again to find out the engine oil temperature difference.

2.4 Experimental setup

The total experimental setup is shown in the fig 2.4. In four wheelers and heavy vehicles there is a dedicated engaging and disengaging mechanism to activate and run the air conditioning unit and it extracts power from the engine. There is a certain amount of reduction in engine power because of compressor load and increased fuel consumption. There will be many problems if the same system is implemented in this motorcycle engine for activating the cooling system and it requires more mechanical components thereby increases its cost. This conventional method will not be effective and efficient. It is a hectic process so initially the cooling system is operated by the external power supply and then it may be altered in the future work based on the conditions.The engine's exhaust port is facing towards the compressor which will spit fire and exhaust gases will be blown on the compressor. Due to the lack exhaust pipe a sheet metal is fixed in-between the compressor and engine. The sheet metal will block all the exhaust gas and it will isolate the compressor and capillary tube. The exhaust pipe is not included in the experimental setup because it is not mandatory. The expansion valve is required component in the vapor compression refrigeration system. In this experimental setup the capillary tube is used as an expansion valve. Two refrigerant filters are also used in this system for seamless functioning of the refrigeration system. The wiring system for the spark plug supply is should be grounded in order to avoid accidental shocks. In this experimental setup the ground wire is fixed to the stand in which the engine and the compressor is mounted.

Fig -2.4: Experimental setup

3. RESULTS

3.1 Engine oil temperature test with R134a

The engine oil temperature test is conducted under various engine speeds and with constant ambient air temperature. For each level of increment in the engine speed the speed is maintained for 3 minutes and then the engine oil temperature is noted down by using a thermometer. The test was conducted with 12 different engine speeds. In this test R134a is used as a refrigerant. The result was noted down in the table 3.1.1 and 3.1.2

Table-3.1.1: engine oil temperature test without cooling system

S.No.	Time (min)	Speed (Rpm)	Oil Temperature (°C)
1	3	1250	31
2	6	1500	36
3	9	2000	43
4	12	2500	50
5	15	3000	54
6	18	3500	59
7	21	4000	66
8	24	4500	75
9	27	5000	82
10	30	5500	94
11	33	6000	102
12	36	6500	109

Table - 3.1.2: Engine oil temperature test with cooling system

S.No.	Time (min)	Speed (Rpm)	Oil Temperature (°C)
1	3	1250	25
2	6	1500	30
3	9	2000	35
4	12	2500	41
5	15	3000	46
6	18	3500	47
7	21	4000	58
8	24	4500	66
9	27	5000	73
10	30	5500	86
11	33	6000	96
12	36	6500	106

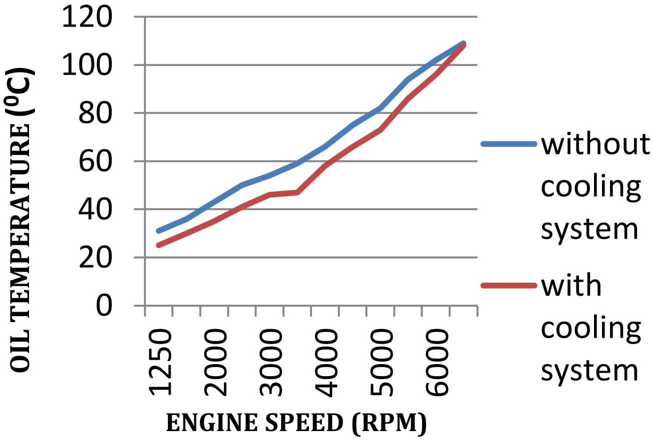

Chart – 3.1: Difference in engine oil temperature

According to the above test results there is an average temperature drop of about 7-8°C at different engine speed. The obtained result is sufficient for the real time implementation of the system in engine.

3.2 Engine oil temperature test with R12

The engine oil temperature test is conducted under various engine speeds and with constant ambient air temperature. For each level of increment in the engine speed the speed is maintained for 3 minutes and then the engine oil temperature is noted down by using a thermometer. The test was conducted with 12 different engine speeds. In this test R134a is used as a refrigerant. The result was noted down in the table 3.2.1 and 3.2.2.

Table - 3.2.1: Engine oil temperature test without cooling system

S.No.	Time (min)	Speed (Rpm)	Oil Temperature (°C)
1	3	1250	32
2	6	1500	37
3	9	2000	45
4	12	2500	52
5	15	3000	55
6	18	3500	60
7	21	4000	67
8	24	4500	75
9	27	5000	83
10	30	5500	95
11	33	6000	103
12	36	6500	110
13	39	7000	116

Table - 3.2.2 : Engine oil temperature test with cooling system

S.No.	Time (min)	Speed (Rpm)	Oil Temperature (°C)
1	3	1250	25
2	6	1500	30
3	9	2000	37
4	12	2500	44
5	15	3000	49
6	18	3500	52
7	21	4000	59
8	24	4500	67
9	27	5000	74
10	30	5500	83
11	33	6000	94
12	36	6500	99
13	39	7000	106

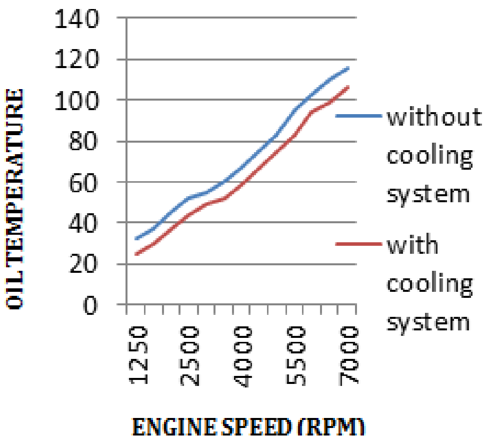

Chart – 3.2 : Difference in engine oil temperature.

According to the above test results there is an average temperature drop of about 7-8⁰C at different engine speed. The obtained result is sufficient for the real time implementation of the system in engine. The obtained test results are much better when compared to the test conducted with previous evaporator coil.

4. CONCLUSIONS

In this study, an ideal vapor compression refrigeration system was considered and the engine oil temperature test was conducted at various engine speeds for a particular time period with R134a and R12 as refrigerant in static condition. The major findings contained in this work are as follows:

- The total experimental setup for the engine oil temperature test was fabricated and tests were done successfully.
- As a result of the test there is an average temperature drop of 7-8⁰C of the engine oil when R134a is used as a refrigerant.
- The critical temperature of the refrigerant R134a is found out to be 101⁰C and this critical temperature is not enough to cool the engine oil when the engine is running at higher speed.
- As a result of the test there is an average temperature drop of 8-9⁰C of the engine oil when R12 is used as a refrigerant.
- The implementation of this concept will increase the lifetime of internal mechanical components by proper lubrication and also enhance the smoothness of the engine.
- This setup has demonstrated that it is possible to use this concept in real-time applications if it is redesigned according to the engine specification.

REFERENCES

[1] Shudo, T., Nabetani, S. & Nakajima, Y. (2001). Analysis of the degree of constant volume and cooling loss in a spark ignition engine fuelled with hydrogen. Int. j. Engine Res., Vol.2, pp. 81-92.

[2]. E. Granryd, Hydrocarbons—an overview, International Journal of Refrigeration 24 (2001) 15–24.

[3]. X.H. Han, Q. Wang, Z.W. Zhu, G.M. Chen, Cycle performance study on R-32/R-125/ R-161 as alternative refrigerant to R-407C, Applied Thermal Engineering 27 (2007) 2559–2565.

[4]. K. Mani, V. Selladurai, Experimental analysis of a new refrigerant mixture as drop in replacement for CFC12 and HFC134a, International Journal of Thermal Sciences 47 (2008) 1490–1495.

[5]. Fahad abou nada(2010) , investigation of the effect of engine lubricant oil on remote temperature sensing using thermo graphic phosphors. 2321-3051

[6]. D.Sendil Kumar, Dr.R.Elansezhian, Investigation of R152a/R134a Mixture in Refrigeration System (IJEIT) Volume 2, Issue 6, December 2012.

[7]. D.Sendil Kumar, Dr.R.Elansezhian, Investigation of R152a/R134a Mixture in Refrigeration System (IJEIT) Volume 2, Issue 6, December 2012.

[8]. Premkartikkumar(2014) , significance of inlet air temperature on reducing engine out emissions of a diesel engine. Volume 38, 28-45 Issue M1

[9]. A.A. Malozemov(2016) Experimental Research of forced Diesel Engine with Oil temperature Control system in cold Ambient Conditions. 1144-1148