

# Reduction of Pollution Content by Increasing the Coefficient of Heat Transfer of Exhaust Gas by Using Natural Circulation Cooling Method

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**Abstract -** There is a need to decrease the pollution content formed by automobile and also to make it more efficient in order to make ecofriendly, energy efficient and reduce emissions of toxic combustion products. The further study suggest that such a system can reduce the amount of toxic components in exhaust gases, particularly at low engine load when the engine exhaust temperature is too low. In this research I am using Natural circulation cooling system with fins to make it more effective. This paper presents the model and experimental test stands to research the cooling effect and elevated temperature of the exhaust gases. The research results were studied to determine the effect of elevated temperature in the cooling system on the composition of the gases. The load and speed characteristics of the standard cooling systems and pressure were tested under different condition. The results confirmed the benefits of increasing the temperature of the coolant. The presented characteristics that apply pressure cooling system reduces the amount of toxic components in exhaust gases, particularly at low engine load, in which the engine operates most often in urban conditions. This research is very useful in order to contribute to decrease the pollution content coming from exhaust gases.

**Keyword:** PUC Pollution control unit, BSEs Bharat stage emission standard, Exhaust gas cooling system, Government Norms, Ambient Concentration, Before and After Cooling Exhaust system.

## I. INTRODUCTION

Motor vehicles are the major source of air pollution in cities which lead to suffer from different environmental problems. Fossil fuels burning in power plant create major pollution content. The major pollutants emitted are Carbon Monoxide (CO) and Hydrocarbons (HC) ,Sox . Carbon Monoxide (CO) which is a colorless, odorless, toxic gas produced by the incomplete combustion of organic compounds. Carbon monoxide decreases the capacity of blood carrying oxygen. Low birth weights in infants is also mainly due to high CO level in blood. All of which are sensitive to blood oxygen content, it can affect the lungs ,brain ,heart and the ability to exercise in ambient concentration.[1] When fuel evaporates directly into the atmosphere or unburned fuel is emitted from the exhaust result in formation of hydrocarbon. HC is one of the major

causes of cancer in many studied and other healthy causes. Other emissions are Carbon Dioxide (CO<sub>2</sub>), Sox and Oxygen (O<sub>2</sub>). This study will concentrate on measuring vehicle exhaust emissions that emitted from exhaust gases before and after cooling the exhaust gases by the help of natural circulation process of gasoline vehicles.

## II. AFFECTS OF POLLUTION CONTENT PRESENT IN EXHAUST GASES

**NITROUS OXIDE (NO<sub>x</sub>)** NO<sub>x</sub> is produced at high temperature .Decrease the function of lungs. Increase the risk of respiratory condition. Increase ground level ozone.

**SULPHUR OXIDE(SO<sub>x</sub>)** Contribute to the formation of photochemical smog ,acid rain.etc .[2]It can cause respiratory problems such as Bronchitis .Can irritate your nose ,throat and lungs. It may also cause coughing , wheezing, phlegm and Asthma attack. Effect are worse when we are exercising ,since SO<sub>x</sub> get linked with cardiovascular disease.

**CARBON MONO OXIDE(CO)** It increase the risk of heart disease. It causes headache, vomiting, dizziness ,and nausea. If level increases it may cause unconscious or people may die. It create risk for unborn babies ,infants .etc

**CARBON DIOXIDE(CO<sub>2</sub>)** It displace oxygen due to which there is breathing problem .[3] It causes headache ,vomiting ,unconscious .It also causes asthma ,heart attack , chocking of breath .It is increasing temperature of earth due to less conductivity of carbon dioxide .Global warming and its effect on environment .

**HYDRO CARBON(HC)** It causes problem related to blood.Breathing problem asthma. Cancer and other diseases .It can also cause slow death.

## III. IN ORDER TO CONTROL POLLUTION STEPS TAKEN BY THE GOVERNMENT

### **BHARAT STAGE EMISSION STANDARDS (BSES)**

Bharat stage emission standards {BSES}[4] are emission standards instituted by the Government of India to regulate

the output of air pollutants from internal combustion engine. This standards are forced implemented by the Central Pollution Control Board under the Ministry of Environment & Forests and climate change. In 13 major cities, Bharat Stage IV emission norms have been in place since April 2010 and it has been enforced for entire country since April 2017. Since October 2010, Bharat Stage (BS) III norms have been enforced across the country. In 2016, the Indian government announced that the country would skip the BS-V norms altogether and adopt BS-VI norms by 2020. [5]In its recent judgment, the Supreme Court has banned the sale and registration of motor vehicles conforming to the emission standard Bharat Stage-IV in the entire country from April 1, 2020.

IV. PRINCIPAL

It works on the principal that the hot fluid always in upward direction and cold water always moves in downward direction .This is due to change in density of fluid. This motion of fluid causes more effective heat transfer.

V. EXPERIMENTAL SETUP OF EXHAUST GAS COOLING SYSTEM



(a)

In this research I am interesting in making Coolant chamber which is installed on exhaust pipe ,in order to decrease the temperature of exhaust gases but ,after some time this coolant fluid will be at same temperature with that of exhaust gases. So,to make it continuous effective it is important to make a system which will continuously cooled it .Therefore natural circulation method is applied on it. In this we are installing a pipe over a coolant chamber in such a way that the one portion of tube is attached at the top and another at the bottom of this chamber. Due to this method the hot fluid of coolant chamber will move in upward direction and then further moves down after getting cooled. This up and down

motion will increase the coefficient of heat transfer and it will be more effective by fins installed on its surface. Due to increase in its surface area there will be huge increment in coefficient of heat transfer.



(b)

Fig 1(a) and (b) the above figure shows about the silencer with coolant chamber and Natural circulation.

VI. RESULT AND DISCUSSION

RESULT ANALYSING BEFORE AND AFTER COOLENT USED IN COOLENT CHAMBER

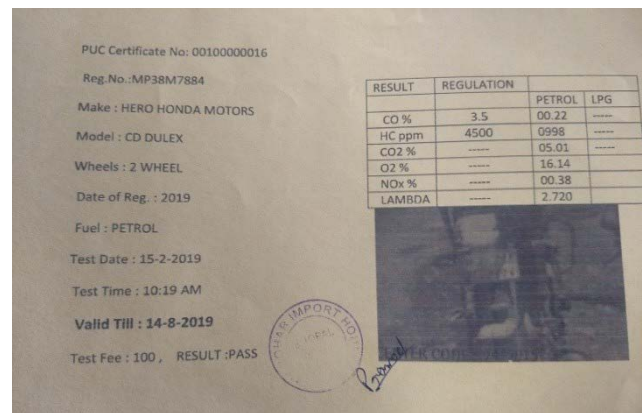


Fig 2. Reading of pollution content taken by PUC before coolant chamber installed in exhaust pipe.

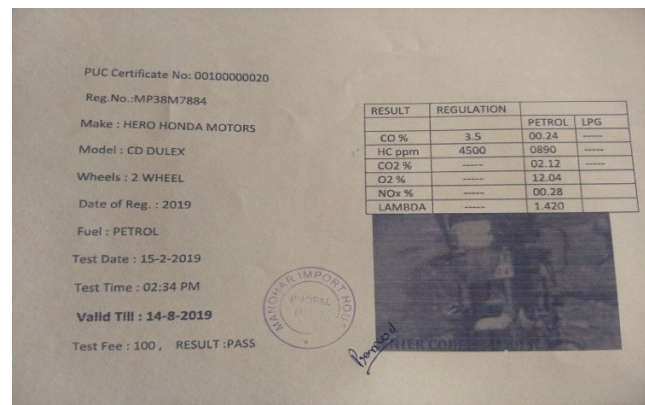


Fig 3. Reading by PUC of pollution content after coolant chamber installed on the exhaust pipe.

Table 1 Average value of pollution content after coolant used in exhaust pipe.

POLLUTION CONTENT IN EXHAUST GASE	READING 1 AFTER COOLENT USED	READING 2 AFTER COOLENT USED	READING 3 AFTER COOLANT USED	AVERAGE OF ALL THIS THREE READING
CO%	00.26	00.24	00.25	00.25
HC%	0878	0890	0884	0884
CO <sub>2</sub> %	02.09	02.12	02.11	02.10
O <sub>2</sub> %	12.16	12.04	12.09	12.09
NO <sub>x</sub> %	00.26	00.28	00.23	0.25
LAMBDA	1.380	1.420	1.220	1.340

Table 2 Comparison of result of pollution content before and after using coolant in cooling chamber.

POLLUTION CONTENT IN EXHAUST GASES	PERCENTAGE OF POLLUTION BEFORE COOLANT USED	PERCENTAGE OF POLLUTION AFTER COOLANT USED
CO%	0.22	0.25
HC%	0998	0884
CO <sub>2</sub> %	05.01	02.10
O <sub>2</sub> %	16.14	12.09
NO <sub>x</sub> %	00.38	00.25
LAMBDA	2.720	1.340

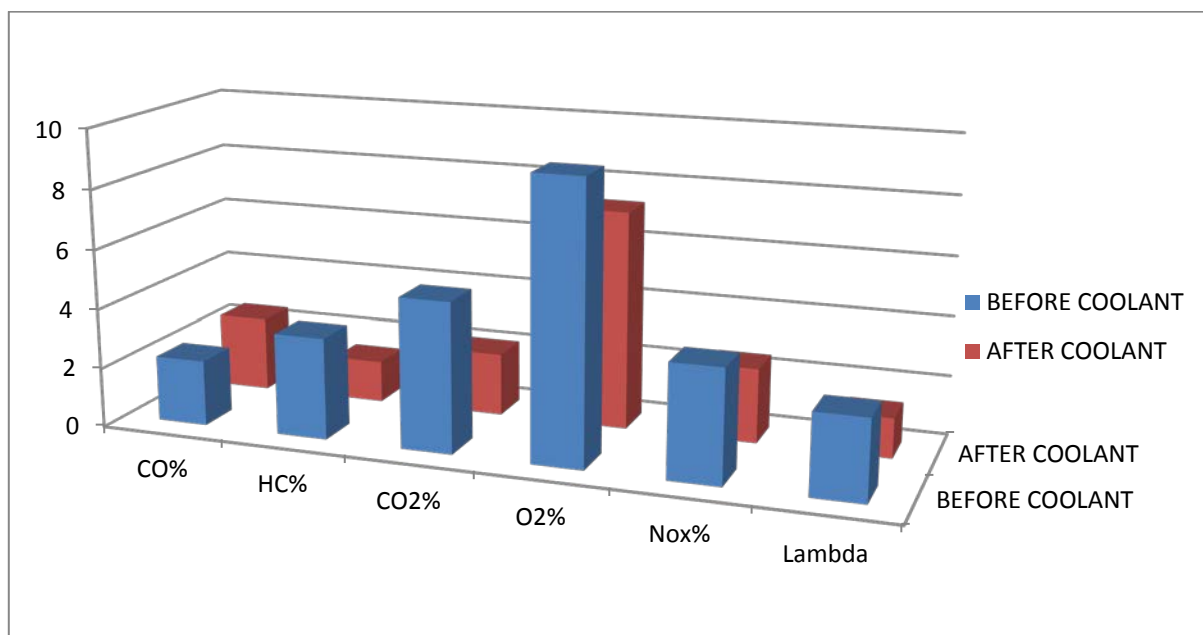


Fig 4: Comparison of result in the form of graph of pollution content before and after coolant used and examine the increment and decrement on this.

## VII. CONCLUSION

The above results shows that there is huge decrement in the pollution content ,but the limitation is for about CO percentage .CO percentage increases as on increasing the cooling effect. But we can conclude that there will be number of pollution content whose percentage is decreasing while increasing the CO percentage. There is also decrement in the oxygen level ,but it does not make much on us, because oxygen is already present in our environment in sufficient amount.

## VIII. ACKNOWLEDGEMENT

I would like to address sincere thanks to all people who were involved in the while process of writing this thesis.

It gives me immense pleasure to express my deepest sense of gratitude and sincere thanks to my highly respected guide **Dr Arun Wamankar**, Associate professor of Mechanical Engineering Department LNCT, Bhopal and my **Co Guide Proff. Jitendra Raghuwanshi** for accepting me to work under their valuable guidance, closely supervising this work over the past few months and helpful suggestion .Their valuable advice and support ,inspite of their busy schedule have really been an inspiration and driving force for me. They constantly enriched my raw ideas with their experience and knowledge . Finally ,a special word of thanks to my parents for encouragement for this work.

I am also thankful to all the staff member of the department of Mechanical Engineering ,LNCT BHOPAL , for their cooperation in this work.

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