International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 09 | Sep 2020 www.irjet.net p-ISSN: 2395-0072

Emission Control by Aqua Silencer

Viral lad[1], Abhi Patel[2], Aman Patel[3], Dhruv Patel[4], Mihir Dhimmar[5], Mr. R.P Patel[6]

[1-5]B.E in Mechanical Engineering, Government Engineering College, Bharuch, Gujarat, India
[6]Assistant Professor Mechanical Dept. Government Engg. College, Bharuch, Gujarat, India

---

Abstract - Air pollution is most important from the public health of view, because every individual person breaths approximately 22000 times a day, inhaling about 15 to 22 kg of air daily. An **aqua silencer** is a concept which is designed to replace conventional single unit engine silencers on board structure. It is made to deal with the control of overall emissions and undesirable sound at the engine exhaust of the vehicle. Sound produce due to working of the engine can be controlled by using water as sound produce in water is less hearable than produce in open air. This is mainly because of small sprockets in water molecules which lowers its amplitude, thus lowers the sound level. Exhaust emissions are controlled by applying a layer of activated charcoal on a perforated tube. Activated charcoal is highly porous and possesses free extra valances and has good absorption properties. So it absorbs the gases from the engine and releases much less portion to the atmosphere. The level of the sound and smoke coming out of the **aqua silencer** is considerably less than conventional silencer. Therefore, serious attempts should be made to conserve the earth's environment from degradation.

Keywords: Aqua Silencer, Emission control, Noise Pollution, Charcoal, Urea based water, Air Pollution

I. Introduction

Aqua silencer is made to reduce the level of noise and emission in IC engines. The main objective why we go for aqua silencer is, in today's life the air pollution causes physical ill effects to the human beings and also to the nature. The main reason behind the air pollution is automobile releasing the gases like carbondioxide and unburnt Hydrocarbon. Carbon emission is the release of carbon into the atmosphere. The carbon emissions are directly referred to the greenhouse gas emissions. The main contributors to climate change. Since greenhouse gas emissions are often calculated as carbon dioxide equivalents, they are called as carbon emissions, when discussing global warming or the greenhouse effect. In industries the burning of fossil fuels has growing in high value, simultaneously increasing of carbon dioxide levels in our atmosphere and thus the rapid increase of global warming. In order to avoid this type of gases, aqua silencer is introduced

II. Literature Survey

1) By Keval I. Patel, Mr. Swastik R, Gajjar

❖ **Design and Development of Aqua Silencer Four Two Stroke Petrol Engine.**

In this paper, by using water as a medium the sound can be lowered and also by using activated charcoal in water we can control the exhaust emission to a greater level.The aqua silencer is more effective in the reduction of emission gases from the engine exhaust using perforated tube and charcoal. In this the U Bend is provided instead of a non-return valve which is a mechanical device, which normally allows fluid (liquid or gas) to flow through it in only one direction. The Aqua Silencer was filled with water and it is directly connected to the exhaust pipe of the engine. There is a chance for the water to get enter into the engine cylinder. To avoid this, U bend is used.

2) S. Richard Brinton, S. Saravanamanoj, G. Sarath Kumar, Sathish Kumar

❖ **Design &Development of Aqua Silencer Using Lime Water**

In this paper, by using lime water as a medium, the sound levels have been reduced and by using activated charcoal in water, it produces almost pollution-free and smokeless emission and is also cheap considering long term use.The activated charcoal layer and metallic mesh covers is provided around circumference of perforated tube. The perforated tube contains the lime water inside it which chemically reacts with exhaust gas from the engine.

3) Supriye Morye, Sameer Mestry, Prajakta Desai, Akshay Parulkar

❖ **Development of Aqua Exhaust Test Rig**

In which the Aqua Silencer is connected with the exhaust of the pipe with the help of flange and after that the non-return valve is connected. The exhaust is passed into the perforated tube and then passing through water so emission and noise will be reduced in 4 stroke petrol engine.

4) Rawale Sudrshan & Patil Nehal S,

❖ Use Of Aqueous Ammonia In Silencer For Removal Of 02, So2 And Nox From Exhaust Gases Of I.C. Engine

By using aqueous ammonia in water as a medium, the sound levels have been reduced and by using activated charcoal in water, it produces almost pollution-free and smokeless emission and is also cheap considering long term use.

5) Vaidehi gulhane, Shubham Hande, V. M. Chavan

❖ Emission & Noise Control Device Aqua Silencer

In this system fuel consumption remainsame as conventional silencers because the use of perforated tube. Due to use of water as a medium ,these system having pollution free emission and smokeless. This system is very cheap. This system is used for both four wheelers and two wheelers.

6) S Santhosh Sathish Kumar, S.Richard Brinton, G.Sarath Kumar, S.Saravanamanoj

❖ Design and Fabrication of Eco-Friendly Aqua Silencer

The basically an aqua silencer consists of a perforated tube which is installed at the end of the exhaust pipe. The perforated tube may have holes of different diameters. The very purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles the perforated tube of different diameter and thus the huge mass of gas from the silencer is spitted into smaller mass and the whole set of working tends to be simplified. Generally, 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. Around the circumference of the perforated

7) Rishikesh Acharekar, Digvijay Bhujbal, Omkar Bhingole, Nitin Sherkar, Prof. Argade R.R.

❖ Design, Development and Experimentation of Aqua Silencer for Four Stroke Petrol& Diesel Engine

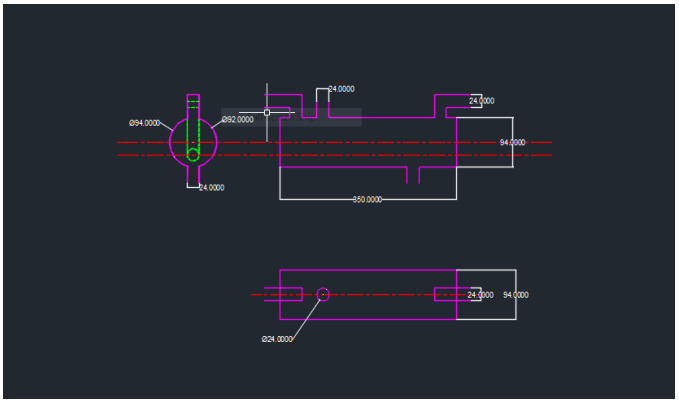
In which the Aqua Silencer is connected with the exhaust of the pipe with the help of flange and after that the non-return valve is connected. The exhaust is passed into the perforated tube and then passing through water so emission and noise will be reduced in 4 stroke petrol engine.

III. Method

Basically an Aqua Silencer consists of a perforated tube which is installed at the end of the exhaust pipe. The perforated tube may have holes of different diameters. The very purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles the perforated tube of different diameters. Generally, 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. Perforated tube contains lime water inside it which chemically reacts with exhaust gas from the engine. Around the circumference of the perforated tube a layer of activated charcoal is provided and further a metallic mesh covers it. The whole unit is then placed in a water container. A small opening is provided at the Top of the container to remove the exhaust gases. A U bend is provided at the end of perforated tube which functions as a non-return valve which prevents the back flow of exhaust gas and lime water back to the engine.

As the exhaust gases enter in to the Aqua Silencer, the perforated tube converts high mass bubbles in to low mass bubbles after that they come in to contact with lime water they chemically react with it and pass through the pass through charcoal layer which again purify the gases. It is highly porous and posse extra free valences so it has high absorption capacity. Since the charcoal layer is covered with outer shell which is filled with water. Sound produced under water is less hearable than it produced in atmosphere. This is mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level hence Aqua Silencer reduces noise and pollution.

IV. Design and Parts



Parts of Aqua Silencer

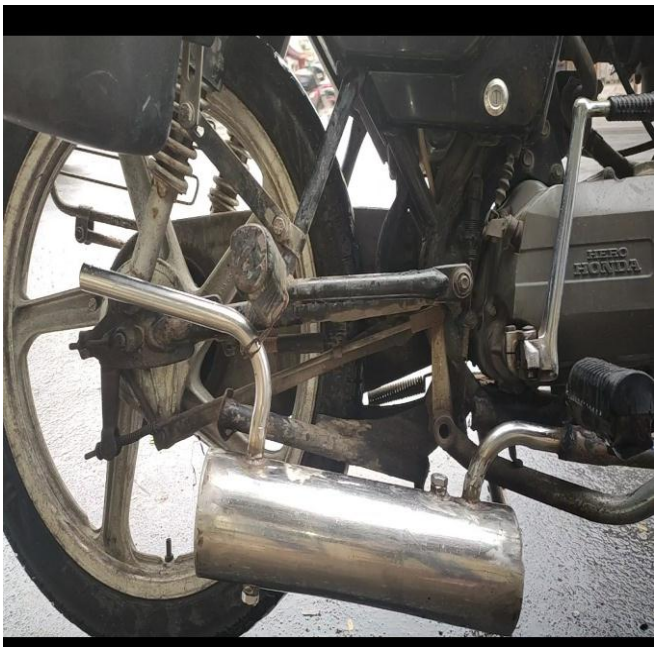
1. **Perforated Tube**: The perforated tube consists of number of holes of different diameters. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube

2. **Flange**: A flange joint is a connection of pipes, where the connecting pieces have flanges by which the parts are bolted together. Here flange is used to connect the silencer to the engine.

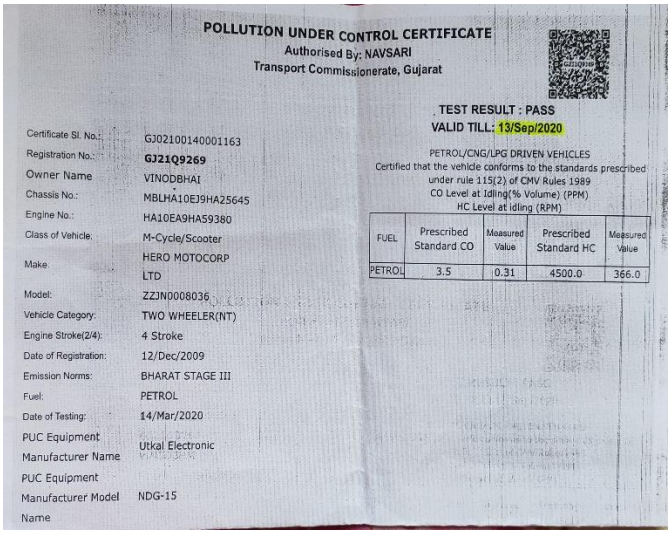
3. **Charcoal Layer**: The charcoal layer has more absorbing capacity because it has more surface area. This charcoal is called as **ACTIVATED CHARCOAL**. It is produced by heating the charcoal above 1500 0c for several hours in a burner. Its surface area gets increased.

4. **Outer Shell**: The whole setup was kept inside the outer shell. It is made up of iron or steel. The water inlet, outlet and exhaust tube was provided in the shell itself.

Experimental setup



V. Result



POLLUTION UNDER CONTROL CERTIFICATE
Authorised By: NAVSARI
Transport Commissionerate, Gujarat

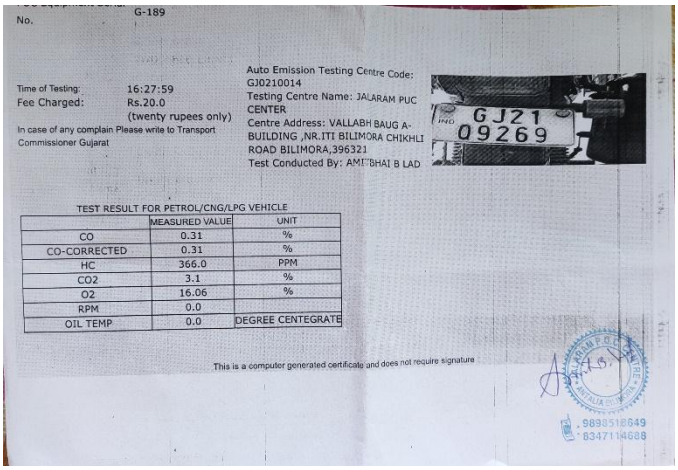
TEST RESULT : PASS
VALID TILL: 13/Sep/2020

PETROL/CNG/LPG DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989
CO Level at Idling(% Volume) (PPM)
HC Level at idling (RPM)

FUEL	Prescribed Standard CO	Measured Value	Prescribed Standard HC	Measured Value
PETROL	3.5	0.31	4500.0	366.0

Certificate Sl. No.:	GJ02100140001163
Registration No.:	GJ21Q9269
Owner Name	VINODBHAI
Chassis No.:	MBLHA10EJ9HA25645
Engine No.:	HA10EA9HA59380
Class of Vehicle:	M-Cycle/Scooter
Make	HERO MOTOCORP LTD
Model:	ZZJN0008036
Vehicle Category:	TWO WHEELER(NT)
Engine Stroke(2/4):	4 Stroke
Date of Registration:	12/Dec/2009
Emission Norms:	BHARAT STAGE III
Fuel:	PETROL
Date of Testing:	14/Mar/2020
PUC Equipment Manufacturer Name	Utkal Electronic
PUC Equipment Manufacturer Model Name	NDG-15

Registration of Vehicle



No. G-189

Time of Testing: 16:27:59
Fee Charged: Rs.20.0 (twenty rupees only)
In case of any complain Please write to Transport Commissioner Gujarat

Auto Emission Testing Centre Code: GJ0210014
Testing Centre Name: JALARAM PUC CENTER
Centre Address: VALLABH BAUG A-BUILDING ,NR.ITI BILIMORA CHIKHLI ROAD BILIMORA,396321
Test Conducted By: AMIT BHAI B LAD

IND GJ21 09269

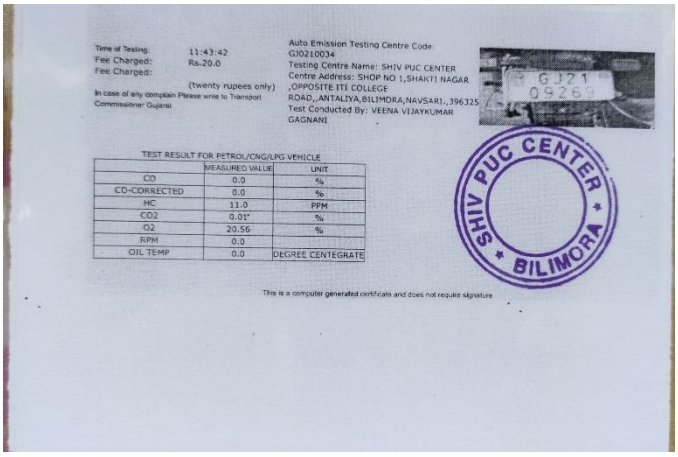
TEST RESULT FOR PETROL/CNG/LPG VEHICLE

	MEASURED VALUE	UNIT
CO	0.31	%
CO-CORRECTED	0.31	%
HC	366.0	PPM
CO2	3.1	%
O2	16.06	%
RPM	0.0	
OIL TEMP	0.0	DEGREE CENTEGRATE

This is a computer generated certificate and does not require signature

9898518649
8347114688

P.u.c test with conventional silencer



Time of Testing: 11:43:42
Fee Charged: Rs.20.0 (twenty rupees only)
In case of any complain Please write to Transport Commissioner Gujarat

Auto Emission Testing Centre Code: GJ0210034
Testing Centre Name: SHIV PUC CENTER
Centre Address: SHOP NO 1,SHAKTI NAGAR ,OPPOSITE ITI COLLEGE ROAD,,ANTALIYA,BILIMORA,NAVSARI,,396325
Test Conducted By: VEENA VIJAYKUMAR GAGNANI

IND GJ21 09269

TEST RESULT FOR PETROL/CNG/LPG VEHICLE

	MEASURED VALUE	UNIT
CO	0.0	%
CO-CORRECTED	0.0	%
HC	11.0	PPM
CO2	0.01	%
O2	20.56	%
RPM	0.0	
OIL TEMP	0.0	DEGREE CENTEGRATE

SHIV PUC CENTER BILIMORA

This is a computer generated certificate and does not require signature

P.UC test with Aqua silencer

Comparison between Conventional silencer and Aqua silencer

PARTICULAR	CONVENTIONAL SILENCER	AQUA SILENCER
CO(% volume)	0.31	0.0
CO Corrected	0.31	0.0
HC(ppm volume)	366.0	**11.0**
CO2(% volume)	3.1	**0.01**
O2(% volume)	16.06	**20.56**
RPM	0.0	0.0
OIL TEMP	0.0	0.0

VI. Conclusion

By using perforated tube, the fuel consumption remains same as conventional system by using water and urea as a medium the sound can be lowered and also by using activated charcoal in water we can control the exhaust emission to a greater level.

The water contamination is found to be negligible in aqua silencer. It is smokeless and pollution free emission equivalent to the conventional to the silencer.

VII. References

1. Keval I Patel, Mr. Swastik R Gajjar, “Design And Development Of Aqua Silencer For Two Stroke Petrol Engine”, IJIRST–International Journal for Innovative Research in Science & Technology, Vol: 1, Issue: 1, June 2014.

2. Martin C. Stumpe and Helmut Grubmuller, “Aqueous Urea Solutions: Structure, Energetics, and Urea Aggregation”, J. Phys. Chem. B 2007, 111, Pg no 6220- 6228

3. P.Balashanmugam, G.Balasubramanian, “Developments of Emission and Noise Control Device(Aqua Silencer)” International Journal of Modern Trends in Engineering and Research, Vol: 2 Issue: 1, January 2015.

4. S.*, PatilSnehal S., NandrekarAmruta A., Abhijeet S. Kabule, “Use Of Aqueous Ammonia In Silencer For Removal Of Co2, So2 And Nox From Exhaust Gases Of I.C. Engines” RawaleSudarshan International Journal of Engineering Science and Innovative Technology (IJESIT)Volume 2, Issue 5, September 20.

5. .Balashanmugam1, G.Balasubramanian2,” Developments of Emission and Noise Control Device (Aqua Silencer)”; Scientific Journal Impact Factor (SJIF): 1.711International Journal of Modern Trends in Engineering and

Research.

6. JuhiSharaf; " Exhaust Emissions And Its Control Technology For An Internal Combustion Engine" International Journal of Engineering Research and Applications , Vol. 3, Issue 4, Jul-Aug 2013.