

Research Paper on Design and Fabrication of Carbon Soot Collector and Ink Formation

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Abstract— Every time when fossil fuels burn they release carbon dioxide. Major part of carbon dioxide in atmosphere is taken by the automobile exhaust. In natural way the carbon dioxide is re-absorbed by plants and trees. In current situation peoples are capturing carbon dioxide from exhaust pipes of large industries. But we know that the exhaust releasing from automobiles take part of 40-50% of total carbon dioxide in atmosphere. In India every year around 175 million vehicles get registered, and the number get increased year by year. Carbon soot collection from automobile exhaust does the job of collection carbon soot (in powdered form) from the exhaust outlet of vehicles. In this case truck and buses contribute large amount of carbon dioxide deposition. The carbon soot collector device is fitted at the end of the exhaust pipe, where it is fitted with clamps. After collection of soot from automobiles, this soot is then treated in lab with various chemicals and additives to create ink from soot. With the help of this we can reduce the pollution and reuse that pollution to create a usable ink or paints from it. There are some limitations while designing the collector device and in formation of ink with the application of this technique we have a better achievement point as well.

Key words: Automobiles, Exhaust, Carbon Soot, Collector Device, Ink Formation

I. INTRODUCTION

Mostly modern automobile engines are coming with hybrid technology or with electric motor/engines. But in previous generation models most of the engines use fuels like petrol diesel to power the driven train by burning them. This burning of fuels creates lots of carbon footprints in the environment which causes the effect of global warming. Because of this scientist done a research and development on reducing this carbon footprints. They created various filters to filter out the exhaust gases from automobile. In previous some years large no. of vehicles have been reg. in worldwide, which are creating lots of pollution. Therefore we come with solution to create a useful and handy device that collects the carbon soot by filtering the exhaust gases. This soot is then goes through lab testing to confirming it is ready to use in ink formation process. After testing is done then it is goes to process of forming ink, where various additives, pigments, and oils are mixed with it to create writeable ink. This ink is then used for various purposes like refillable ink for pens, markers or even for printing ink printer otherwise in Xerox machines. If this ink formation is takes place in large scale it will replace the conventional chemical ink by large scale. It also is a product from waste to useful material.

II. OBJECTIVES

- To capture carbon soot (Soot particles in collector device).
- Formation of ink from carbon soot

- Replacing harmful chemicals by natural and cheap ingredients for ink formation.
- Reduce the cost of ink than the conventional one (Recently used in market).

III. PROJECT DETAILS

A. Carbon Soot Collector:

Carbon soot collector device is fitted on the exhaust of automobiles. This is the device which collects the carbon soot from automobiles. The carbon soot collector connects at tail section of exhaust with clamp fitting. The carbon soot collector is very useful and handy device to handle. Carbon soot collector has four main parts connected to each other with clamping mechanism, which is easy for fitting and easy for cleaning for carbon soot collection. In carbon soot collector filter is fitted in such a way that it can be easily replaceable and easy for cleaning/collection. This device is then fitted with activated carbon collector which is fitted in the centre of the collector. The CAD modelling of the carbon soot collector is show in below,

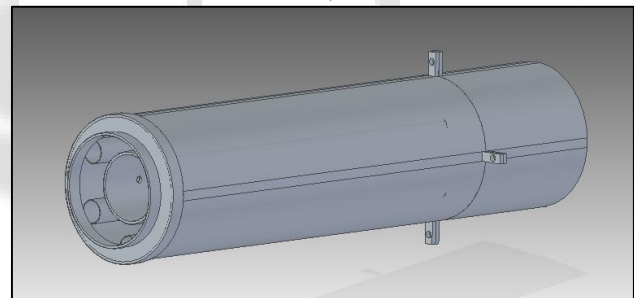


Fig. 1: Carbon Soot Collector

B. Activated Carbon Filter:

The most important part of carbon soot collector is filter we used in it. It must be lighter in weight, also it should capture carbon soot particles from exhaust gases of automobile. For this specific functions we choose activated carbon filter. This filter is produce by Philips, named as 'Philips activated carbon filter AC4103/00'. This activated carbon filter has special properties that can capture volatile organic compound and various gas pollutants from exhaust gases. This filter has capacity to capture particles from size range between 3 to 50 micrometre. Thus capacity of filter is sufficient for capturing carbon soot.



Fig. 2: Activated Carbon Filter

C. INK Formation:

As the soot collected from collector this soot goes from blending process where its particles breaks into the finest particles. This soot is then goes for ink formation process, where soot is treated with household chemicals that are easily available in market. This makes ink much cheaper than the conventional ink.

IV. WORKING

For making of carbon soot collector we selected stainless steel because of its corrosion resistance, temperature (high heat transfer coefficient), light in weight with high in strength and durability than the mild steel and cast iron.

As the collector is made it is fitted to exhaust of automobile (specially for heavy vehicles). The connector section is either fitted manually or welded on tail pipe of exhaust of vehicle. This allows easing in removal of collector device for collecting soot and for ease in refitting of collector device.

In the middle section of collector device the activated carbon filter is fitted in it. This filter allows to collect the carbon soot in powder form. The other section of collector is doing the job not creating extra backpressure on the system.

Following images shows that the carbon soot is collected in actual practice on



Fig. 3: Collector Fitted to Bus Exhaust



Fig. 4: Collection of carbon soot

After the collection of carbon soot, this soot is then treated with various chemical to create the ink. We specifically made the marker pen ink which is easier in formation as well as easy to use. For the formation of Marker pen ink we use the household chemicals or chemicals which are easily available in market.

In the process of process of formation of marker pen ink we used Ethyl acetate, Glycerine, Calcium carbonate, Sodium bicarbonate, Carbon soot in proper proportion. Also we use additional binders for breaking the surface tension of carbon soot which is oily and do not mix properly with other chemicals. This additional binders are alcohol and spirit. We have created various three samples using different binders and tested in certified laboratory.

As the Marker pen is successfully created in the easiest possible way using waste carbon soot which is collected from exhaust gases of heavy vehicles.

V. RESULTS

- The following results are of PUC test done on the vehicle after fitting the collector device

MAHARASHTRA MOTOR VEHICLES DEPARTMENT	
POLLUTION TEST CERTIFICATE FOR 3/4 WHEELER / HEAVY VEHICLES (DIESEL)	
Motor Vehicle Number	
Date of Issue	30-03-2019
Date of Expiry	29-09-2019
Serial Number	Emission Test Result
P.A.4W 263735	Smoke Density in Hartridge Smoke Units 30/25% HSU OK

This shows that the reduction in pollution by 25%.

- The Following tests Results are Done On The Various Ink Samples Done in Certified Laboratory

These Samples are made with keeping the main ingredients in common but changes in binders in additional :-

Sample No.	Solvents added to key Ingredients	Results
1.	Added Alcohol (5ml)	Relative Density = 1.0 g/cc Drying Time = 5.0 sec pH Value = 6.2
2.	Added Spirit (10ml)	Relative Density = 0.9 g/cc Drying Time = 5 sec. pH Value = 8.78
3.	Added alcohol (5ml) + Distilled water (5ml)	Relative Density = 0.6 g/cc Drying Time = 9 Sec. pH Value = 9.59

These Tests are Done by using Test methods which are standardized by Indian Standards for Inks and pens (IS 5805:1993).

As by the results Sample no. 1 & 2 Fails in passing the test as the pH values of both ink Passes its range for passing (6 to 6.5). Also the sample no. 3 fails in drying time whether it should be within 5 sec. and it clocks about 9 sec.

But the sample no. 1 Passes the all test which is made from adding alcohol and which is said to be superior in our terms.

Also the formation of ink much cheaper than the conventional Marker pen ink in the market. It is made in only RS. 50 for the formation of 100ml ink, where it cost RS. 70 to 80 in market for conventional inks.

VI. CONCLUSION

- Activated carbon filter is cheap alternative to expensive filter. Activated carbon filter (Philips AC4103/00) costing of Rs. 900, where the other filters are more expensive.
- In actual working of collector device carbon soot is collected in filter.
- This method of creating soot into a useful ink, which leads to harvesting green energy for useful purpose.
- Successfully created marker pen ink from carbon soot.
- This ink satisfies the standard ink specification as it tested in chemical laboratory.

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