MINIMIZATION OF PM 10 & 2.5 OF ATMOSPHERE BY USING USED ENGINE OIL

Mr. Kale Satish Sukhdev
B.E Mechanical Engineering, ICEEM College Aurangabad

Abstract: Global warming and global climatic changes resulted from anthropogenic PM2.5&PM10 emissions become the main issue recently. Since, the beginning of industrial revolution, the concentration of PM has increased more than 25% in the atmosphere, and resulted in various catastrophic occurrences. Our research is focused on decreasing the level of PM from increases of a vehicles or industrial by adsorption technology. The adsorption is carried out in an absorber like device containing a used engine oil through which the exhaust gases are enter. After adsorption we found a significant amount of PM reduction excellent Efficiency.
Keywords: Global warming, Emission PM2.5,PM10, catastrophic, industrial emissions, automobile emissions, adsorption, Adsorbent, physical adsorption.

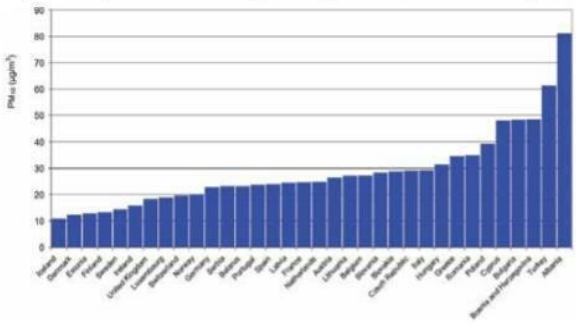
I. INTRODUCTION

I. PM 2.5 & PM10 Emissions and Its Adverse Effects on Environment:

Global warming: - A gradual increase in the overall temperature of the earthts atmosphere generally attributed the greenhouse effective caused by increased levels of carbon dioxide, CFCs and other pollutants. Global Land-Ocean Temperature Index. Vehicle emissions can affect the environment in several ways. Cars and motorcycles emit greenhouse gasses, such as carbon dioxide, which contribute to global warming. Some air pollutants and particulate matter from these can be deposited on soil and surface waters where they enter the food chain; these substances can affect the reproductive, respiratory, immune and neurological systems of animals.

The WHO Environment and Health Information System (ENHIS), which is based to a large extent on data submitted by European Union (EU) member states to the European Environment Agency AirBase (3), includes PM10 monitoring data from urban and suburban background locations. Fig. 1 presents the population exposure, expressed as annual mean concentration of PM10, weighted by the population in cities with data, in 403 cities in 34 WHO European Member States for 2010. In only 9 of these 34 Member States, PM10 levels in at least some cities are below the annual WHO air quality guideline (AQG) level of 20 µg/m3. Almost 83% of the population of the cities for which PM data exist is exposed to, PM10 levels exceeding the AQG levels. Although this proportion remains high, it is an improvement compared to previous years, with average PM10 levels slowly decreasing in most

Fig. 1.
Population-weighted annual mean PM_{10} in cities by WHO European Member State, 2010



II. EFFECTS OF GLOBAL WARMING ON ENVIRONMENT

- As climate changes, the probability of certain types of r weather events are affected. Changes have been observed in the amount, intensity, frequency and types of precipitation in Rain.
- The cryosphere is made up of areas of the earth which are covered by snow or ice. Observed changes in the cryosphere include declines in Arctic sea ice extent, the widespread retreat of alpine glacier and reduced snow cover in the Northern Hemisphere.
- The oceans serve as a sink for carbon dioxide, taking up much that would otherwise remain in the atmosphere, but increased levels of CO2 have led to ocean acidification. Furthermore, as the temperature of the ocean increases, they become less able to absorb excess CO2.
- Amount of oxygen dissolved in the oceans may decline with adverse consequences for ocean life

III. PARTICULATE MATTER EMISSIONS

"Particulate matter" (PM) is the general term used to describe solid particles and liquid droplets found in theair. The composition and size of these airborne particles and droplets vary. Some particles are large enough to be seen as dust or dirt, while others are so small they can only be seen using a powerful microscope. Two size ranges, known as PM10 and PM2.5, are widely monitored, both at major emissions sources and in ambient air. PM10 includes particles that have aerodynamic diameters less than or equal to 10 microns (µm), approximately equal to one-seventh the diameter of human hair. PM2.5 is the subset of PM10 particles that have aerodynamic diameters less than or equal to 2.5 µm. Particles within the two size ranges behave differently in the atmosphere. PM2.5, or fine particles, can

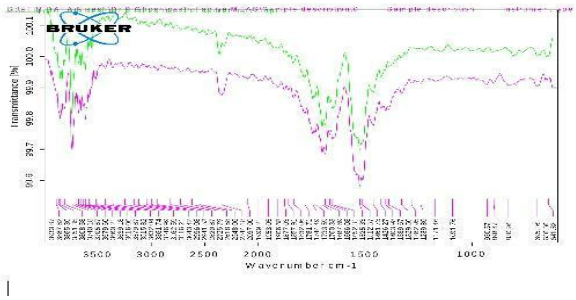
remain airborne for long periods and travel hundreds of miles. Coarse particles, or the subset of PM10 that is larger than 2.5 μm, do not remain airborne as long and their spatial impact is typically limited because they tend to deposit on the ground downwind of emissions sources. Larger coarse particles are not readily transported across urban or broader areas because they are generally too large to remain suspended in air and they tend to be removed easily on contact with surfaces. In short, as the particle size increases, the amount of time the particles remain airborne decreases. The PM Concentrations indicator describes the various ways PM can harm human health and the environment. PM can be emitted directly or formed in the atmosphere. Primary" particles are those released directly to the atmosphere. These include dust from roads and black and/or elemental carbon from combustion sources. In general, coarse PM is composed largely of primary particles. "Secondary" particles, on the other hand, are formed in the atmosphere from chemical reactions involving primary gaseous emissions. Thus, these particles can form at locations distant from the sources that release the precursor gases. Examples include sulfates formed from sulfur dioxide emissions from power plants and industrial facilities and nitrates formed from nitrogen oxides released from power plants, mobile sources, and other combustion sources. Unlike coarse PM, a much greater portion of fine PM (PM 2.5) contains secondary particles.This indicator presents trends in annual average primary PM emissions data tracked by the National Emissions Inventory (NEI). The NEI tracks emissions data, both measured and estimated, for primary particles only and therefore may only be representative of a small fraction of all emissions that serve to form PM 2.5. Because secondary particles are not released directly from stacks, the NEI instead tracks the precursors that contribute to formation of secondary particles. These precursors include nitrogen oxides, dioxide, ammonia, and other gases (e.g., particle-producing organic gases), some of which are addressed in separate indicators (the Nitrogen Oxides Emissions indicator; the Sulfur Dioxide Emissions indicator). As noted above, particles formed through secondary processes are not included in this indicator. Primary emissions of PM can exist as solid or liquid matter (the "filterable" portion) or as gases (the "condensable" portion). Data for the condensable portion exist only for the years 1999 to 2011. To allow for a valid comparison of emissions trends from 1990 to 2011, only data for the filterable portion of PM10 and PM2.5 are included in the trend graphs. Condensables are, however, included in the pie charts shown inExhibits 2 and 5.

All emissions data presented in this indicator are taken from the NEI. Primary particulate emissions data represented for the traditionally inventoried anthropogenic source categories: (1) "Fuel combustion," which includes emissions from coal-, gas-, and oil-fired power plants and industrial, commercial, and institutional sources, as well as residential heaters and boilers; (2) "Other industrial processes," which includes chemical production, petroleum refining, metals production, and processes other than fuel combustion; (3) "On-road vehicles," which includes cars, trucks, buses, and motorcycles; and (4) "Conrad vehicles and engines," such as farm and construction equipment, lawnmowers, chainsaws, boats, ships, snowmobiles, and aircraft. For 2011 only, this indicator includes a comparison of these anthropogenic sources with emissions from miscellaneous and other sources, such as agriculture and forestry, wildfires and managed burning, and fugitive dust from paved and unpaved roads. The NEI also documents estimates of primary emissions from fugitive dust and miscellaneous sources. The NEI is a composite of data from many different sources, with PM data coming primarily from EPA model as well as from state, tribal, and local air quality management agencies. Different data sources use different data collection methods, and many of the emissions data are based on estimates rather than actual measurements. For mobile sources, the data are based on mobile source models for on-road and nonroad vehicles, often using state-supplied model inputs (U.S. EPA, 2015). Emissions from wildfires in 2011 come primarily from an estimation process that bases fire activity and location on satellite detection (U.S. EPA, 2015). For most fuel combustion sources and industrial sources, emissions are from the state, local, and tribal air quality management agencies and are estimated using emission factors.NEI data have been compiled since 1990 and cover all 50 states and their counties, D.C., the U.S. territories of Puerto Rico and Virgin Islands, and some of the territories of federally recognized American Indian nations. Data are presented for 1990, 1996, 1999, 2002, 2005, 2008, and 2011. With the exception of 1993,the NEI data are published on a triennial cycle, thus an annual trend is not readily available

IV. CHEMICAL ADSORPTION OR CHEMISORPTION

When the force of attraction existing between adsorbate and adsorbent are chemical forces of attraction or chemical bond, the process is called chemical adsorption or chemisorption. During this chemical adsorption is most major factor absorbed PM 2.5 and PM 10 .when lubricant oil and mixture base(KOH) during overall all reaction PM minimize during don't formed any new component in the oil by FTIR ANALYSIS report during this overall reaction .

Fig show FTIR reports of lubricating oil



V. FACTORS ON WHICH ADSORPTION DEPENDS

Properties of used engine oil 15W40 .

5.1Flash Point. The flash points of samples were analysedby open cup flash point apparatus by ASTM D97. A beakercontaining 10 mL of sample was placed on Bunsen Burner,which fittedwith thermometer. A flame source was

brought at intervals to determine the temperature at which a flash appears on the surface of the sample while the lube oil in the beaker was heated. The flash point of fresh lube oil i s 200◦ C, for used engine oil flash point is 120 C, in extraction by composite *solvent* treatment method flash point is 150◦

5.2) Specific Gravity. Specific gravity of treated oil samples was analyzed by digital hydrometer of Thermo-Hygro. Specific gravity of fresh engine oil was 0.90, while the Specific gravity of used engine oil was 0.93. the result of the was specific gravity for the composite solvent extraction treatment is 0.88, the specific gravity of single solvent single solvent extraction treatment is 0.858, and specific gravity of acid treatment0.909 as shown in Figure 3.We found that the value of specific gravity of used engine oil is more for recycled oil by different methods. It could be lower or higher than fresh engine oil depending on the nature and type of contaminations

5.3) Viscosity. Kinetic viscosity of used engine oil can being increased due to oxidation or contamination, while it may also be decreased due to dilution with light fuels (diepetrol) [8]. Viscosity of fresh lube oil is 90 cP, used engine oil 120 cP, which shows presence of contaminations in used engine oil, where the viscosity values of refined engine oils by composite solvent method, single solvent method, and acid treatment method are 94 cP, 98 cP, and 92 cP, respectively. Figure 4 shows that the used oil has high viscosity due to contaminations. Acid treatment method has an advantage over others. Pour Point. Pour points of samples were analysed by

5.4) pour point apparatus by ASTM D97 in which 20 mL of samples of oil were introduced into a test tube, and then the samples were highly cooled at specific rate. The temperature which certain hydrocarbons (Paraffin) began to convert into crystalline form called cloud point. On further cooling the oil samples stopped to flow, and that temperature was called the pour point of that oil. By this way cloud point and pour point of used and re-refined engine oil were analysed. Pour point of lube oil may be decreased and increased, depending on the nature of lube oil method of refining [12].The result chart in Figure 5 shows that th e pour point of fresh

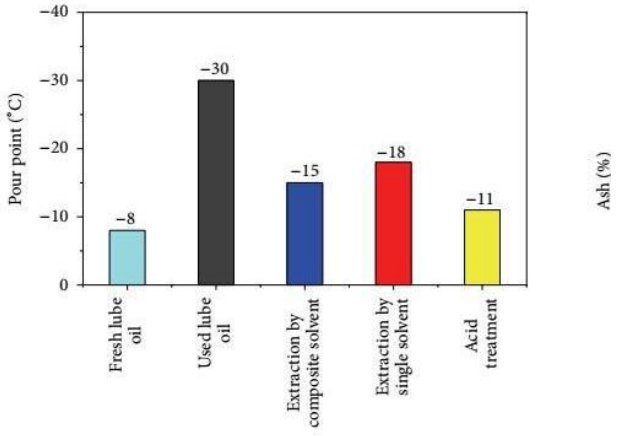


FIGURE 5: Effect of refining on pour point.

oil is −8◦C and used engine oil is −30◦C. This decrease in pour point is because of degradations of additives, which were present in fresh oil as pour point depressants. Pour Point values of refined engine oils by composite solvent, single solvent, and acid treatment are −15◦C,

−18◦C, and−11◦C, respectively. These results show that the two method(i.e., acid treatment and extraction by composite solvent) are comparatively better than single solvent extraction method

5.6) Ash Percentage. From experiment result it was found that the percentage of ash in fresh oil is 0.01%, percentage of ash in used engine oil is 2.02%, percentage of refined oil by Composite extraction is 0.09%, in single solve treatment 0.15% ash was found, and acid treatment method gave 0.04% ash in refined oil ras shown in Figure 6. The acid treatment method and extraction by composite solvents has an advantage over single solvent extraction treatment

VI. OBJECTIVES OF OUR PROJECT IS

I. To minimize the level of PM in the environment.
II. To adsorb PM 2.5 andPM 10 from emission gases .
III. To determine the PM removal efficiency through the engine oil
IV. To prepare an eco-friendly and cost efficient adsorption model which can selectively reduce PM level from the exhaust gases of automobiles.
V. To make a handy pollution control device for convenient and comfortable traveling for bikes automobile

VII. LITRATURE SURVEY

I. Environmental Effects of missions Exhaust Global and Local Effects- A Comparison between Gasoline and Diesel: - n the above paper there is a comparison between two fuel exhaust system i.e. Gasoline and Diesel. When gasoline burn it produce carbon monoxide(CO), hydrocarbon(HC), carbon dioxide(CO2) and polycyclic aromatic hydrocarbon(PAHs) and when diesel is burn it produce nitrogen oxides(NOx) and particulate matter(PM). The result shows this paper is that burning gasoline and diesel fuel and to determine which fuel and its developed forms are less harmful to humans and which are most suitable for the environment. Gasoline fuel generate about 50% more CO2 than diesel fuel, and it also emit about ten times more CO, PAHs and around five times moreHC than diesel fuels; burning diesel fuel will produce less CO2 emission than gasoline fuel, but will produce around ten times more NOx and PM than gasoline fuels. It also suggest that using a gasoline fuel in urban areas might help to reduce the human health effects and using the diesel fuel on motorways or in rural areas might help to reduce greenhouse gases(GHG) emission and minimize the global warming effect. Considering the diesel fuel exhaust emission NOx and PM are the two major problems. CO, CO2 and HC of diesel fuel exhaust emission are much lower than gasoline fuel counterpart. Due to the higher fuel economy and less the emission, diesel vehicle take a more and more important role in world auto mobile market.

VIII. EXPERIMENTATION

I. Design: -
Total Volume: - L×B×H ≡ .025x0.25x0.25m

Experimental Setup: -
1. System consists of three compartments: -
a) Gas Inlet Section
b) engine oil 1 litter
c) Gas Outlet Section
2. System made up of CR (Cold Rolling Steel) Sheet which is fabricated by welding process to avoid leakages.
3. The inlet pipe and outlet pipe are of 1 inch and 1inch

Experimental Run or Procedure: -

- Take analysis of Exhaust gas of bike before attaching the system to generator exhaust.
- Attach the system to the exhaust of generator by provided riveted joints and connect the inlet of system to the outlet of generator
- Start the generator
- Run the generator for particular time , the exhaust gases will release from the engine of generator
- These gases passed through the inlet of system into 1st compartment of the system
- Then due to this pressure, the gases start to pass through tank engine oil
- After adsorption of PM from the inlet Tank soluble engine oil gases come out into liquid form
- At this stage again take analysis of exhaust gas which will coming out from outlet of system and compare

Cost Estimation: -

1) Fabrication + Material cost 1000

62) Analysis : ₹. 200

3)used engine oil : ₹. 100

4) Total cost : ₹. 1300

Advantage of Model: -

- Our project is helpful in preventing PM release into the environment which is a major GHG.
- It is useful in PM capturing which has significance on land, i.e., in farms, in industries.
- It is a good air pollution control option.
- A person using this device would be listed in responsible citizens‟ category contributing to pollution control as well as to nations welfare.
- It is less expensive technique as compared to others.

Disadvantage of Model: -

- The device may look big on a Two-wheeler.
- The person seating on the back seat may feel uncomfortable during travelling.
- Extra money need to be spent which Money

Results discussion:- Experimental results on Run: -
Actual experimental results (75% Removal of PM 2.5 & PM.10) After comparing the analysis of Exhaust gas before and after assembling system, the efficiency of CO2 adsorption of engine oil found out to be.
2) The type of adsorption on engine oil is chemical adsorption i.e. the adsorption

IX. CONCLUSION

We know that adsorption is a complex phenomenon to study as compared to distillation, absorption and many more unit operations but this process has adequate potential to dominate in pollution control techniques because if engine oil is used as an adsorbent then we can reduce the overall cost dramatically. Our research is absolutely focused on PM reduction from exhaust gases of a two-wheeler and four where by adsorption using Engine oil . For this purpose, we have designed the adsorption based model which is easily attachable to the exhaust section of a two-wheeler and is aspired to bring revolution in the field of vehicular pollution emissions and control. Although, we got less PM removal (20% Oily) during our experimentation but it enlightens us with the remedies and solutions that can be applied in reduction of PM from exhaust of automobiles. Lastly, we conclude by saying that our technology is helpful for society by minimizing carbon release from vehicles into the environment. It is also a brilliant topic for further research and development.

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