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Status of Respirable Suspended Particulate Matters: Concentration & Impact; In the Highly Motorized Areas at Jabalpur

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ABSTRACT

The determination of respirable suspended matter as a vital parameter in the analysis of pollution is done via gravitimatric analysis of a certain volume of air sample by means of APM-460 & APM-550 sampler. The device are intended to figure-out the prevailing concentration of particulate-matter ranging 2.5 micron & 10 micron. The parameter is a crucial constituent towards respiratory disorders, asthma and infection of lungs Jabalpur has a population of nearly 19 lak and has nearly 2.0lak vehicles of all sorts. Besides the vehicular –movement, a variety of commercial & constructional- activities lead to elaborate the dispersion of particulate matter.

Further, it is important to keep in mind that the concentration of particulate matter shows a significant variation throughout the year; as per the rains, cold and summer while the diurnal variations are commonly observed as a function of time and the level of activities initiated. The study centres around the prevailing status of the respirable suspended particulate matters during the summer. The best favour is attained when the rainfall activates and the environment becomes clear. Some-times the condition is more severe during winter season, due to inversion.

Keywords:—*Gravitimetric, inversion, respirable, diurnal-variation and whatman filter paper.*

I. INTRODUCTION

The determination of particulate matters is aimed at the studies, keeping in mind the significance of suspended particulate matters in the development of any location. The element is observed because of the interaction of the same with the human-health. Both the sizes of particulate –matter lead to breathing disorders, difficulty in breathing, asthma, lung-infection, scattering of light and reduced-visibility.

The observation of the existing level of pollutants is executed through the devices means for a close monitoring. The basic device that is put in use is

- Envirotech APM 460
- Envirotech APM 550.

To measure the ambient concentrations of Respirable Suspended Particulate Matter with the help of Respirable Dust Sampler incorporating Whatman Filter Paper.

II. LITERATURE REVIEW

In today's society there is a great need for environmental protection. Things that

happened during our parents and grandparents age have caused a great concern for our ozone, our air, and our environment. You constantly hear about the many sources of pollution, but we hardly ever hear about the solutions. In this, I will present one possible solution to the air pollution problem that has been caused by too many automobile emissions being released into the air. This possible solution deals with switching from diesel gas, to fuel trucks and bus fleets, to natural gas. I will discuss how this switch would assist in the reduction of air pollution and in this way help the environment.

There are many types of pollution such as: smog, acid rain, and greenhouse gas emissions. The causes of these pollutants include carbon monoxide, hydrocarbon, and nitrogen oxide, as well as various sulfur compounds. Pollutants are released into the air for several reasons. One reason is that diesel fuel does not burn as cleanly as natural gas. These pollutants are released into the atmosphere by the burning of the fuel. Automobiles are responsible for half of the world's pollution problem due to their use of these fuels. There have been 41 different toxic elements in diesel exhaust identified by the State of California. Of these toxins, about half are recognized or considered to be carcinogens.

Due to the problem that has been described up to now, there are several environmental laws that have been enacted to help control and reduce air pollution. The major law in this area would have to be the Clean Air Act of 1970. This was the highest point in history regarding air pollution. It was the largest law to be past regarding air pollution up to that point. Another legislative decision that has had a huge impact is the Clean Air Act Amendments of 1990. A few of the major points amended include: classifying areas.

Pollution is now a common place term that our ears are attuned to. We hear about the various forms of pollution and read about it through the mass media. Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty.

III. The Sources

Agricultural activities: Ammonia is a very common by product from agricultural activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers has grown up, emitting harmful chemicals into the air and water.

Exhaust from factories and industries:

Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds and chemicals into the air thereby deteriorating the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

Mining operations: Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons responsible for the deteriorating health conditions of workers and nearby residents.

Effects of Air pollution

1. Respiratory and heart problems: The effects of Air pollution are alarming. They are known to create several respiratory and cardiac disorders besides Cancer, among other threats to the body. Millions of people are known to have died due to direct or indirect effects of Air pollution. Children in areas exposed to air pollutants commonly suffer from

3. Acid Rain: Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combines with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals and crops.

4. Eutrophication: Eutrophication is a condition where high amount of nitrogen present in some pollutants gets developed on sea surface and turns itself into algae and adversely affect fish, plants and animal species. The green colored algae that is present on lakes and ponds is due to presence of this chemical only.

5. Effect on Wildlife: Just like humans, animals also face some devastating effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat. The toxic pollutants deposit over the surface of the water and can also affect sea animals

6. Depletion of Ozone layer: Ozone exists in earth's stratosphere and is beneficial for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydro chlorofluorocarbons in the atmosphere. As ozone layer will go thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

Exhaust from factories and industries:

Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds and chemicals into the air thereby deteriorating the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

4. Mining operations: Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons responsible for the deteriorating health conditions of workers and nearby residents.

5. Indoor air pollution: Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Have you ever noticed that once you paint walls of your house, it creates some sort of smell which makes it literally impossible for you to breath.

Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion etc.

1. Use public mode of transportation: Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of car pooling. If you and your colleagues come from the same locality and have same timings you can explore this option to save energy and money.

2. Conserve energy: Switch off fans and lights when you are going out. Large amount of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the amount of fossil fuels to be burned.

3. Understand the concept of Reduction, Reuse and Recycle: Do not throw away items without reusing. For e.g. you can use old jars to store cereals or pulses.

4. Emphasis on clean energy resources: Clean energy technologies like solar, wind and geothermal are on high demand these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.

5. Use energy efficient devices: CFL lights consume less electricity, besides durability, and thus resulting a cut-down in the electricity bills and conserving the environment.

V. The Methodology

The repairable dust concentration is determined by gravimetric analysis, by measuring the change in weight of the filter paper on account of the dust deposited on it. The handling of the filter paper a minimum so that paper does not get damaged. The filter papers in use for high volume Samplers are made of binder free glass fibers and are non-hygroscopic.

- The filter papers are kept unfolded, in a clean flat box and are serial-numbered.
- The filters are put in desiccators for 16 hours to get rid of moisture and are weighed
- Immediately when taken out.
- The sampler is run for a particular period of 8 hours or less, and the observations of the
- Rate of air flow and the resulting weights on the filter-paper are made**.**

A number of places are selected in the city as a probe-point for monitoring Particulate matters. Once a day for 3 hours in peak hours of traffic, in highly polluted areas

We have 15 such location which represents a good mix up of highly motorized areas. Those are:

1. Adhartal
2. Civil- Lines
3. Damoh Naka
4. Deendayal Chowk
5. Ghamapur
6. Gwarighat
7. Labour Chowk
8. Madan Mahal
9. Medical- College
10. Parijaat Building
11. Ranital
12. Russel Chowk
13. Ranjhi
14. Shastri Bridge
15. Shiv Nagar

The Observations Made At Various Locations: Summer

The intended objective of the operation is to develop a clear picture of the concentration of suspended particulate matter; 10 micron; as per their behaviour are

Table 1: The Observations Made At Various Locations: Winter

The intended objective of the operation is to develop a clear picture of the concentration of suspended particulate matter; 10 micron; as per their behaviour are

Location	**Time of Sampling**	**Volume of Air Collected Cubic-Metre Per Minute**	**Weight of Particulate Matter, Mg**	**Concentra-tion of Par-ticulate Mat-ter Mg/Cubic Meter**	**Particulate Matter Collected In The Cup, Mg**
Damoh Naka	3 Hours	1.35x180=243	80	329.71	40
Parijat Building	3 Hours	1.4x180=252	45	178.57	40
Shiv Nagar	3 Hours	1.4x180=252	45	178.57	50
Deen-Dayaal Cross-ing	3 Hours	1.35x180=243	45	205.76	50
Shashtri Bridge”	3 Hours	1.40x180=252	50	198.41	40
Ghamapur	3 Hours	1.35x180=243	50	205.76	35
Russel-Chowk	3 Hours	1.4x180=252	45	178.57	50
Ranital	3 Hours	1.4x180=252	70	277.77	50
Labour-Chowk	3 Hours	1.4x180=252	40	158.73	30
Madan Mahal	3 Hours	1.4x180=252	70	277.77	55
Adhartal	3 Hours	1.4x180=252	50	198.41	35
Ranjhi	3 Hours	1.35X180=243	60	246.90	40
Civil Lines	3 Hours	1.4X180=252	40	158.73	35
Medical College	3 Hours	1.4X180=252	60	238.09	50
Gwarighat	3 Hours	1.35X180=243	50	205.76	45

Table 2: The Observations Made At Various Locations: Summer

The intended objective of the operation is to develop a clear picture of the concentration of suspended particulate matter; 2.5 micron; as per their behaviour are

Location	Time of Sam-pling	Volume of Air Collected Cubic-Metre Per Minute	Weight of Particulate Matter, Mg	Concentra-tion of Particulate Matter Mg/Cubic Meter	Particulate Matter Collected In The Cup, Mg
Damoh Naka	3 Hours	1.35X180=243	100	413.22	55
Parijat Building	3 Hours	1.4x180=252	50	198.41	45
Shiv Nagar	3 Hours	1.4x180=252	50	198.41	50
Deen-Dayaal Crossing	3 Hours	1.35x180=243	50	206.00	55
Shashtri Bridge	3 Hours	1.40x180=252	48	190.47	46
Ghamapur	3 Hours	1.35x180=243	54	222.2	42
Russel-Chowk	3 Hours	1.4x180=252	60	238.09	59
Ranital	3 Hours	1.4x180=252	75	297.61	60
Labour-Chowk	3 Hours	1.4x180=252	46	182.52	35
Madan Mahal	3 Hours	1.4x180=252	80	317.46	65
Adhartal	3 Hours	1.4x180=252	55	218.25	35
Ranjhi	3 Hours	1.35X180=243	50	205.76	40
Civil Lines	3 Hours	1.4X180=252	45	178.57	35
Medical Col-lege	3 Hours	1.4X180=252	70	277.77	50
Gwarighat	3 Hours	1.35X180=243	60	246.91	55

Table 3: The Observations Made At Various Locations: Winter

The intended objective of the operation is to develop a clear picture of the concentration of suspended particulate matter; 2.5 micron; as per their behaviour are

Location	**Time of Sam-pling**	**Volume of Air Collected Cubic-Metre**	**Weight of Par-ticulate Matter, Mg**	**Concentration of Particulate Matter Microgram/ Cubic Meter**
Damoh Naka	3 Hours	2210	5	2.26
Parijat Building	3 Hours	2150	3	1.39
Shiv Nagar	3 Hours	2000	2	1.0
Deen-Dayaal Cross-ing	3 Hours	2750	5	1.81
Shashtri Bridge”	3 Hours	2870	4	1.39
Ghamapur	3 Hours	2950	4	1.35
Russel-Chowk	3 Hours	2670	5	1.87
Ranital	3 Hours	3110	5	1.60
Labour-Chowk	3 Hours	2650	4	1.50
Madan Mahal	3 Hours	2850	4	1.40
Adhartal	3 Hours	3090	5	1.61
Ranjhi	3 Hours	3010	5	1.66
Civil Lines	3 Hours	2570	3	1.16
Medical College	3 Hours	3085	8	2.59
Gwarighat	3 Hours	2950	7	2.37

Table 4: The Observations Made At Various Locations: Winter

The intended objective of the operation is to develop a clear picture of the concentration of suspended particulate matter; 2.5 micron; as per their behaviour are

Location	**Time of Sampling**	**Volume of Air Collected Cubic-Meter**	**Weight of Particulate Matter, Mg**	**Concentration of Particulate Matter Microgram/Cubic Meter**
Damoh Naka	3 Hours	2590	10	3.86
Parijat Building	3 Hours	3016	5	1.65
Shiv Nagar	3 Hours	3085	5	1.62
Deen-Dayaal Crossing	3 Hours	3085	10	3.24
Shashtri Bridge”	3 Hours	3072	5	1.62
Ghamapur	3 Hours	3090	10	3.23
Russel-Chowk	3 Hours	2670	5	1.87
Ranital	3 Hours	3110	10	3.21
Labour-Chowk	3 Hours	2650	10	3.77
Madan Mahal	3 Hours	2850	10	3.50
Adhartal	3 Hours	3090	10	3.23
Ranjhi	3 Hours	3010	10	3.32
Civil Lines	3 Hours	2570	5	1.94
Medical College	3 Hours	3085	10	3.24
Gwarighat	3 Hours	2950	10	3.38

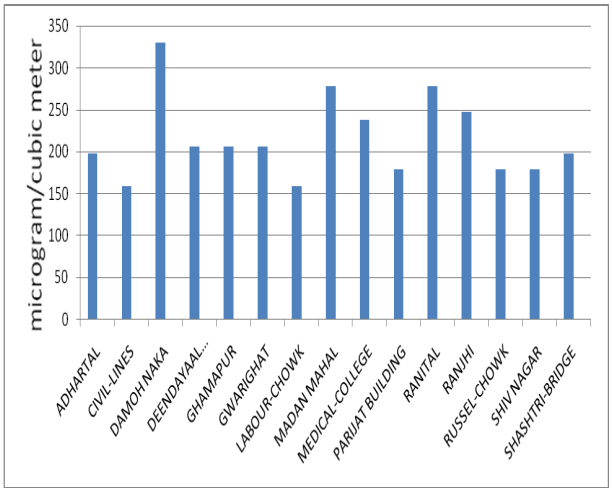

Figure 1 : The Observations Made At Various Locations For 10microns: Summer

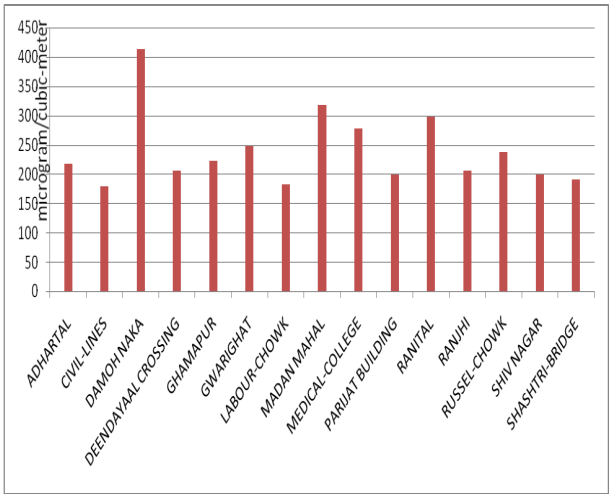

Figure 2 : The Observations Made At Various Locations For 10 Microns: Winter

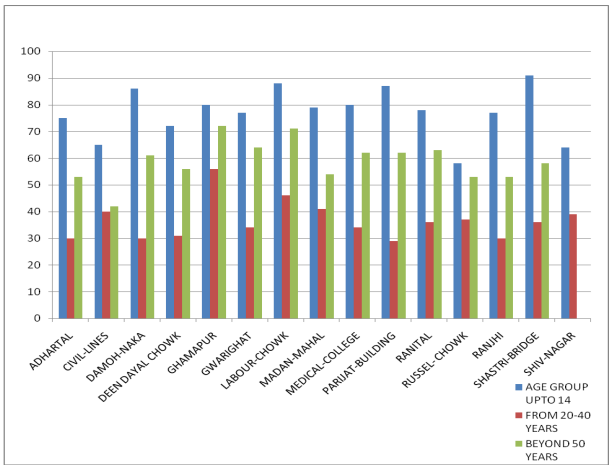

Figure 3: Clinical-Surveys Distributed Over Jabalpur City: Conducted Over In Summer-Season

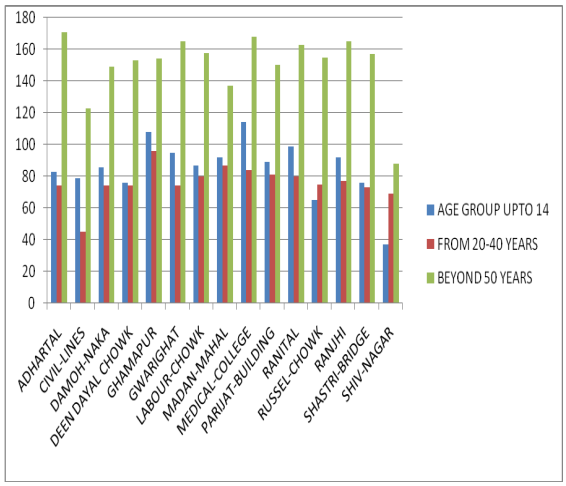

Figure 4: Clinical –Surveys Distributed Over Jabalpur City : Conducted Over In Winter Season

VI. CONCLUSION

This work contributes with a methodology to evaluate the emission of particulate matter on highly motorized area from an environmental perspective; taking into consideration different zone phases. This methodology allows for quantifying and characterizing the PM and also enables further intervention through mitigation measures in order to reduce the pollution. The weather condition variables influence the emission concentration of PM. The observation taken at Damoh Naka is 329.71mg/cubic meter which is highest and at Labour Chowk & Civil Lines 158.73mg/ cubic meter is lowest concentration of suspended particulate matter; 10 micron in summer season. Similarly the observation taken concentration of suspended particulate matter at winter season in which highest range observe in Damoh Naka 413.22mg/cubic meter and lowest range Labour Chowk 182.52mg/cubic meter.

Concentration of suspended particulate matter; 2.5micron in summer season, highest observation taken at Medical College 2.59mg/cubic meter and lowest at Shiv Nagar 1.0mg/cubic meter. Similarly concentration of SPM; 2.5micron in winter season, highest observation taken at Damoh

Naka 3.86mg/cubic meter which is highest and lowest is Shiv Nagar and Shashtri Bridge 1.62mg/cubic meter.

Clinical Surveys distributed over Jabalpur City in summer season number of patients in age group upto 14 years, from 20-40 years and beyond 50 years suffering from breathing, disorders & elergy.

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