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Studies on Ambient Air Quality Monitoring Near the Solid Waste Disposal Site at Harihar Tq, Davangere Dist.

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Abstract - *In this study, the ambient air quality is monitored near the Harihar taluk, Davangere district, and solid waste disposal site using a High Volume Air Sampler to measure parameters like Suspended Particulate Matter (SPM), Sulphur Dioxide (SO2), and Nitrogen Dioxide (NOX). From the observations made, the air quality index (AQI) is calculated at North, South, East, West, and some selected locations near the Harihar taluk, Davanger It has been noted that the suspended particulate matter concentration was considerably closer to the NAAQS requirements set for the industrial zone. Sulfur dioxide (SO2) and nitrogen dioxide (NO2) concentrations were within the guidelines set out by the NAAQS. Thus, the air quality index falls within the range of 0 to 50 AQI values, indicating that it is safe for employees to breathe there and that the air quality at the solid waste disposal site is good.*

Key Words: ***Air Quality, Suspended Particulate Matter, SO_2, NO_2, NAAQS, AQI***

1. INTRODUCTION

Due to the presence of hazardous compounds in the atmosphere, which will influence human health and the health of other living things as well as possibly contributing to climate change, air pollution is also known as air contamination. Pollutants come in a variety of forms, such as biomolecules, nitrous oxide, nitrous dioxide, methane, carbon dioxide, chlorofluorocarbons, and carbon monoxide.

Various illnesses, allergies, and even human mortality may be caused by air pollution. These are also harmful to living things like animals, crops, and the environment as a whole by producing ozone depletion, climate change, or adverse effects on the built environment like acid rain. Air pollution may result from both natural processes and human activity.

Developing a plan for reducing pollution that is creatively focused on protecting public health requires more information than simply knowing where the unusual health effects in terms of type and expected number of cases are due to pollution. This information may be necessary to satisfy and encourage decisions that may be more expensive and involve a larger amount of the community.

The effects of air pollution on health are the outcome of a complicated series of physical, chemical, behavioral, and physiological processes. Pollutants are released into the atmosphere as the initial link in the chain, where they mix and disperse, resulting in a diverse geographical and temporal distribution of concentrations. When pollutants are transported through the air, they go through a number of chemical and photochemical transformations.

At the same time, people conduct their daily activities. People in Europe spend 80 to 90 percent of their time indoors. The bulk of these buildings are homes, places of employment, and industrial settings, all of which may be causes of air pollution in their own right. Even homes have their own internal sources of air pollution, including the materials used in construction and everyday activities like heating, cooking, and indulging in hobbies.

Monitoring of ambient air quality primarily focuses on the levels of outside pollutants. Multiple time-activity patterns and microenvironments influence personal exposure. As a result of exposure to external pollution, the dose delivered to a person's lungs affects the dose delivered to the various target internal organs. The amount of the pollutant absorbed by the various biological systems, the intensity of the pollutant or its derivatives, as well as immunological condition, therefore define the individual health effects. As a result, the monitoring statistics at best only allude to the potential for harmful health effects. Even while exposure is a solid predictor of health risks, different people who have had the same level of exposure may get different doses of the same pollutant and may have distinct health effects. To understand why sensitive people respond more strongly, it is important to investigate how much various demographic groups—especially fragile ones like youngsters, the elderly, and people with disabilities—are exposed to. This involves analyzing human time-activity patterns and micro environmental concentrations for distinct demographic groupings.

2 Objectives

- To compare the concentration levels suspended particulate matter of air pollutants with the national ambient air quality standards at the solid waste disposal site in Harihar Taluk, Davangere District.
- To compare the concentration levels of gaseous pollutants including Sulphur dioxide and nitrogen dioxide with the national ambient air quality standards at the solid waste disposal site in the Harihar Taluk, Davangere District.
- Calculating the Air Quality Index based on the measurements of Sulphur Dioxide, Nitrogen Dioxide, and Suspended Particulate Matter and comparing the AQI values to NAAQS.

2.1 The Earth's Atmosphere

The atmosphere stores and distributes the contaminant which have been released into it, and it is this function which is of interest in air pollution. The behavior of atmosphere determines whether the pollution released into it will remain around us or shall be blown away. The atmosphere is a mixture of gases surrounding the earth in several layers of varying thickness and density.

The layer nearest to the earth is called as troposphere, which extends form the earth surface to about 10-12km. in general, the atmosphere is not heated by the sun's rays, rather is heated from below by the warm earth. Temperature, therefore, decrease with altitude in this layer along with decrease in the density and pressure of gases. The lower troposphere up to 2km is of most interest in an air pollution meteorology shown in the figure. About 80% of the mass of atmosphere is contained in troposphere.

it is crucial to do research on India's air quality and develop regulations to lessen air pollution.

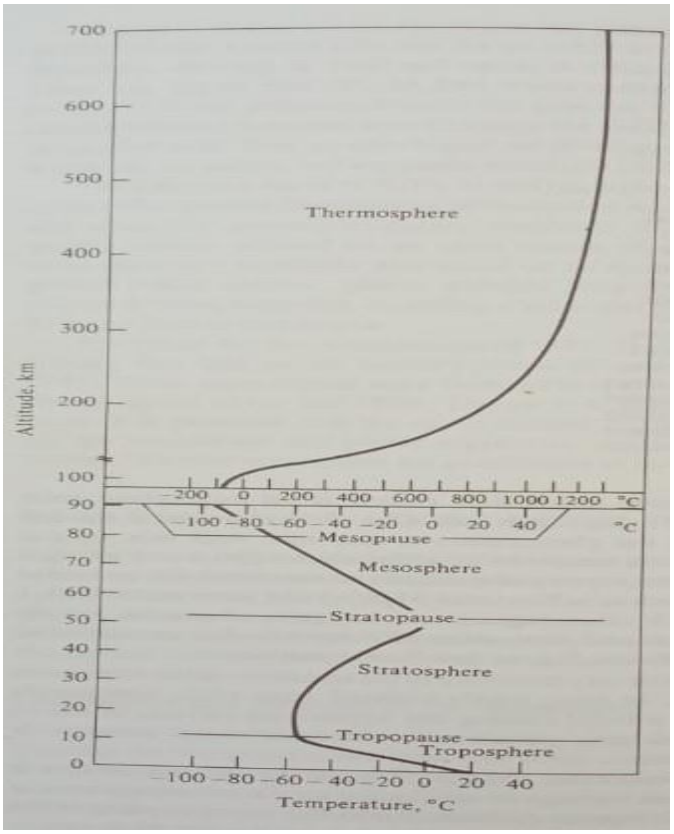

Fig 1: Temperature Profile of Earth's atmosphere

2.2 Monitoring of Air Quality

Values for ambient air qualities, which often refer to outside air, represent air pollution concentrations. The guidelines are established for a variety of goals, including planning and other purposes, as well as uses related to human health, building, agriculture, plants, and ecosystems. The WHO, the EU, and the US EPA are just a few of the organizations that have provided standards. These criteria are typically but not always identical, despite the fact that they are offered for the same goal. Any numerical standards must take into account the average time, unit, and statistical metrics. Without this, there is no common basis for a given criteria, making it ambiguous or even useless.

3.1 Sampling and analysis of Particulate Matter (PM_{10}) in Ambient Air (Gravimetric method)

Instrument/ equipment

The following are the main accessories for determining the concentration of particulate matter PM_{10} in an ambient air.

- Weighing balance

- High volume air sampler with the size selective inlet for the particulate matter(PM_{10}) and volumetric flow control
- Caliberated flow measuring device to control the air flow

 Reagents/ chemicals filter media- What man filterpaper of size (8*10 in) size

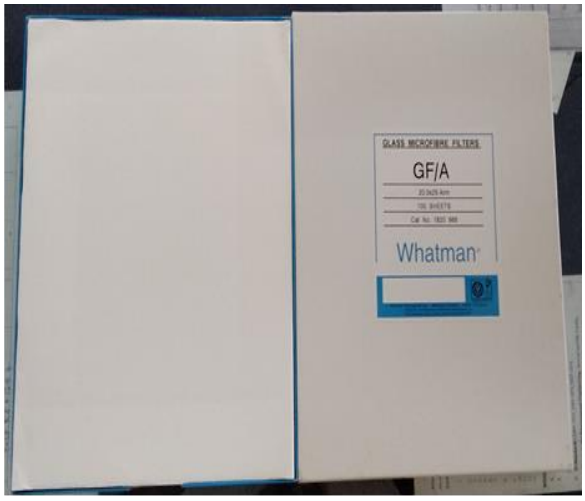

Fig 3.3 – Whatman's Filterpaper

- Sampling and examination of particulate matter

Initially the filter paper is noticed for any damages and the identification code of filter is written over the filter paper. Dry the filter in a conditioning environment or in a desiccator for about 24hours. Note down the initial weight of the filter paper using a weighing balance. Detach the faceplate, take out the faceplate and the wing nuts. Loosen the filter from its jacket and position it so that its rough side is facing upon the support screen. Then start the instrument for 8hours. Note down the flowrate on hourly basis. Note down the time for sampling and median flowrate. Later dry the filter paper in a conditioning environment or in a desiccator for 24hours. Weigh the filter in a weighing balance and note down the weight of the filter paper. Now using the formulae determine the concentration of the particulate matter.

3.2 Sampling and analysis of Sulphur dioxide in ambient air (Improved West and Geake method)

 Principle of the method

Modified West and Geake method (IS 5182 part 2 method of measurement of air pollution: SO2

A potassium tetracholoromercurate solution absorbs Sulphur dioxide from the air (TCM).

A dicholorosulphitomurcurate compound is synthesized, which is prone to oxidation by atmospheric oxygen. The absorber solution may be stored for a while until testing because, once generated, this complex is unreactive to strong oxidants such as ozone and nitrogen oxides. To produce the brightly colored pararosalinie methlysulphonic acid, the product is allowed to mix with para-rosaniline and formaldehyde. A calibrated spectrophotometer is used to quantify the solution's absorbance.

The monitoring and quantification of Sulphur dioxide in ambient air have to have the following:

- Weighing balance
- Vacuum pump: Capable of maintaining an air pressure differential greater than 0.7 atmosphere at the desired flow rate
- Calibrated flow-measuring device to control the airflow
- Absorber: all glass midget impinge
- Spectrophotometer: Able to measure the absorbance of a sample at 560nm
- Glass wares: low actinic glassware must be used for analysis
- Reagents/ chemicals
- Distilled water
- Mercuric chloride
- Sodium chloride
- Ethylene Diaminetetraacetic Acid Di Sodium salt
- Sulphamic acid
- Formaldehyde
- Pararosaniline

Sampling and analysis of Sulphur dioxide in an ambient air

- Sampling
- Absorbing reagent: 0.04Molarity Potassium tetrachloromercurate (TCM) - Take 10.86g of Mercuric chloride ($HgCl_2$) in water add 0.0066g of Ethylene diamine tetra acetic acid and 6.0g of

Sodium Chloride in a water and make up to 1litre in a volumetric flask. The potential of Hydrogen of this solution should be nearly equal to 4.0,.

30ml of absorbing solution must be poured in an impinge, and samples must be retrieved each hour at a flow rate of 1L/min. After sampling, check the sample's volume and move it to a bottle for storage.

➢ Analysis

After sampling measure 10ml of aliquot sample in a 25ml volumetric flask. Mix 1ml of Sulphamic acid allow it for about 10minutes. Mix 2ml of Formaldehyde and 2ml of Pararosalinine. Dilute it up to 25ml using distilled water. It allowed to go through the reaction for about 30minutes. Make use of distilled water to adjust the Spectrophotometer to the zero reading. Adjusting the wavelength to 560nm quantify the absorbance of a solution. Later using the formulae calculate the concentration of SO_2.

3.3 Sampling and analysis of Nitrogen dioxide in ambient air (Modified Jacob and Hochheiser method)

➢ Instrument/ equipment

The monitoring and quantification of Nitrogen dioxide in ambient air have to have the following

- Weighing balance
- Vacuum pump: Capable of maintaining a vacuum of at least 0.6 atm across the flow control device.
- Calibrated flow measuring device: To control the airflow from0.2 to 1L/min
- Spectrophotometer which is having capacity of quantifying absorbance at 540nm installed with 1cm path length cells.

➢ Reagents

- Distilled water
- Sodium hydroxide
- Sodium arsenite
- Hydrogen peroxide
- Sulphanilamide
- NEDA (N-(1-naphthyl) Ethylene diamine Dihydrochloride)

➢ Sampling

30 mL of absorbent solution must be introduced in an impinge. For 4 hours, gather samples at flow rate of 0.2-1 L/min. Assess the sample volume after sampling, and now put it in a bottle for preservation.

➢ Analysis

To recover the water which is evaporated during the sampling, mix distilled water up to the calibration mark, and carefully stir.

Later take 10ml of aliquot sample in a 50ml volumetric flask. Introduce 1ml of Hydrogen peroxide and 10ml of Sulphanilamide and 1.4ml of NEDA allow it to react for about 10minutes now adjust Spectrophotometer to zero using distilled water and quantify the absorbance at 540nm wavelength and now using the formulae calculate the concentration of Nitrogen dioxide.

4. Results

Table 2:-Values of the AQI in respected areas during the month of April, May and June

Sl no	Locations of solid waste disposal site	AQI value during the month of March	AQI value during the month of April	AQI value during the month of June
1	NORTH ZONE	36.06	29.89	35.7
2	EAST ZONE	32.2	29.49	31.8
3	SOUTH ZONE	32.9	31.7	32.07
4	WEST ZONE	29.7	31.3	29.4
5	500m away from the SWD site	27.42	26.4	27.14
6	1.5km away from the SWD site	30.65	24.36	30.35

5. Conclusions

To finish this investigation, it was determined the concentrations of SPM, SO2, NO2, and AQI at the 6 selected locations at the Harihar taluk's clean solid waste disposal facility. The conclusions derived from the data and outcomes are discussed in this chapter.

- Based on the locations, it can be assumed that during the months of April, May, and June the SPM agglomeration is closer to the limits of SPM prescribed by the NAAQS in an industrial zone and is therefore quite harmful to the workers who are working close to the landfill site of Harihar taluk. In all locations during the months of April, May and June the SO_2 and NO_2 values were within the NAAQS permissible levels.

- The NAAQS allowed limits for SO2 and NO2 were met in all sites throughout the months of April, May, and June.

- The solid waste disposal site is severely contaminated by SPM, making it unpleasant for the employees and leading to a range of health concerns.

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