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AIR QUALITY MONITORING FROM JAMUAON KHANPUR TO POLICE STATION NAGRA, BALLIA IN RURAL AREAS OF UTTAR PRADESH

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Abstract - *Air pollution is one of the most important major causes of diseases like asthma, cancer, bronchitis, birth defects, and immune system-like diseases. Human exposure to fine particles can have significant harmful effects on the respiratory and cardiovascular systems. To investigate daily exposure characteristics to $PM_{2.5}$ and PM_{10} with ambient concentrations in a rural environment, personal exposure measurements on the road, from Jamuaon Khanpur to Police Station Nagra in the Ballia city, India. To account for all the sources of particulate matter exposure, measurements on several different days during May 2021 were carried out Smiledrive Air Quality Pollution Monitor was used to measure $PM_{2.5}$ and PM_{10} concentration. Airborne particulate matter has now become an issue within the worldwide environment due to the health problems and environmental degradation it causes. This has necessitated that almost all rural areas attempt to set standards for coarse and fine particles because of their noticeable impacts on the environment. This paper could be a review of how $PM_{2.5}$ and PM_{10} within the atmosphere affect visual air quality and human health. The challenge during this paper is to explain the comprehensive effects of $PM_{2.5}$ and PM_{10} to identify its minimization within the environments with the view of rural areas its effective control strategies for adequate air quality management. On the road site locations are an important source of air pollution emitting pollutants like $PM_{2.5}$ and PM_{10}, etc. which is adversely affect human health especially the respiratory system. The present study aims at the monitoring of $PM_{2.5}$ and PM_{10}, health condition of persons lives on the roadside, in the vicinity of road site locations. In the present study, the relevant literature review has also been carried out to study and analyze the impact of air pollution on human health. A reconnaissance survey of 20 selected locations from Jamuaon Khanpur to Police Station Nagra, Ballia has been conducted for the period May 2021. The average $PM_{2.5}$ and PM_{10} levels of all the sites have been estimated and compared with the prescribed value.*

Key Words: **Air Quality, Air Pollution, Human Health, Particulate Matter like $PM_{2.5}$ and PM_{10}, Road Site Locations**

1.INTRODUCTION

Road traffic emissions are a serious source of air pollution in urban areas with subsequent adverse human health effects. Although improvements in vehicle technology play a major role in reducing traffic emissions at the source. The burning of fossil fuels produces pollutants like particulate matter especially $PM_{2.5}$ and PM_{10}, nitrogen oxides (NOx), carbon monoxide gas (CO), and hydrocarbons (HC), and SO_2 are directly emitted by vehicles. Exposure to those air pollutants has both acute and chronic effects on human health, affecting several different systems and organs. Particulate (PM) is that the term used for a mixture of solid particles and liquid droplets suspended within the air. These particles originate from a range of sources, like power plants, industrial processes, and diesel trucks, and that they are formed within the atmosphere by the transformation of gaseous emissions. Their chemical and physical compositions counting on location, time of year, and weather. Particulates consist of both coarse and fine particles. Supported size alone, small airborne particles can become lodged within the lungs or maybe enter the bloodstream. Whereas, fine particles have an aerodynamic diameter of less than 2.5μm ($PM_{2.5}$). They differ from PM_{10} in origin and chemistry. Sources of doors or ambient pollution are varied and include both natural and man-made ones. $PM_{2.5}$ may be a subset of PM_{10} and in ambient air $PM_{2.5}$ fraction approx. 70% of total PM_{10}. Most pollution is man-made outdoor air pollution which derives from the poor combustion of fuel or biomass fuels e.g., exhaust fumes from cars, furnaces, or wood stoves. To see the present quality of air, evaluate the effectiveness of control programmers, and identify areas in need of restoration Air quality monitoring is required. Pollutants such as Particulate matter (PM_{10}, PM_1, and $PM_{2.5}$) are monitored under the program of NAMP with the assistance of agencies like CPCB, SPCB, NEERI, etc. The ambient air quality objectives/standards are a prerequisite for developing the program for effective management of ambient air quality and to reduce the damaging effects of air pollution. Besides the health effects caused by day-to-day concentrations of urban pollution, premature death and morbidity are experienced during and following pollution 'episodes'—periods of prolonged and abnormally high concentrations of 1 or more outdoor air pollutants. Air quality is very important just because we've got to breathe the air around us. People who live in industrial cities should be especially concerned since we are exposed to a greater amount of pollutants coming from industries, car traffic, commercial, yet other sources. (Environmental assessment and policy 2010.) Air pollutants can cause a spread of health problems - including breathing problems; lung damage;

bronchitis; cancer; and nervous system damage. Pollution may also irritate the eyes, nose, and throat, and reduce resistance to flu and other illnesses (Environmental assessment and policy 2010). This paper will specialize in air quality monitoring in between Jamuaon Khanpur to Police Station Nagra, Ballia. Hopefully, this paper provides valuable information comparing air quality measurements and results between Jamuaon Khanpur to Police Station Nagra, Ballia and finally helps authorities to require necessary actions to boost the air quality in these towns. Three air quality models were used for predicting PM_{10} and $PM_{2.5}$ concentrations at urban traffic intersection (M-GFLSM) of particulates, CALINE3 model, and the CAL3QHC model (Sharad Gokhale, Namita Raokhande, 2008). Caline 4 model was used for Air Quality Prediction and Modelling (Pintu Kumar, 2020). Concentration of pollutants is predicted by air quality prediction model i.e., CALINE-4/2.1 model (Kafeel Ahmed, 2016). Review of Air Quality Monitoring: Case Study of India, reveal that the Air pollution is one of the foremost and grave public health and environmental anxiety in most of evolving countries (Humaib Nasir, 2016). The ambient air quality survey was carried out at four different locations with respect to SO_2, NO_2, SPM and RSPM, and monthly air sampling was carried out for a period 24 hrs at each of the site. Pollutant's concentration was used to calculate the air quality index which ranged between 62.50 to 109.0 thus categorizing the sites from moderate to heavily polluted on a five-level air quality index with potential health hazards (Joshi P. C, Semwal Mahadev, 2011). Characterization of chemical species in $PM_{2.5}$ and PM_{10} aerosols in Hong Kong (X.H Yao, K. H., 2003).

1.1 Objectives of Present Study

- Data collection (primary and secondary) through reconnaissance survey.
- Air quality monitoring for PM_{10}, PM_1 and $PM_{2.5}$ at pre-selected location from Jamuaon Khanpur to Police Station Nagra, Ballia.
- Comparing the same with permissible limits and suggestions for improvement.

2. METHODOLOGY

2.1 Site Selection

For the present study, a segment of Rasra -Belthara Road was selected. The research site stretches 11.2 Km longitudinally along the length of the road segment. The road segment extends from JAMUAON KHANPUR (26.059311, 83.859352) to NAGRA BALLIA ROADWAY NEAR NAGRA POLICE STATION, BALLIA (25.963542, 83.868831) on Rasra-Belthara Road Roadway further this road connects to NH 28. Some portion of the selected segment is under construction, due to which many trucks, trolleys, and tractors run over the selected site also buses, cars, autorickshaws, and motorbikes run on the road. This area was selected for study because there was a need to know the concentration of traffic emission pollutants and to know about how pollutants are decreasing with distance from the center of the road. the location of the study area is shown in the figure.

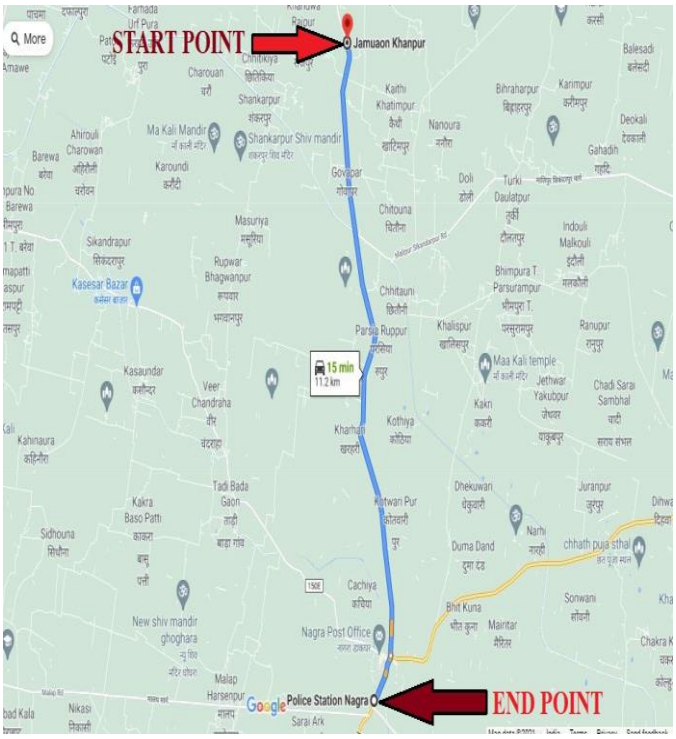

Fig -1: Map of Selected Monitoring Site

2.2 Monitoring Period

Monitoring has been done for 3 days on an hourly basis from 06:30 Am to 09:30 Am and 03:00 Pm to 06:00 Pm. The First 7 locations have been monitored on 10-05-2021, then 7 locations on 13-05-2021, and monitoring at the last 6 locations has been done on 16-05-2021.

2.3 Monitoring Procedure

For the present study monitoring procedure of particulates matter (PM_1, $PM_{2.5}$, and PM_{10}) have been done on a segment of Rasra-belthara Road from Jamuaon Khanpur to Nagra Police Station, Ballia, which had 20 locations within the selected site. A monitoring procedure has been performed on the roadside within the selected site of 11.2 km. At the start point, first of all, placed the monitoring device at the roadside for 10 minutes, and then pressed the calibrate button for 3 seconds. After 10 minutes fresh readings for PM_1, $PM_{2.5}$, and PM_{10} have been noted at the roadside. The same procedure as above has been followed for taking the readings for all 20 selected locations between the Jamuaon Khanpur to Nagra Police Station, Ballia. Similarly for the rest of the 19 locations above procedure has been followed to find the concentration of particulates matter at a different

location on the road. At each location, it took 30 minutes to find out the concentration of selected air quality parameters for the present study. The monitoring procedure was done at regular intervals, four times a day for the selected site, at 10-hrs intervals for May 2021. For the selected site, the readings were taken between 06:30 am - 09:30 am in the morning when traffic congestion was not very much and 03:00 pm - 06:00 pm in the evening when traffic was very active. All locations are on the roadside and the location of Jamuaon Khapur to Nagra Police Station, Ballia. for all the locations from Nagra Police Station to Parasia Ruppur is under construction and due to which the PM concentration for these locations is the highest among all the locations from Parasia Ruppur to Jamuaon Khanpur, Ballia site.

3. RESULTS AND DISCUSSION

The analysis will be done using site sampling for different land use categories i.e., different locations on the pre-selected site. After that, the graphical analysis will be done using MS Excel.

Table -1: Concentration of air pollutants at each location

Locations Name	PM_1	$PM_{2.5}$	PM_{10}
Jamuaon Khanpur	9	14	15
Jamuaon Chowk	21	36	32
Near Shiv Tample Jamuaon	28	37	42
Naurangia Village Turn	28	29	44
Malipur Chowk	30	40	46
Sikarahata Mod, Malipur	35	42	52
Chhitauni, Gowapar Village Intersection	28	36	44
Nichuadih Village Turn	31	41	47
Parasia Ruppur Market Chowk	47	55	63
Mohmadpurjapti Mafi Village Turn	30	39	49
Harjan Basti Kothia	21	42	46
Kothia Villaage Turn	30	43	45
Kothia Chowk	43	55	62
Hindustan Oil Petrol Tank Nagra	33	44	48
Murtaza Oil Store Nagra	41	53	65
Nagra Market Chowk	30	42	49
Tiwari Clothing Store	38	53	58
Vidayrthi Book Store	42	65	68
Hanuman Tample, Nagra	28	38	43
Nagra Police Station	45	72	68

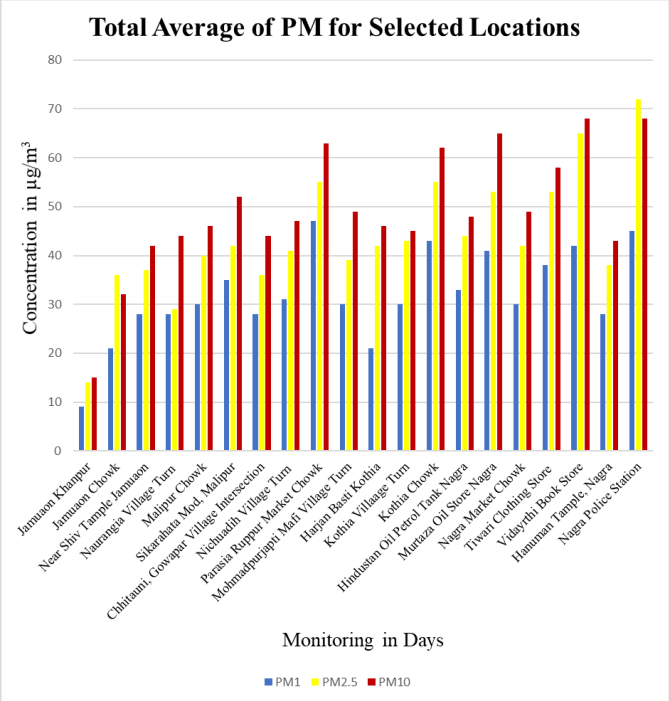

Chart -1: Total Average of PM for Selected Locations

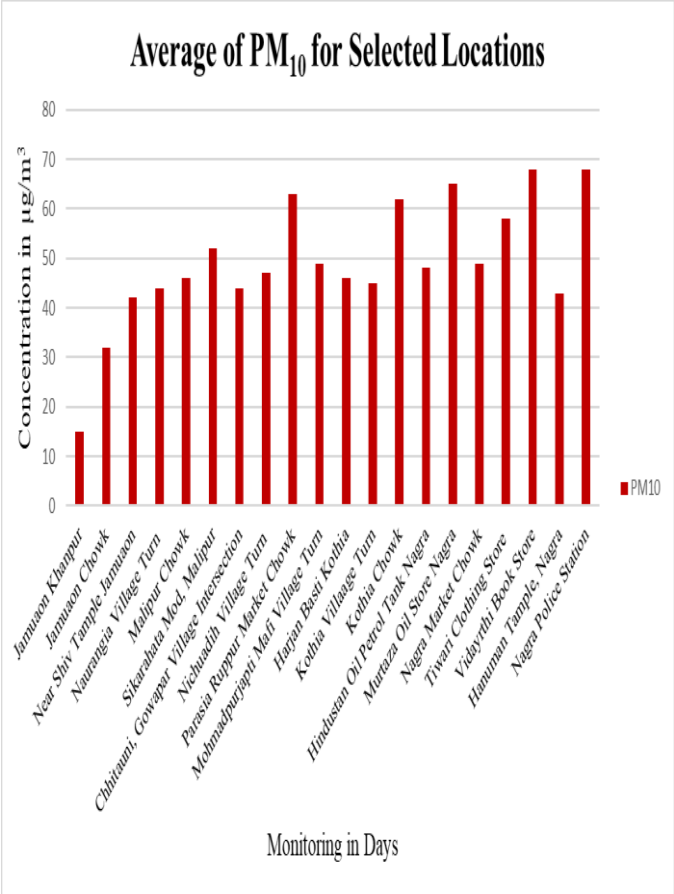

Chart -2: Average of $PM_{2.5}$ for Selected Locations

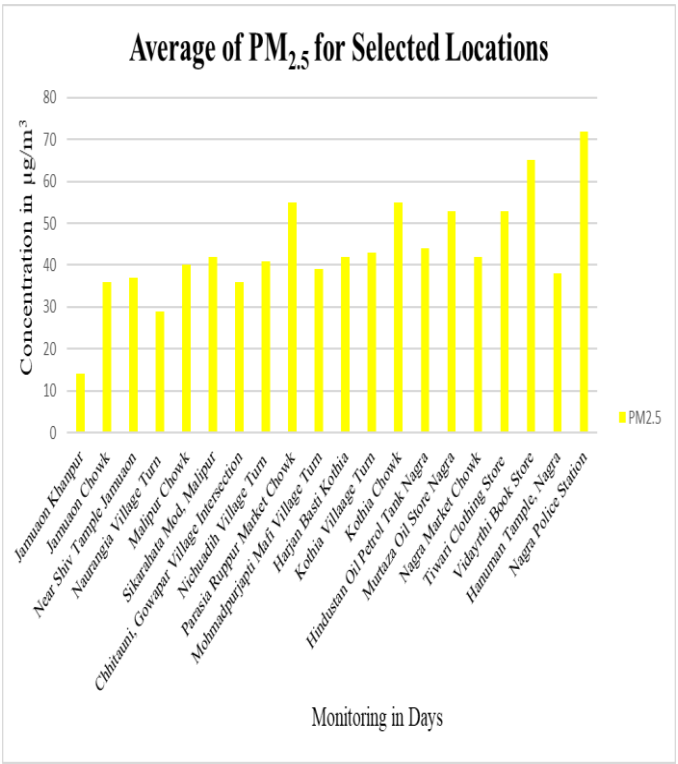

Chart -3: Average of PM_{10} for Selected Locations

3. CONCLUSIONS

Particulate matter (PM) is strongly related to human morbidity and mortality. Traffic is one of every the most sources of PM Outside rural areas. In this paper, $PM_{2.5}$ and PM_{10} data and meteorological variables were collected from Jamuaon Khanpur to Police Station Nagra, Ballia during the summer season, 2021. The observed readings of out of doors $PM_{2.5}$ and PM_{10} concentration were highest for the Police Station Nagra, Ballia because of traffic congestion was very active near Police Station Nagra, Ballia and a few readings of out of doors $PM_{2.5}$ and PM_{10} concentration for all the locations don't match the WHO standards because many construction activities are occurring in between Jamuaon Khanpur to police Station Nagra, Ballia and traffic congestion is also one of the factors for increasing the outdoor $PM_{2.5}$ and PM_{10} concentration for various land use categories in pre-selected site. The readings were taken within the peak hours i.e., within the morning and therefore the evening hours when the traffic congestion was greatly.

The results reinforce the thought that the most source of $PM_{2.5}$ and PM_{10} in pre-selected locations is because of construction activities and vehicular emissions.

In selected locations the level of various pollutants was as given below:

- PM_{10} concentration varies from 15 to 68 ($\mu g/m^3$)
- $PM_{2.5}$ concentration varies from 14 to 72 ($\mu g/m^3$)

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