

# Chemical Characterization of Fine and Coarse Particulate Matter in Gopalganj District of Bihar

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## ABSTRACT

A sampling campaign was conducted in Gopalganj district of Bihar for assessing the mass concentration of PM<sub>2.5</sub> and PM<sub>2.5-10</sub> so as to correlate it with the air quality of the district. Concentration of a dozen of elements namely Cd, Cr, Cu, Mn, Ni, Pb, Zn, Fe, Ca, K, Na and Al were quantified. Sampling was done on nuclear polycarbonate filters. For principal component analysis (PCA) of elements and mass concentration data, three main sources were identified as PM<sub>2.5</sub> and PM<sub>2.5-10</sub> concentration. They are resuspended crustal dust, industrial emissions and vehicles exhaust. The effect of weather conditions was also studied. It was found that pollution in summer was higher than those in winter. The PM<sub>2.5</sub>/PM<sub>2.5-10</sub> ratio in summer was found to be in the range of 0.35 - 0.9 whereas the same ratio in winter was 0.20 - 0.50. The concentration of both types of particles exceeded the permissible WHO limits.

**Keywords** : Particulate matter pollution, Metal pollution, Fine and coarse particles

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## I. INTRODUCTION

Climate, environment and health of individual are severely affected by the particles present in the air. The ill effects and size of the particles are inversely proportional to each other [ 1 - 5]. The whole world seems to be concerned with this pollution in recent years [6- 7]. Consequently, the present program of assessing air quality of Gopalganj district of Bihar and its relationship with the particulate matter has been launched in the year 2021. The outcome of the study is being communicated in the present paper.

## II. METHODS AND MATERIAL

Samples of particulate matter were collected from the bus stand of Gopalganj from June 2021 to May 2022. Samples were collected on a weekly basis with 24 hours sampling time. Gent Stacked Filter Unit Samplers were used for collecting the air samples. Filters were conditioned and weighed before and after collecting the samples. Mettler balance with 10 microgms sensitivity was used for weighing. Concentrations of particles were analysed gravimetrically. The trace element contents of PM

including Cd, Cr, Cu, Mn, Ni, Pb, Zn, Fe, Ca, Na, K and Al were used by Absorption Atomic Spectroscopy technique.

### III. RESULTS AND DISCUSSION

Processed data are presented in Table1. Concentrations of PM2.5, PM2.5-10 and ratio between the two have been shown in fig 1. Particulate matter concentrations from the air samples analysis data, the annual average concentration of PM2.5-10 was found to be 107±27.7 microgms/Nm<sup>3</sup>. The data for PM2.5 was 52.8±11.8 micrograms/Nm<sup>3</sup>. Daily mean concentration values have been shown in fig 1. The data indicate higher value in summer and lower value in winter. The difference may be due to differences in dispersion and deposition rate of particulate matter in the two seasons.

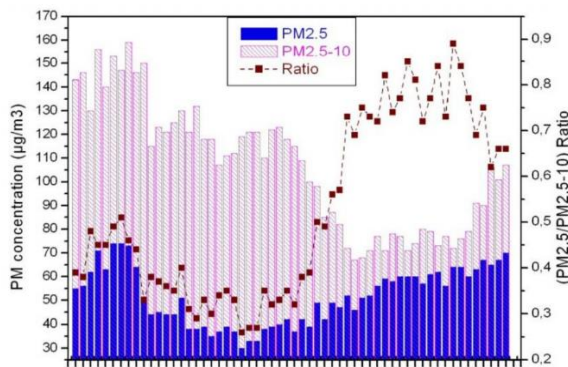


Fig. 1: Daily mean concentrations of PM 2.5-10 (µg/m<sup>3</sup>) and PM2.5/PM2.5-10 ratio during the sampling period (June 2021-May 2022).

Table 1 : The mean concentration values of the detected elements in the two fractions (in ng/Nm<sup>3</sup>) during winter and summertime.

	Summer		Winter	
	PM2.5 (ng/Nm <sup>3</sup> )	PM10 (ng/Nm <sup>3</sup> )	PM2.5 (ng/Nm <sup>3</sup> )	PM10 (ng/Nm <sup>3</sup> )
Cd	2,44	2,20	1,95	1,76
Cr	73,95	52,48	91,59	66,22
Cu	240,35	125,05	280,55	178,92
Mn	20,19	72,38	24,66	78,01
Ni	195,40	153,05	144,08	140,72
Pb	324,28	210,26	355,03	222,86
Zn	1343,26	612,74	1465,22	697,48
Fe	2045,79	2065,61	1853,54	2150,41
Ca	1095,61	12320,56	954,57	11011,52
Na	591,02	2877,47	607,32	2575,17
K	409,03	1607,48	386,35	1351,93
Al	169,28	2112,57	98,35	1696,98

### IV. CONCLUSION

Concentrations of particulate matter of both types, fine and coarse, are higher than WHO permissible limits in Gopalganj in both the seasons, summer and winter. Safety measures must be taken to control the situation by reducing the production of particles on one hand and to prevent their stay in air by precipitation. Regular use of proper masks can curb the entry of these particles in respiratory tract. Coordination between general public and administration may prove beneficial.

### V. REFERENCES

- [1]. Matteo Bo, Pietro Salizzoni, Marina Clerico and Riccardo Buccolieri ; Assessment of Indoor Outdoor Particulate matter Air Pollution : A Review, Atmosphere, 8(2017)136.
- [2]. Robert B. Hamanaka and Gokhan M. Mutlu ; Particulate Matter Air Pollution : Effects on the Cardiovascular system ; Front Endocrinol ( Lausanne ), 9(2018)680.
- [3]. Ionannis Monisalidis, Elizavet Stavropouou, Agathangelos Stavropouous and Eugenia Bezirtzoglou, Environmental and Health impacts of Air Pollution : A Review, Front Public Health

- , 20 Feb 2020  
<https://doi.org/10.3389/pubh.2020.00014>
- [4]. Hyouk - Soon Kwon, Min Hyung Ryu and Christopher Carlstan ; Ultrafine particles : Unique physicochemical properties relevent to health and disease, Experimental and Molecular Medicines , 52(2020)318-328
- [5]. Jessica Briffa and Renold Blundell, Heavy metal pollution in the environment and their toxicological effects on human, Heliyon, 6(9)(2020)e04691
- [6]. Bharat Sharma, How Firecrackers Are Harmful for Your Health; Science and Future, Nov 03, 2021
- [7]. Lisa Schipper , Vanesha Castan Broto and Winstor Chow , Five key points in the IPCC report ( AR6 ) on climate change impacts and adaptation ; The Conversation , March 03 , 2022

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