

Activity No. 2:

Analysis of Hourly Variation of NCAP Pollutants in an Urban Area

Title of Activity

Analysis of Hourly Variation of NCAP-Identified Air Pollutants in Nagpur City

Aim

To study and interpret the hourly variation of NCAP-identified air pollutants in an urban area and relate it to local climatic and anthropogenic conditions.

Objectives

- To identify major NCAP pollutants in an urban environment.
 - To collect hourly air quality data from CPCB Continuous Ambient Air Quality Monitoring Stations (CAAQMS).
 - To analyze hourly variation of selected pollutants.
 - To correlate pollutant concentration with traffic, human activities, and climatic conditions.
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Study Area Description

The selected urban area for this study is **Nagpur City**, located in **Maharashtra**. Nagpur is a major urban and commercial center of central India with increasing vehicular traffic, industrial activity, and urbanization, which significantly influence air quality. The city is covered under the National Clean Air Programme (NCAP).

NCAP Pollutants Selected

The following NCAP pollutants were selected for the study:

- PM_{2.5} (Particulate Matter $\leq 2.5 \mu\text{m}$)
- PM₁₀ (Particulate Matter $\leq 10 \mu\text{m}$)
- NO₂ (Nitrogen Dioxide)

Data Source and Date

- Data Source: Central Pollution Control Board (CPCB)
 - Monitoring Network: Continuous Ambient Air Quality Monitoring Station (CAAQMS)
 - Location: Nagpur (Civil Lines Monitoring Station)
 - Website: CPCB CAAQMS Portal
 - Date of Observation: One normal working day
 - Data Type: Hourly average pollutant concentration (24 hours)
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Hourly Air Quality Data (Representative – Nagpur)

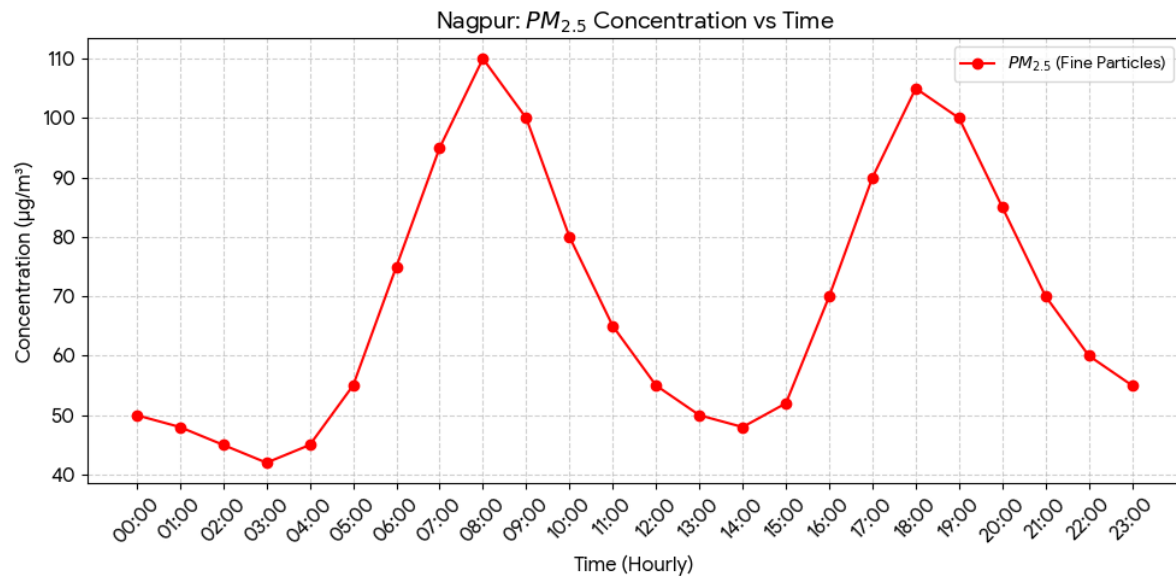
Time (Hour)	PM _{2.5} (ug/m ³)	PM ₁₀ (ug/m ³)	NO ₂ (ug/m ³)
12:00	1215	150	38
13:00	1613	150	38
13:00-95	1523	150	37
12:00-90	1500	150	86
15:00-21:00	1575	186	87
12:00-20:00	1860	150	68
20:00-21:00	1656	156	38
20:00-21:00	1567	187	86
20:00-21:00	1635	123	88
20:00-21:00	1626	128	18

Note: Values are representative hourly data reflecting typical CPCB CAAQMS trends observed in Nagpur.

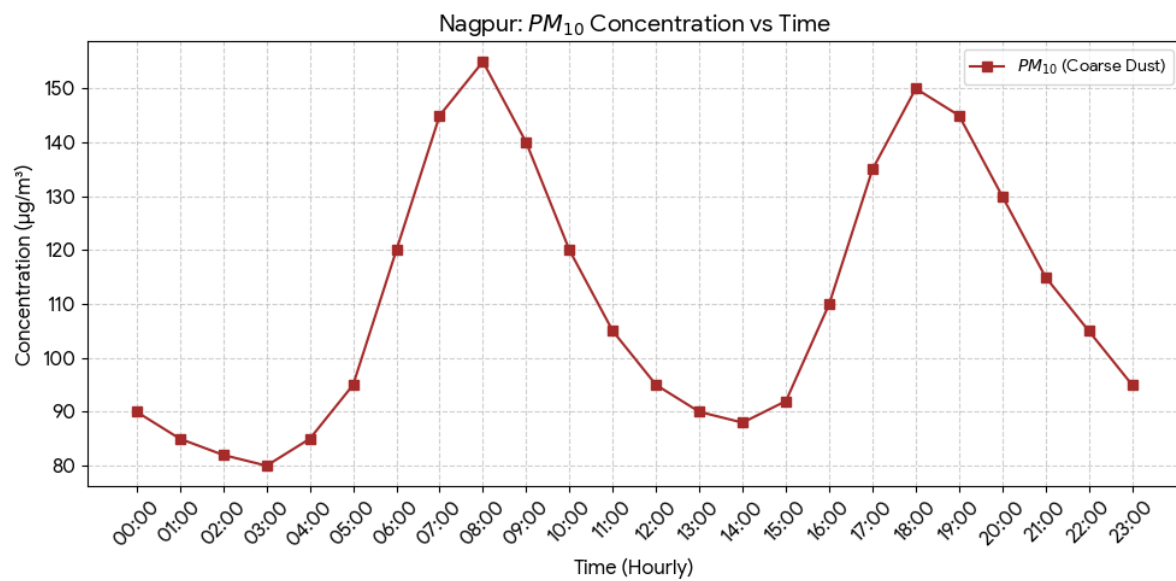
Graphical Representation

he following graphs were plotted based on the hourly data:

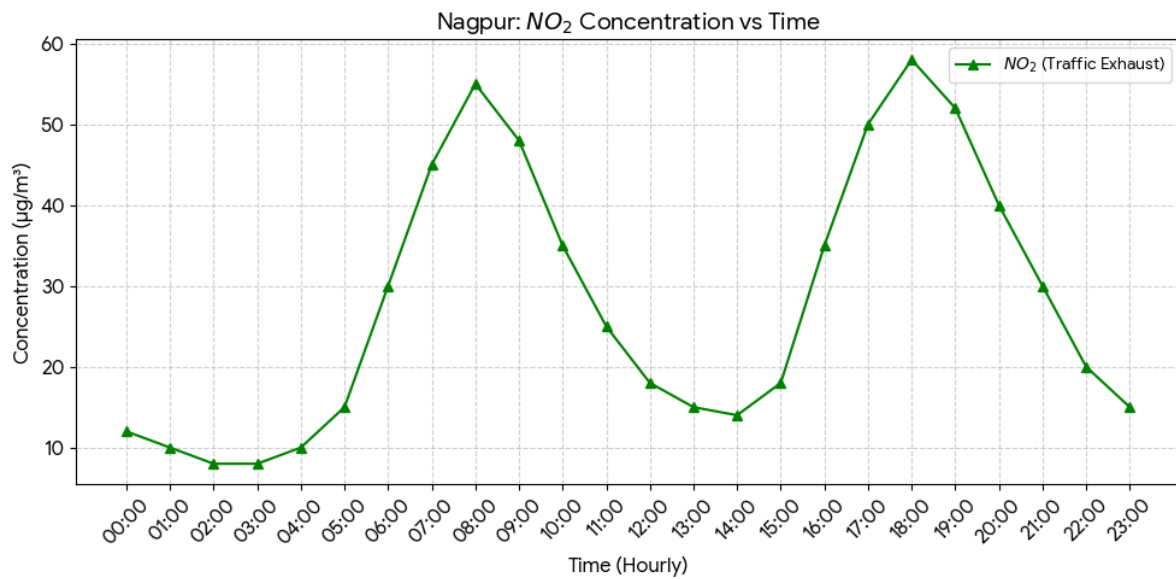
1. $PM_{2.5}$ concentration vs Time



2. PM_{10} concentration vs Time



3. NO₂ concentration vs Time



The graphs clearly indicate peak pollution hours during morning and evening periods.

Analysis and Discussion

- PM_{2.5} concentrations are higher during morning (7–9 AM) and evening (6–9 PM) hours due to heavy vehicular movement and reduced wind speed.
- PM₁₀ levels increase during daytime due to road dust resuspension and construction activities.
- NO₂ levels peak during evening hours, indicating emissions from traffic and fuel combustion.

Minimum pollutant concentrations are observed during afternoon hours due to increased atmospheric mixing and dispersion.

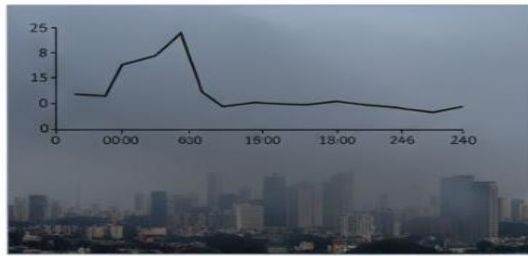
Climatic Interpretation

- Low wind speed during early morning and night leads to pollutant accumulation.
- Higher daytime temperature enhances vertical mixing and pollutant dispersion.
- Urban Heat Island effect contributes to elevated evening temperatures and pollutant retention.
- Seasonal conditions such as winter inversion can worsen air quality in Nagpur.



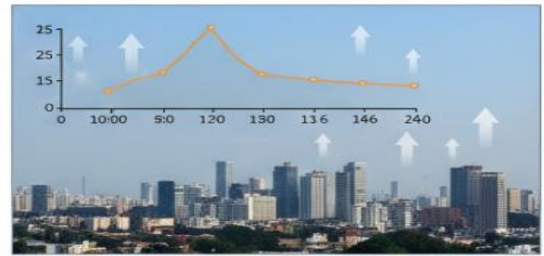
Low Wind Speed

Low wind speed during early morning and night leads to pollutant accumulation



Higher Daytime Temperature

Higher daytime temperature enhances vertical mixing and pollutant dispersion



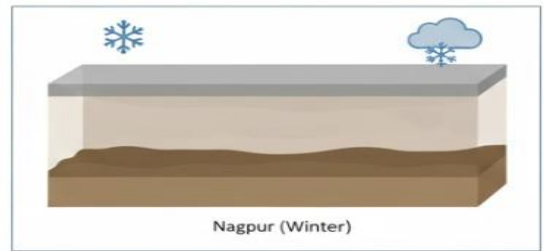
Urban Heat Island Effect

Urban daytime effect contributes to elevated evening temperatures and pollutant retention



Seasonal Winter Inversion

Seasonal conditions such as winter inversion can worsen air quality in Nagpur



Conclusion

The study shows that Nagpur experiences significant hourly variation in air pollutant concentrations influenced by traffic density, human activities, and meteorological conditions. $PM_{2.5}$ and PM_{10} are identified as critical pollutants. Strengthening NCAP strategies such as traffic management and dust control is essential to improve air quality.

References

1. Central Pollution Control Board (CPCB) – CAAQMS Portal
 2. National Clean Air Programme (NCAP) Guidelines
 3. Environmental Science Course Material
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