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A COMPARATIVE STUDY OF AIR QUALITY INDEX (AQI) IN SELECTED CITIES OF MAHARASHTRA

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ABSTRACT

Air pollution is a major environmental and public health concern in India, driven by rapid urbanization, industrialization, vehicular emissions, and construction activities. This study presents a comparative analysis of the Air Quality Index (AQI) of five major cities in Maharashtra – Mumbai, Pune, Nagpur, Nashik, and Chhatrapati Sambhajinagar (Aurangabad) – using secondary data from the Central Pollution Control Board (CPCB) and Maharashtra Pollution Control Board (MPCB). The analysis shows that Mumbai and Pune generally record higher AQI levels due to heavy traffic and industrial activities, while Nashik experiences relatively better air quality. AQI tends to worsen during winter and improve during the monsoon because of seasonal meteorological conditions. The study highlights the need for effective pollution control measures, sustainable urban planning, improved public transport, and continuous air quality monitoring to safeguard environmental quality and public health.

KEYWORDS: *Air Quality Index, AQI, Maharashtra, CPCB, MPCB, Air Pollution, Urban Environment, Environmental Management*

INTRODUCTION

Air pollution is recognized as one of the most serious environmental issues affecting human health, ecological balance, and sustainable development across the world. According to the World Health Organization (WHO), exposure to polluted air contributes to millions of premature deaths annually through respiratory diseases, cardiovascular disorders, and other chronic health conditions. Rapid industrialization, urbanization, increasing energy consumption, and growing vehicular traffic have significantly contributed to deteriorating ambient air quality, particularly in developing countries such as India.

Maharashtra is India's most industrialized state and is home to several metropolitan cities, including Mumbai, Pune, Nagpur, Nashik, and Chhatrapati Sambhajinagar. These cities are characterized by rapid population growth, expanding transportation networks, construction activities, and industrial development, all of which contribute to varying levels of air pollution.

To facilitate public understanding of ambient air quality, the Central Pollution Control Board (CPCB) introduced the National Air Quality Index (AQI), which classifies air quality into six categories: Good, Satisfactory, Moderate, Poor, Very Poor, and Severe. The AQI is calculated using major pollutants, including $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, NH_3, O_3, and Pb. This standardized index helps governments monitor pollution trends and implement appropriate control measures.

A comparative evaluation of AQI across Maharashtra's major cities provides valuable insights into regional pollution patterns and helps identify pollution hotspots. Such analyses also support evidence-based policymaking for environmental protection and public health improvement.

The present study therefore compares the AQI status of five major cities in Maharashtra using official CPCB and MPCB data to understand their relative air quality conditions and the factors responsible for observed variations.

REVIEW OF LITERATURE

Sharma et al. (2022) reported that particulate matter ($PM_{2.5}$ and PM_{10}) remains the principal contributor to poor air quality in Indian metropolitan cities and poses serious health risks.

Guttikunda and Goel (2021) observed that transportation, industrial emissions, and construction dust significantly influence AQI levels in major urban centres across India.

The Central Pollution Control Board (2024) reported that seasonal variations strongly affect AQI, with winter months generally recording higher pollution levels due to lower atmospheric mixing heights and temperature inversion.

Maharashtra Pollution Control Board (2024) highlighted that Mumbai and Pune frequently experience elevated AQI values because of dense vehicular traffic, industrial emissions, and rapid infrastructure development.

World Health Organization (2021) emphasized that long-term exposure to particulate matter is associated with increased mortality from respiratory and cardiovascular diseases.

Recent studies also indicate that implementation of the National Clean Air Programme (NCAP) has contributed to gradual improvements in air quality monitoring and pollution control measures across several Indian cities, although considerable challenges remain in rapidly urbanizing regions. This study attempts to provide a comparative analysis of selected cities using official government data and interpreting the results from an environmental management perspective.

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OBJECTIVES

The study aims to:

1. Compare the Air Quality Index (AQI) of selected cities in Maharashtra.
2. Examine seasonal variations in AQI among the selected cities.
3. Identify the major factors responsible for air pollution in each city.
4. Assess the relationship between urbanization and air quality.
5. Suggest policy measures for improving ambient air quality in Maharashtra.

RESEARCH METHODOLOGY

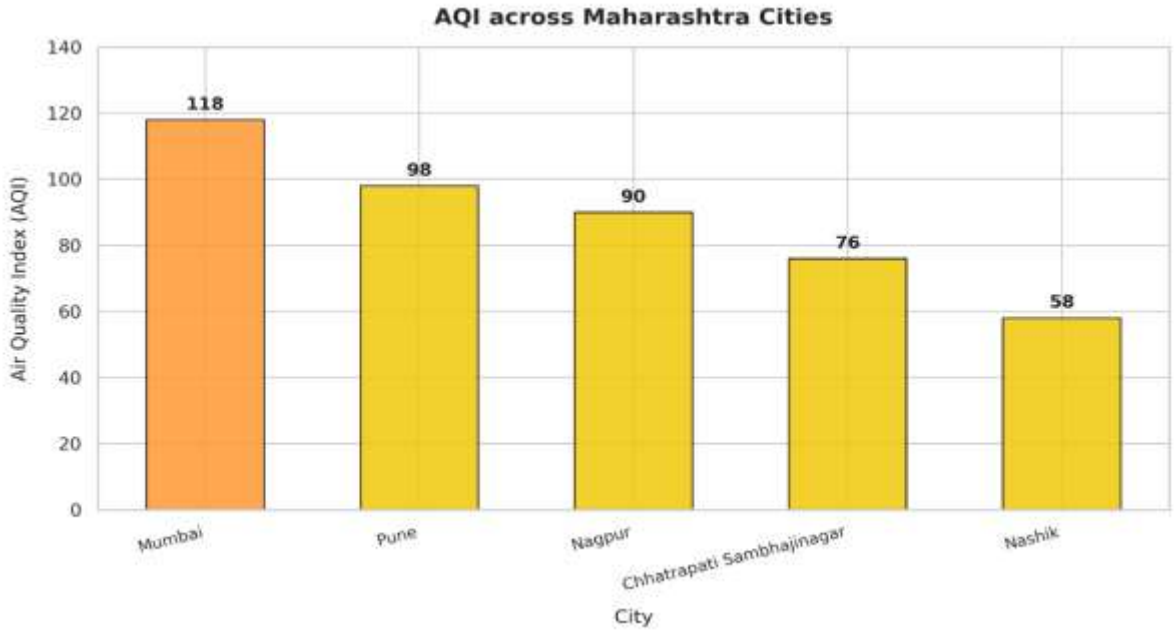
The study adopts a descriptive and comparative research design based on secondary data.

Data obtained from Central Pollution Control Board (CPCB),Maharashtra Pollution Control Board (MPCB),National Clean Air Programme (NCAP),Ministry of Environment, Forest and Climate Change (MoEFCC),Peer-reviewed journal articles

Study Area

Five major cities of Maharashtra have been selected. Mumbai, Pune, Nagpur,Nashik
Chhatrapati Sambhajinagar.

RESULT AND DISCUSSION



Source- CPCB Continuous Ambient Air Quality Monitoring System (CAAQMS) and MPCB Air Quality Status Reports.

The comparative analysis of the Air Quality Index (AQI) of five major cities in Maharashtra-Mumbai, Pune, Nagpur, Nashik, and Chhatrapati Sambhajinagar reveals noticeable differences in air quality due to variations in urbanization, industrialization, traffic density, and meteorological conditions.

Mumbai recorded the highest AQI among the selected cities for most of the study period. High vehicular traffic, industrial emissions, port activities, construction work, and dense population contribute significantly to deteriorating air quality. During winter, the AQI frequently reaches the *Moderate* to *Poor* category due to reduced atmospheric dispersion of pollutants.

Pune also exhibited relatively high AQI levels. Rapid urban expansion, increasing private vehicle ownership, industrial estates, and ongoing infrastructure projects are the major sources of air pollution. Seasonal changes indicate higher AQI during winter and lower values during the monsoon because rainfall helps remove airborne particulate matter.

Nagpur showed moderate AQI values. Industrial activities, thermal power plants in the surrounding region, road dust, and vehicular emissions influence the city's air quality. Although pollution levels are lower than Mumbai and Pune, winter months show a noticeable increase in particulate matter concentration.

Nashik recorded the best air quality among the five cities. Lower industrial density, comparatively less traffic congestion, and better urban environmental conditions contribute to lower AQI values. The city generally remained within the *Good* to *Satisfactory* AQI categories throughout most of the study period.

Chhatrapati Sambhajinagar (Aurangabad) exhibited AQI values between those of Nagpur and Nashik. Industrial activities, urban growth, and vehicular emissions contribute to pollution levels, although they remain lower than those observed in Mumbai and Pune.

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Comparative AQI Status of Major Cities in Maharashtra

City	Overall AQI Status	Major Sources of Pollution	Seasonal Trend	Comparative Rank
Mumbai	Moderate to Poor	Vehicular traffic, industries, port activities, construction dust	Highest during winter; improves in monsoon	1 (Highest Pollution)
Pune	Moderate	Heavy traffic, industries, construction, road dust	Higher in winter; moderate during summer	2
Nagpur	Moderate	Vehicular emissions, industries, thermal power plants, road dust	Noticeable winter increase	3
Chhatrapati Sambhaji nagar	Satisfactory to Moderate	Industrial activities, traffic, urban expansion	Moderate seasonal variation	4
Nashik	Good to Satisfactory	Limited industries, lower traffic density, better green cover	Lowest AQI throughout most of the year	5 (Lowest Pollution)

Source- CPCB Continuous Ambient Air Quality Monitoring System (CAAQMS) and MPCB Air Quality Status Reports.

This pattern reflects the influence of population density, industrial development, transportation intensity, and construction activities. Seasonal variation was observed across all five cities, with AQI values increasing during winter because of low wind speed, temperature inversion, and limited pollutant dispersion, while the monsoon season recorded the lowest AQI due to rainfall and atmospheric cleansing.

Overall, the findings suggest that cities with higher urbanization and traffic experience poorer air quality. Strengthening public transportation, controlling industrial emissions, managing construction dust, promoting green spaces, and enhancing continuous air quality monitoring are essential for improving air quality across Maharashtra.

CONCLUSION

The comparative analysis of air quality in five major cities of Maharashtra—Mumbai, Pune, Nagpur, Nashik, and Chhatrapati Sambhajinagar (Aurangabad)—reveals significant spatial variations in pollution levels. The study indicates that highly urbanized and industrialized cities, particularly Mumbai and Pune, experience comparatively poorer air quality due to increased vehicular emissions, industrial activities, construction dust, and high population density. In contrast, Nashik generally records better air quality because of comparatively lower industrialization and traffic congestion, while Nagpur and Chhatrapati Sambhajinagar exhibit moderate pollution levels.

The findings also show that particulate matter ($PM_{2.5}$ and PM_{10}) is the primary contributor to deteriorating air quality across all selected cities. Seasonal variations further influence air quality, with pollution levels increasing during winter because of unfavourable meteorological conditions and improving during the monsoon owing to rainfall and enhanced atmospheric cleansing.

The study concludes that rapid urbanization and economic development must be accompanied by effective environmental management strategies. Strengthening emission control measures, promoting sustainable public transportation, regulating industrial emissions, controlling construction dust, increasing urban green spaces, and expanding continuous air quality monitoring are essential for improving air quality. The findings provide useful insights for policymakers, urban planners, and environmental agencies in designing evidence-based strategies to reduce air pollution and protect public health in Maharashtra.

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