

Article

Spatial Analysis of Air Pollutants in an Industrial City Using GIS-Based Techniques: A Case Study of Pavlodar, Kazakhstan

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Abstract: The given research employs high-resolution air quality monitoring and contemporary statistical methods to address gaps in understanding the urban air pollution in Pavlodar, a city with a significant industrial presence and promising touristic potential. Using mobile air quality sensors for detailed spatial data collection, the research aims to quantify concentrations of particulate matter (PM_{2.5}, PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and ground-level ozone (O₃); assess their distribution; and identify key influencing factors. In this study, we employed Geographic Information Systems (GISs) for spatial analysis, integrating multi-level B-spline interpolation to model spatial variability. Correlation analysis and structural equation modeling were utilized to explore the relationships between variables, while regression analysis was conducted to quantify these relationships. These techniques were crucial for accurately mapping and interpreting spatial patterns and their underlying factors. The study identifies PM_{2.5} and NO₂ as the primary contributors to air pollution in Pavlodar, with NO₂ exceeding the 24 h threshold in 87.38% of locations and PM_{2.5} showing the highest individual air quality index (AQI) in 75.7% of cases. Correlation analysis reveals a positive association between PM_{2.5} and AQI and a negative correlation between NO₂ and AQI, likely due to the dominant influence of PM_{2.5} in AQI calculations. Structural equation modeling (SEM) further underscores PM_{2.5} as the most significant impactor on AQI, while NO₂ shows no significant direct impact. Humidity is positively correlated with AQI, though this relationship is context-specific to seasonal patterns observed in May. The sectoral analysis of landscape indices reveals weak correlations between the green space ratio (GSR) and air quality, indicating that while vegetation reduces pollutants, its impact is minimal due to urban planting density. The road ratio (RR) lacks sufficient statistical evidence to draw conclusions about its effect on air quality, possibly due to the methodology used. Spatial variability in pollutant concentrations is evident, with increasing PM_{2.5}, PM₁₀, and AQI towards the east-northeast, likely influenced by industrial activities and prevailing wind patterns. In contrast, NO₂ pollution does not show a clear geographic pattern, indicating vehicular emissions as its primary source. Spatial interpolation highlights pollution hotspots near industrial zones, posing health risks to vulnerable populations. While the city's overall AQI is considered "moderate", the study highlights the necessity of implementing measures to improve air quality in Pavlodar. This will not only enhance the city's attractiveness to tourists but also support its sustainable development as an industrial center.

Keywords: air pollution; air quality index (AQI); particulate matter (PM_{2.5}; PM₁₀); green space ratios; road ratio; Pavlodar, Kazakhstan



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The Analysis Of Air Pollutants

Sabine Zange



The Analysis Of Air Pollutants:

The Analysis Of Air Pollutants Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**The Analysis Of Air Pollutants**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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Table of Contents The Analysis Of Air Pollutants

1. Understanding the eBook The Analysis Of Air Pollutants
 - The Rise of Digital Reading The Analysis Of Air Pollutants
 - Advantages of eBooks Over Traditional Books
2. Identifying The Analysis Of Air Pollutants
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an The Analysis Of Air Pollutants
 - User-Friendly Interface
4. Exploring eBook Recommendations from The Analysis Of Air Pollutants
 - Personalized Recommendations
 - The Analysis Of Air Pollutants User Reviews and Ratings
 - The Analysis Of Air Pollutants and Bestseller Lists
5. Accessing The Analysis Of Air Pollutants Free and Paid eBooks

- The Analysis Of Air Pollutants Public Domain eBooks
 - The Analysis Of Air Pollutants eBook Subscription Services
 - The Analysis Of Air Pollutants Budget-Friendly Options
6. Navigating The Analysis Of Air Pollutants eBook Formats
 - ePub, PDF, MOBI, and More
 - The Analysis Of Air Pollutants Compatibility with Devices
 - The Analysis Of Air Pollutants Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of The Analysis Of Air Pollutants
 - Highlighting and Note-Taking The Analysis Of Air Pollutants
 - Interactive Elements The Analysis Of Air Pollutants
 8. Staying Engaged with The Analysis Of Air Pollutants
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers The Analysis Of Air Pollutants
 9. Balancing eBooks and Physical Books The Analysis Of Air Pollutants
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection The Analysis Of Air Pollutants
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine The Analysis Of Air Pollutants
 - Setting Reading Goals The Analysis Of Air Pollutants
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of The Analysis Of Air Pollutants
 - Fact-Checking eBook Content of The Analysis Of Air Pollutants
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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