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Assessment of Urban Air Quality of Hyderabad City on The Basis of Land Use Pattern

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Abstract

Air pollution is the latest attention in the field of environment due to the influence of globally generated air pollution affecting on global climate. Air pollution is growing environmental problem of metropolitan cities of Pakistan, it can deleteriously affect the environment and public health of the citizens. This study assessed the air quality of Hyderabad city with insight to its land use pattern which includes: Residential, Commercial, Recreational and industrial along with entrance and exit routes of the city. Fifteen sampling points were targeted which includes: three sampling point from each land use pattern, two sampling point for entrance and exit route and one for control as a reference point. Haz-Scanner Model HIM-6000 (air quality monitoring instrument), a US EPA portable device was used for 24-hour average monitoring of Particulate Matter (PM2.5), Particulate Matter (PM10), Nitric Oxide (NO) Nitrogen dioxide (NO2), Carbon monoxide (CO), Ozone (O3), and Sulphur dioxide (SO2).

Keywords: Mega urban regions; Urban air pollution; Land use changes; Sustainable urban land use

Introduction

Urban air pollution is a major concern throughout the world in both, developed and developing countries. Swelling urban population and increased volume of motorized traffic in cities have resulted in severe air pollution affecting the surrounding environment and human health. Urbanization triggered rapid development which may have negative influence on the environment i.e. air pollution.1It is estimated that more than 50% population of the world lives in urban area and the 70% of the world's population will be expectedly living in cities and towns.2 The high urbanization rate tends to have elevated air pollutant concentration which pose negative effect on air pollutant concentration. The main affecting factors of air pollution include population density, vehicle engine, motors, generators and industrial emission [1-3].

Materials and Methods

A qualitative and quantitative research was designed for the Hyderabad city of Pakistan for the assessment of ambient air quality and its impact on population. Air quality assessment has been done on different land use pattern of the city which includes commercial, residential, recreational and industrial along with entrance and exit of the city (Figure 1).

Administratively the city of Hyderabad is divided into 5 towns and 20 union councils has an area of 319 KM2 with population density is 5400/ KM2. It is the second most urbanized city in Sindh, after Karachi, with 80% of its residents live in urban areas. Hyderabad is a city and the capital of Hyderabad Division in the Sindh province of Pakistan. Total 15 locations were selected for air quality monitoring, given with GPS Coordinates.

It is observed that CO level at industrial land use pattern at all monitored locations found within SEQSs limit and WHO Guidelines. CO is a colorless, odorless, tasteless, and toxic air pollutant, produced by the incomplete combustion of carbon-containing fuels, such as gasoline, natural gas, oil, coal, and wood [4,5].

PM2.5 and PM10 at all sampling locations were satisfactory as per SEPA ambient air quality standards; however, it does not comply with the WHO guidelines (25 µg/m3 24-hour mean for PM2.5and 50µg/m3 24-hour mean for PM10). The 24-hour average monitoring results for PM2.5at three industrial sampling points were 39 µg/m3, 34 µg/m3 and 31 µg/m3 and for PM10 were 89 µg/m3, 91.33 µg/m3 and 87 µg/m3.

NO at all three locations found within SEPA Standards which is 40 µg/m3 for 24-hours average. NO2 at all industrial sampling location land use pattern was found beyond SEPA standards which are 80 µg/m3 for 24 hours mean but within WHO guidelines (200 µg/m3 for 1 hour). The 24-hour average monitoring results for NO2at three industrial sampling points were 86.66 µg/m3, 85.66 µg/m3 and 88.66 µg/m3. The general observation was made to identify the factor of high NO2 at industrial area are industrial emissions of boiler and generator with improper air to fuel ratio and combustion installation at power station as well as some agricultural activities. So majorly industries are responsible for contributing NO2 pollution at industrial land use pattern of Hyderabad. However, SO2 comes within SEPA standard which is 120 µg/m3 24-hours mean but it is not comply with WHO guidelines which is 20µg/m3 24-hour mean. The 24 average monitoring results were 65.66µg/m3, 58.66 µg/m3 and 60.66 µg/m3 [6-8] (Figure 2).

The reason for better air quality in Hyderabad as compared to other mega urban cities is that, it has minimum number of industrial units as compared to the major cities of Pakistan, especially Karachi. It has only one industrial area with the wide range of small-scale to medium-scale industries which includes steel re-rolling, brick kilns, and steel recycling units. The industrial area is not congested, as in other mega cities of Pakistan as well as traffic congestion and heavy transport mobilization is also limited. Moreover, industries are in open areas at Hyderabad, that is the reason why most pollutants like carbon monoxide, particulate matter, ozone and sulfur oxides found within SEQSs limits and WHO guidelines. Moreover, the source of SO2

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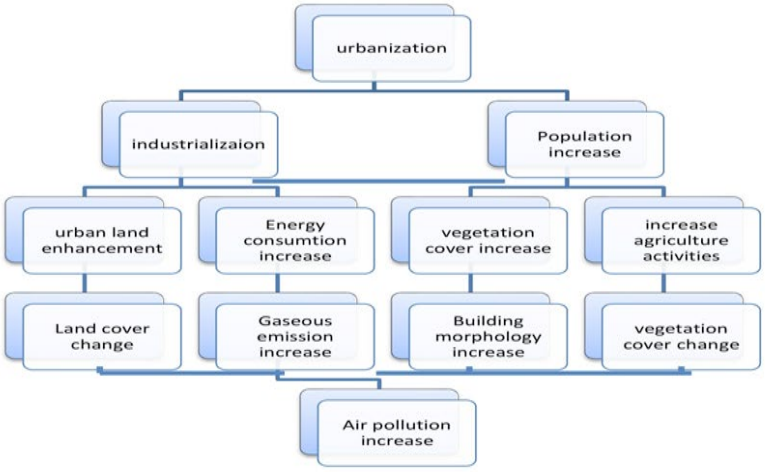

Figure 1: Urbanization and its phenomenon on Land use change, urban planning and air pollution.

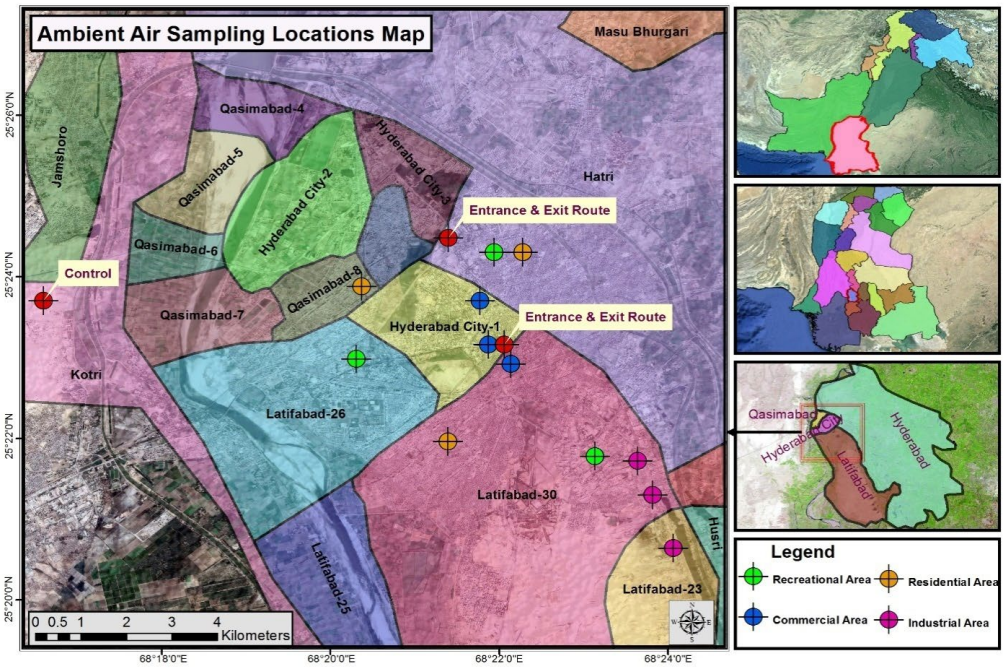

Figure 2: Combined Map showing all sampling locations in Hyderabad in different land use patterns.

in the atmosphere is the burning of fossil fuels by power plants and other industrial facilities. Smaller sources of SO2 emissions include: industrial processes such as extracting metal from ore; natural sources such as volcanoes; and locomotives, ships and other vehicles and heavy equipment that burn fuel with a high sulphur content. Industries are in open areas and the burning of fossil fuels with heavy Sulphur content at the city is low with the limited number of vehicles and engines. Volatile organic compounds (VOC) content at the city was found low which contributes to ground level ozone by chemical reactions between oxides of Nitrogen (NOx) and (VOC). However, ozone O3 at all industrial sampling location was comes within WHO and SEPA Guidelines [9, 10].

Conclusion

In previous section, concentration of air pollutant at every land use pattern has been discussed. The average concentrations of air pollutants at all land use patterns of Hyderabad city are discussed and it is concluded at the land use pattern where urban sprawl is high and more congested, high level of air pollutant experienced at those areas. Concentration of air pollutant was compared with SEPA guidelines and WHO Guidelines and both have different guidelines for different air pollutants which has been discussed in detail.

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