

Mitigation Strategies for Reducing of Air Pollutant, Case Study: Al-Hilla City -Babylon Province/ Iraq

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Abstract

Air pollution is one such form that refers to gas emission, regardless of indoor or outdoor air pollution. Pollution may be considered a biological, physical, or chemical change of the air. It occurs when dust, toxic substances, and smoke enter the environment and make it difficult to survive as the air becomes contaminated for humans, plants, and animals. In this paper the, data of SO₂, NO₂ and CO₂ from three monitoring stations in Al Hilla city - Babylon governorate in 2020 have been collected. In an attempt to view the concentrations of the main pollutants in this city and compare them with the Standards for various world health organizations, and Providing a valid solution to reducing the effect of air pollution on the environment and human health. This paper provides the Iraqi government with useful information for the execution of a strategic plan at the personal and collective level to emphasize the reduction of multi-pollutant emissions and the overall risks associated with air pollution in Al Hilla or other Iraqi cities.

Key Words: Air Pollution, Pollutants, Mitigation Strategies, Al Hilla city.

1. Introduction

Air pollution is one such form that refers to gas emission, regardless of indoor or outdoor air pollution. Pollution may be considered a biological, physical, or chemical change of the air [1,2]. It occurs when dust, toxic substances, and smoke enter the environment and make it difficult to survive as the air becomes contaminated for humans, plants, and animals. It is one of the most significant environmental issues influencing individuals and the earth in general. In its latest study, the World Health Organization warns that 1 in 9 people who breathe toxic air die due to respiratory diseases. [3,4]. Emissions from a multitude of sources, primarily stationary, industrial and domestic fossil fuel combustion and petrol and diesel vehicle emissions, are producing the urban air pollution. The extent of impact estimates, however, varies between cities and nations, hindering the understanding and generalization of the causal relationship between air pollution and health. In an exemplary urban environment, persons are exposed to an intricate mix of air pollutant species

with a capacious range of exposure-response functions and health impacts [5]. Bad air quality has both acute and chronic impacts on human health. In an effort to measure air quality in a manner acceptable for public use and action, several countries have established descriptors. There are various air quality indices, reflecting the global condition of urban air pollution. [6].

In recent years, the environment of Iraq has been exposed to various types of pollution resulting from wars, unregulated industrial, agricultural, and commercial activities that have increased due to growth population, emissions from power plants and oil fields [7]. Therefore, the substantial increase in the amount rate of fuel-consuming vehicles and the creation of a large number of factories have resulted in a significant increase in the concentration of gaseous and particulate matter in the air. Sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and carbon dioxide (CO₂) are known to be the main air pollutants in Iraq, and on the other hand, so effective air pollution mitigation strategies necessary to be identified in order to resolve these issues. [8,9]. This paper provides the Iraqi government with useful information for the execution of a strategic plan to emphasize the reduction of multi-pollutant emissions and the overall risks associated with air pollution in Babylon governorate or other Iraqi governorates.

2. Methodology

2.1. Sampling Points

Al Hilla city is located in the center of the Babylon governorate southern of Baghdad (the capital of Iraq). Presently, there are more than 2.4 million people living in this city, being the sixth place of the population and Sixteenth largest place of the area in the Iraqi governorates. In recent years, the levels of emissions have risen and could worsen due to the end of the economic crisis and the increase in fossil fuel use. Due to the heavy traffic around major urban routes and major highways crossing the city, pollution in Hilla city include traditional diffuse urban sources, industrial sources and traffic emissions. Locations sampling for air pollution in Al-Hilla city was illustrated in Fig.1.

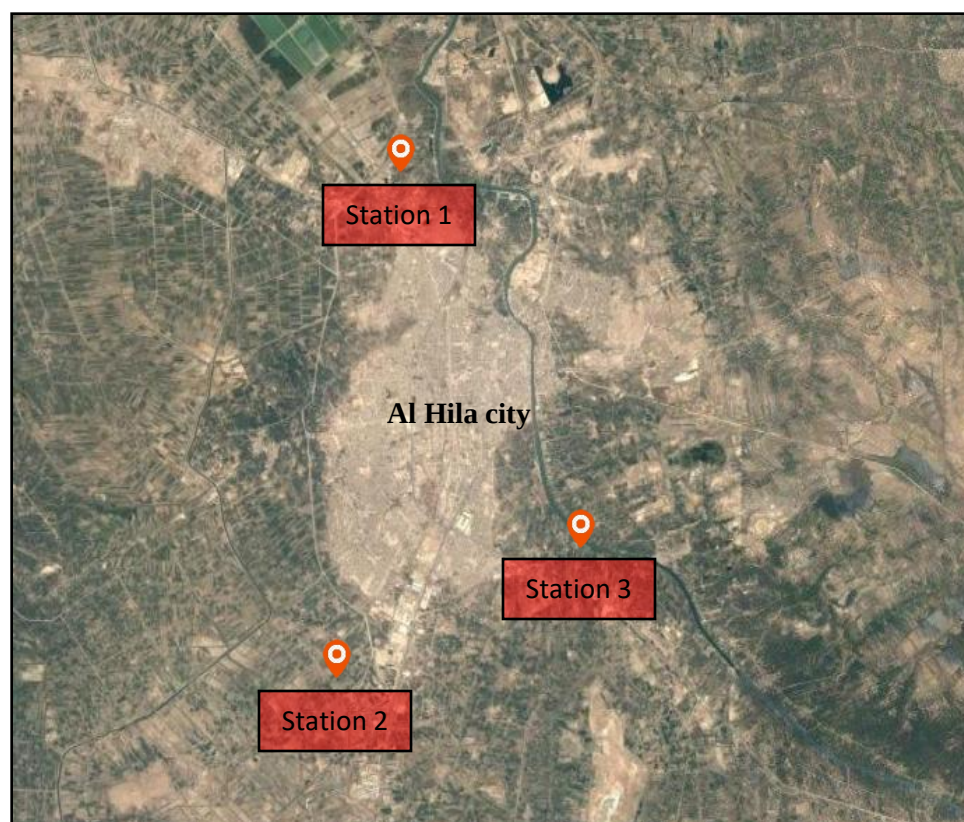


Fig. 1:locations sampling for air pollution in Al-Hilla city [10].

2.2 Data of pollutants

Data on air quality used in this paper in three stations of Al Hilla city were collected in order to survey the concentrations of SO_2 , NO_2 , and CO_2 of the ambient air in 2020. These stationary stations belong to the Babylon Governorate's Environmental Protection Directorate, which in turn is affiliated with the Iraqi Ministry of Health and Environment and located on three major highways of the city that connect it with the governorates of Karbala, Najaf, and Al-Qadisiyah. The Air pollutants detection instrument was run for five days a week (Sunday to Thursday), the average monthly recording were obtained as data to analyze and compare with various world health organizations standards (Table 1).

Table 1: Various world health organizations standards

Average timing	Pollutants standards concentrations (mg/l)			Ref.
	CO2	NO2	SO2	
1 hr.	-	1.2	0.2	[11]
8 hr.	-	-	-	
24 hr.	-	-	0.08	
365 d.	-	0.03	0.02	
1 hr.	-	0.18	0.25, 0.14	[12]
3 hr.	-	-	-	
8 hr.	-	-	-	
24 hr.	-	-	0.04	
1 year	-	0.03, 0.053	0.03	
10 min	-	-	0.2	[13]
15 min	-	-	-	
30 min	-	-	-	
1 hr.	-	0.11	-	
24 hr.	-	-	0.045	
365 d.	-	0.02	0.02	
1 hr.	-	0.11 (>18 times a calendar year)	0.13 (>3 times a calendar year)	[14]
8 hr.	-	-	-	
24 hr.	-	-	0.048 (> 24 times a calendar year), 0.2 (thresholds value)	
365 d.	-	0.02 (value limited), 2.13 (thresholds value)	-	
1 hr.	-	0.11 (>8 times a calendar year)	0.13 (> 24 times a calendar year)	[15]
3 hr.	-	-	0.5 (> once a year)	
24 hr.	-	-	0.045 (>3 times a calendar year), 0.14 (> once year)	
365 d.	-	0.02, 0.05, 0.53	-	
10 min	-	-	0.2	
15 min	3000 0	-	-	[16]
1 hr.	-	0.11	-	
8 hr.	5000	-	-	
24 hr.	-	-	0.01	
365 d.	-	0.2	-	

3. RESULTS AND DISCUSSION

Figures 2, 3, and 4 demonstrate the average monthly concentrations recorded at Al-Hilla city in 2020 by threemonitoring stations chosen for this paper, also with their location and the population affected. SO₂ concentrations extremely exceeded the world health

organizations standards. Fig. 2 illustrates that all stations exceeded the standard limit, from that can be seen the highest annual rate of pollutant concentrations is in the third station (13.1775 ppm) and the lowest annual rate is in the first station (8.725 ppm). This is attributed to the high volume of traffic resulting in large amounts of SO₂ through car exhausts according to the process of burning fuel. Finally, it can be seen that the SO₂ levels were widespread in the congested districts of cars and neighboring industrial zones.

While NO₂ distribution in the ambient air of Hilla city can be described by Fig. 2. It is clear that all stations exceeded the standard limit; the second station has the highest concentration of pollutants, with a noticeable difference from the other two stations. By realizing the location of the station located in the middle of three nearby universities, as well as on a highway linking the city of Hilla to Najaf Governorate, this can be explained the increase in NO₂ levels due to the severe traffic congestion caused by the site, however, the annual rate at the second station (73.335 ppm), the first station has the lowest annual rate (14.636 ppm)

Measurements done in the research zone illustrated that the highest CO₂ concentrations in the first station (393.585 ppm). While the third station has, the lowest annual rate (200.237 ppm) were found as shown in Fig. 4

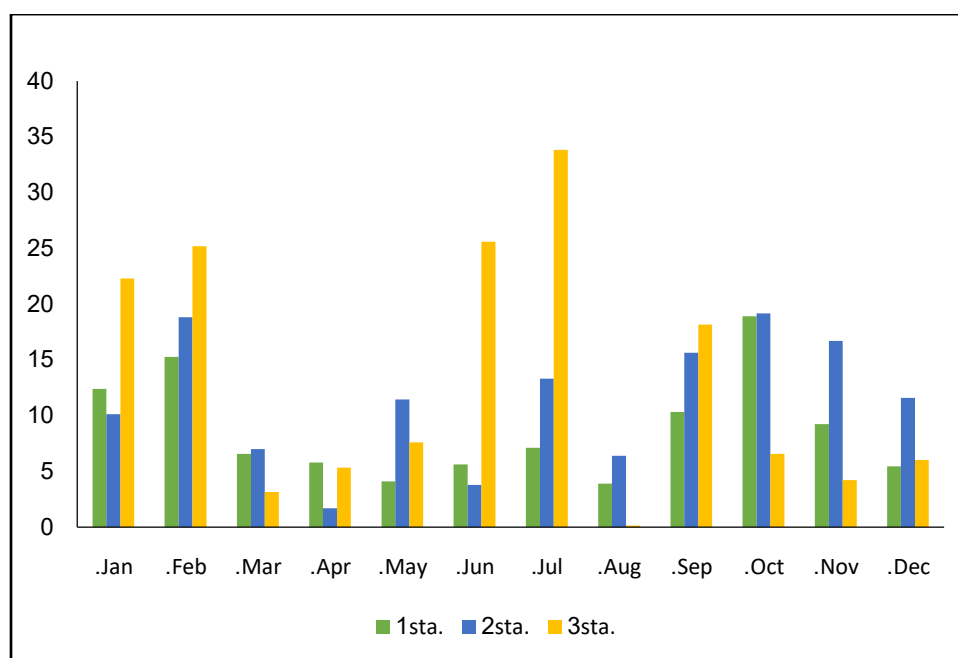


Fig. 2: The average monthly concentrations of SO₂ concentrations of Al Hilla city.

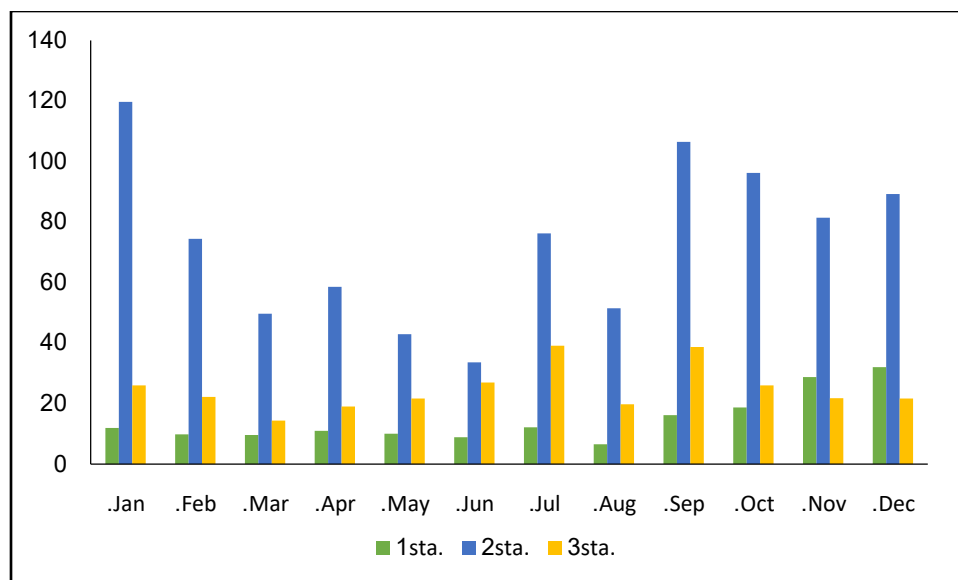


Fig. 3: The average monthly concentrations of NO₂ concentrations of Al Hilla city.

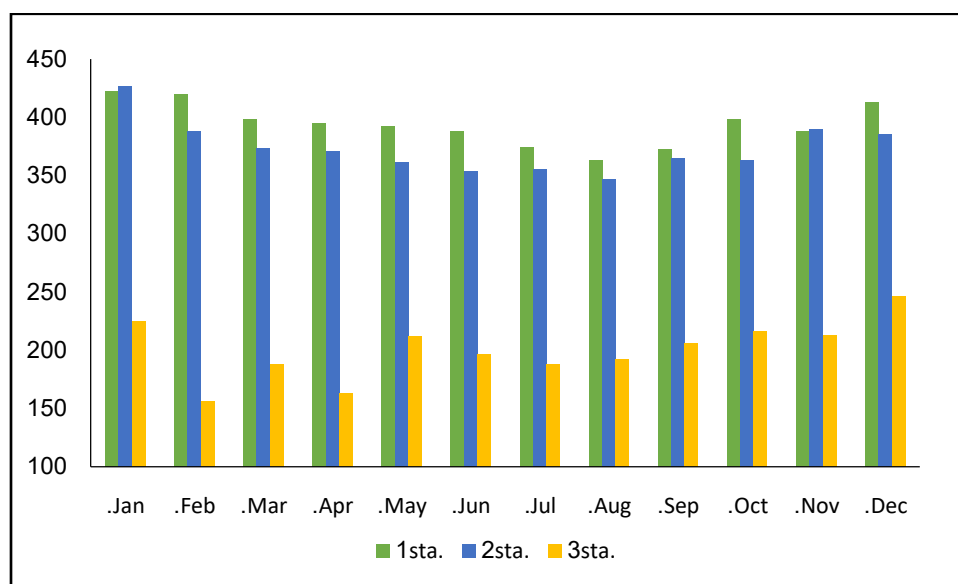


Fig. 4: The average monthly concentrations of CO₂ concentrations of Al Hilla city.

4. Mitigation Strategies

More attempts to reduce the issue of air pollution must be made at several levels, and the following are some suggestions that can be exercised to reduce this phenomenon at the personal and collective level:

4.1 Personal level

- Use public transit, walk or bike whenever possible.
- Purchase of home or office equipment that is energy-efficient with an energy star label.
- Follow the refueling instruction for vehicles. Make sure that there is no leak of fuel outside the filler cap and that the fuel filler cap is securely closed.
- Purchase portable gasoline containers, which are spill-resistant.
- Apply compost or mulch.
- Using heaters with gas instead of burning wood.
- Participation in energy efficiency projects administered by local authorities.
- Reducing the number of vehicle usage times by purchasing items in one go.
- Avoid slow speeds driving; because that will consume large quantities of fuel for a certain distance, compared to traveling the same distance at a normal speed.
- Regular maintenance for vehicles, such as: replacing the oil and filter, and making sure the tires are fully inflated; To avoid consuming more fuel while traveling a certain distance, it can be traveled with less fuel if the vehicle is well maintained.
- Purchase of vehicles that are electric or hybrid.
- Use of manual or power plant tools that do not depend on fuel.
- Use the washing machine while full of clothes and, when filled with cooking utensils, use the dishwasher; minimize the number of uses and reduce the consumption of energy.
- Using cleaning products that are environmentally friendly.
- Using paints containing low-volatile organic compounds or paints based on water instead of solvents.
- Advocate for measures to minimize power plant pollution and advocate for the implementation of stricter international vehicle emissions standards. Encouraging government-funded research projects based on developing electrically powered transportation means to reduce vehicles that depend on combustion of fossil fuels in their work.
- Encouraging the production of alternative energy sources that are clean, sustainable and environmentally friendly to reduce the use of fossil fuels.
- Application of the carbon credit system to pollutants such as SO_x, NO_x, CO, and CH₄; to decrease the percentage of pollutants allowed in the atmosphere annually.

- Planning to replace (LED) lamps with fluorescent and incandescent bulbs, which are 50% and 90% more efficient than fluorescent and incandescent bulbs, respectively.

4.2 Collective level

- Create an environment and more places safer for bicycling.
- Conversion of public transport vehicles to electric.
- Convert private transportation to electric vehicles.
- Cultivation of vertically growing plants that mitigate air pollutants.
- The adoption of a new society habits.
- Activating the green building principle.
- The enactment of laws and legislation to reduce pollution.

5. Conclusions

The monthly average concentration of SO₂, NO₂, and CO₂ by three stations has been recorded for 2020, in order to show the problem of air pollution present in Al Hilla city. This paper briefs the mitigation strategies that can be implemented in different sectors by individuals, society and governments: transport, manufacturing, households, energy production, agriculture and shipping. Also, can present useful information for the Iraqi and Local governments for the execution of a strategic plan to emphasize the reduction of multi-pollutant emissions and the overall risks associated with air pollution.

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