



Determination of Some Air Pollutants during COVID-19 in AL Nasiriya City, Southern Iraq

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Abstract: The current study estimated the concentrations of some air pollutants gases like carbon monoxide (CO), carbon dioxide (CO₂), and sulfur dioxide (SO₂) in AL Nasiriya city, south of Iraq. The samples were collected monthly from January to December 2020 for five stations within AL Nasiriya city. Stations one, two, three, and four were at industrial, commercial, and residential areas, while the five-station was rural. The Horiba Mobile Laboratory monitored air pollutants and it contains a mobile ambient air quality monitoring system. The result found a different concentration of gases over seasons and stations during the study period. The highest result was in stations three and four for CO and CO₂, while the highest result for SO₂ was in station two. The result shows different AQI values in other study stations.

Keywords: Air pollutants, Air quality index, Gases, Concentrations, Al Nasiriya city

The world has faced many environmental problems in recent years, including air pollution. Air contains a mixture of oxygen, nitrogen, water vapor, carbon dioxide, hydrogen, methane, nitrous oxide, etc. (Hu et al 2021). Air pollution is the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere (WHO 2016). The main cause of air quality degradation is a mixture of substances that come naturally or artificially, causing diseases and deterioration of other environmental elements. Air pollution is considered one of the rapidly spreading environmental pollutants, and its effect not only in the source region but also extends to long distances. Therefore, it cannot be controlled after emission from the source, and it must be treated before being released into the air (Iraqi Ministry of Environment 2016). In the past century, air pollution has become one of the world's main problems for two reasons. Firstly, increase the population, especially in the urban area, and Secondly, a rapid increase of energy, industries, and rising levels of fossil fuel combustion (Perera 2017). Six common air pollutants are released into the atmosphere (carbon monoxide, sulfur oxides, nitrogen oxides, ground-level ozone, particulate matter, and lead). These pollutants are released into the atmosphere as primary or secondary pollutants resulting from human activities. The most common pollutants produced from these activities are SO₂, which is mainly produced from power plants and oil refineries, and NO_x, especially nitrogen dioxide NO₂. It is released into the atmosphere through high-temperature combustion and CO, resulting from the

incomplete combustion of fuel and CO₂ released from incomplete burn processes and cement plants (Douabul et al 2013). Many countries have suffered from air pollution; Iraq is one of these countries. The main causes of air quality in Iraq are vehicles, power plants, and oil fields (Shehabalden and Azeez 2017). Hence, the present study's objective is to estimate the concentration of some gases, including SO₂, CO₂, CO, in the air in AL Nasiriya city to obtain primary air pollutants in the air covid 19 periods and the quarantine period.

MATERIAL AND METHODS

Study area: Nasiriya city is located in the south of Iraq and the center area of Thi Qar provenance. It is a crowded city, heavy traffic, and an industrial area. Sampling was chosen in five places in Al-Nasiriya city (industrial sites, heavy traffic, commercial, residential and rural) from January to December 2020 (Fig. 1 and Table 1).

RESULTS AND DISCUSSION

This work was done using a mobile laboratory (Horiba) for continuous determination of some air pollutants (Plate 1), including Carbon monoxide (CO), Carbon dioxide (CO₂), sulfur dioxide (SO₂). The air quality index (AQI) measurement is adopted in this study to know the ambient air quality and pollution degree. The variation in the categories of this guide between stations for all gases was studied. After taking the gaseous pollutant concentrations, all measurements of the gases were converted to AQI values for each pollutant using standard formulas prepared by EPA. Gases values were

calculated seasonal through an online program prepared for this purpose (available on <https://www.airnow.gov/aqi/aqi-calculator>).

This highest concentration recorded for CO was 1.33 ppm at station 3 in the autumn season, while the lowest value was 0.15 in station 5 in the spring season. The mean concentration during the study period was 0.53 ppm (Fig. 2). For CO₂, S4 recorded the highest of 474.9 ppm in the spring season, and the lowest value was 341 ppm in the winter season. Simultaneously, the mean concentration for all study periods was 374.8 ppm (Fig. 3). SO₂ values ranged between .014 ppm in station 4 in spring and 0.077 ppm in station 1 in summer with the average for station of 0.026 ppm (Fig. 4).

In ST3 and ST4 CO and CO₂ were with more concentrations during the study period (Figs. 2 and 3). This is because they are more crowded by vehicles, and they are not open areas compared with other stations. Moreover, the



Plate 1. Mobile Ambient Air Quality Monitoring system/ Horiba

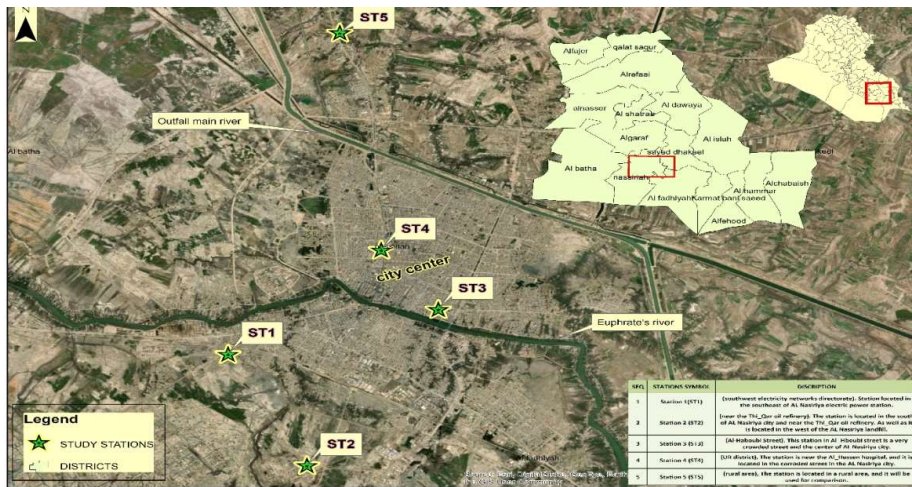


Fig. 1. Study stations in Al Nasiriya city, south of Iraq

Table 1. Description for all sites studied in Al Nasiriya city, south of Iraq.

Sites	Description of the sites
St ₁ (Southwest electricity networks directorate) N: 31 01 44.14 E: 46 12 24.12	Station located in the southeast of AL Nasiriya electric power station.
St ₂ (Near the Thi_Qar oil refinery) N: 30 59 41.19 E: 46 13 37.72	Station is located south of AL Nasiriya city and near the Thi_Qar oil refinery as well as it is located in the west of the AL Nasiriya landfill.
St ₃ (Al-Haboubi Street) N: 31 02 31. 17 E: 46 15 44.88	Station in Al_Haboubi street is a very crowded street and the center of AL Nasiriya city.
St ₄ (UR district) N: 31 03 36.66 E: 46 14 51.39	Station is near the Al_Hussen hospital, and it is located in the corroded street in the AL Nasiriya city.
St5 (Rural area) N: 31 07 34.38 E: 46 14 15.12	Station is located in a rural area, and it will be used for comparison.

reason may also be due to differences in wind speed, as shown in Figure 5. As light winds have a weak effect on the dispersion of pollutants, which helps in increasing the pollutant concentration. In contrast, the lowest pollution was in ST5, a rural area. Generally, all CO concentrations were during the study area were below the Iraqi and international standards. These results are consistent with Shehabalden and Azeez (2017) during their study in Basra city. The mean CO₂ concentrations in station four were 430.7 and higher than the international and Iraqi standards. This result is similar to AL-Anbari et al (2018).

There were significant differences between stations for CO and CO₂ while there were no significant differences between seasons. Besides, there was a significant correlation between CO and CO₂, ST2 has had a high mean concentration of SO₂ during the study period (Fig. 4). This is because the ST2 is near the Thi-Qar oil refinery, and this station is also located in the southeast of the AL Nasiriya electric power station. Both sources (Thi-Qar oil refinery and electric power station) have many gas emissions during their work, and this emission has an amount of SO₂. The mean concentrations for SO₂ during the study period were ST1 (0.0285 ppm), ST2 (0.033), ST3 (0.026), ST4 (0.0212), and ST5 (0.0222) and that below the WHO and Iraqi standard for one hour. These results are inconsistent with previous results (Douabul et al 2013). Statistical analyses in this study

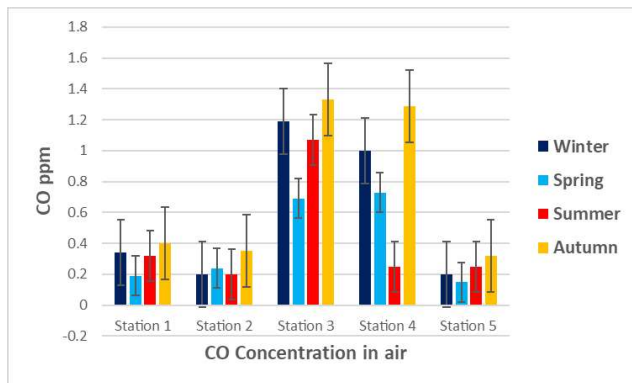


Fig. 2. CO concentrations in air (ppm) in five stations during four seasons

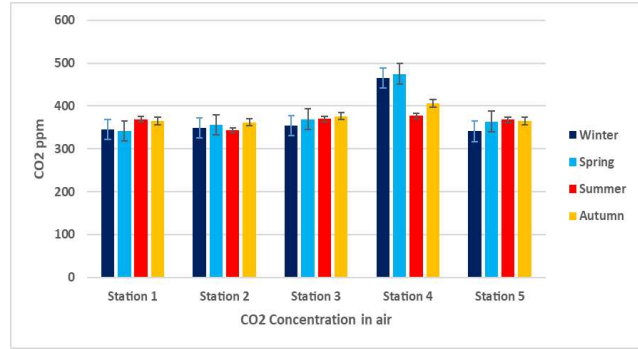


Fig. 3. CO₂ concentration in air (ppm) in five stations during four seasons

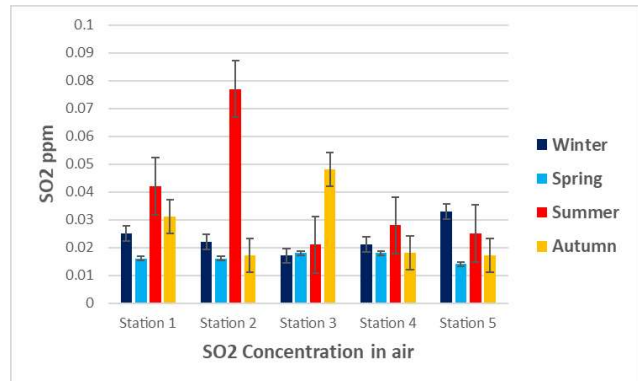


Fig. 3. SO₂ concentration in air (ppm) in five stations during four seasons

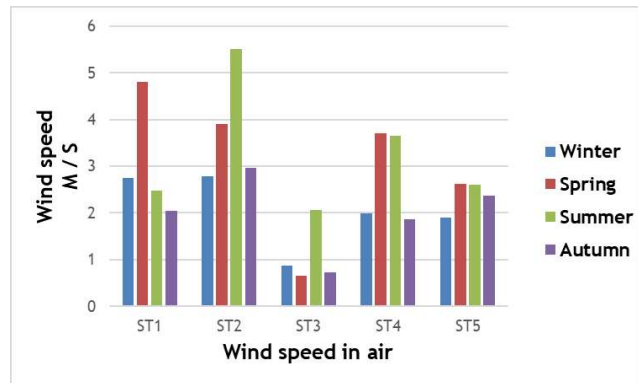


Fig. 4. Wind speed measurement in five stations during four seasons

Table 2. WHO and Iraqi standard for some air pollutants

Gases pollutants	WHO standard	Iraqi standard	Current study				
			ST1	ST2	ST3	ST4	ST5
CO	9 ppm / 8 hour	9 ppm/8 hours 35 ppm/hour	0.31 ppm	0.24 ppm	1.07 ppm	0.81 ppm	0.23 ppm
SO ₂	0.01 ppm / hour 0.03 ppm / year	0.15 ppm / hour 0.02 ppm / year	0.028 ppm	0.033 ppm	0.026 ppm	0.021 ppm	0.022 ppm
CO ₂	250 ppm	250 ppm / hour	359.4 ppm	357.5 ppm	367.3 ppm	430.7 ppm	359.3 ppm

Table 3. Range of AQI comparing with concentrations of gases for this study

Gases (ppm)	Stations	Mean values ppm	AQI s	Levels of health concern	AQI standard
CO	1	0.31	3	Good	0 - 50
	2	0.24	2	Good	
	3	1.07	11	Good	
	4	0.81	9	Good	
	5	0.23	2	Good	
SO ₂	1	0.028	0	Good	0 - 50
	2	0.033	0	Good	
	3	0.026	0	Good	
	4	0.021	0	Good	
	5	0.022	0	Good	

showed no significant differences between stations and seasons for SO₂. However, the results were higher than the Iraqi standard for the year (Table 2).

An indicator determines the degree of pollution in a city or pollutant source for the AQI index. This index is allowed to compare primary air pollutants. These air pollutants include PM, O₃, SO₂, NO_x, and CO (Yan et al. 2019). The current study for all stations recorded between 2-11 for CO and 0 for SO₂. These categories are good for CO and SO₂ concentrations. Simultaneously, the highest AQI values were marked in station three for CO (Table 3).

CONCLUSION

The levels of air pollution such as CO, and SO₂ were within the international and Iraqi standards, while CO₂ was above the international and Iraqi standards during the study period.

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