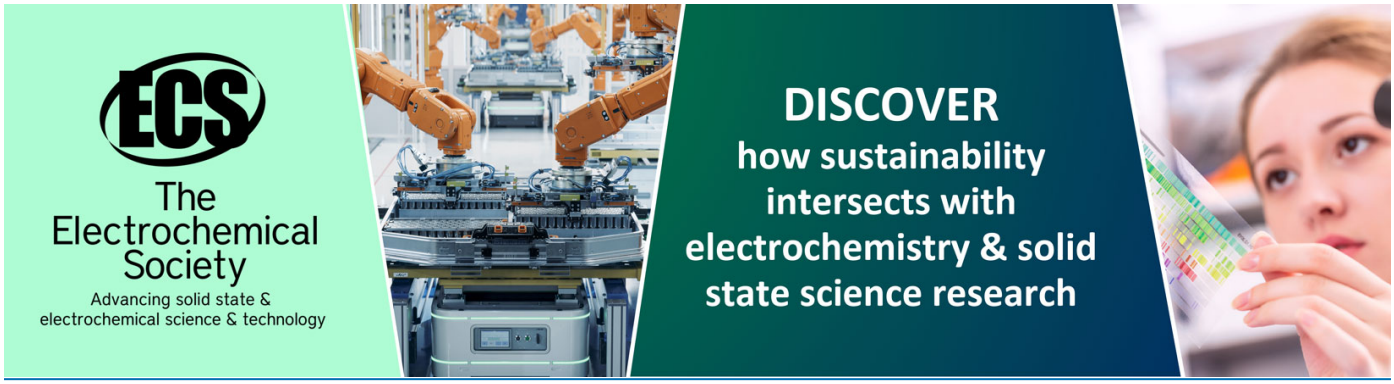
Study, analysis and detection of pollutants in rain water for selected areas over Baghdad city for the 2018-2019 rainy season



Study, analysis and detection of pollutants in rain water for selected areas over Baghdad city for the 2018-2019 rainy season

Hasan M. Azeez

Mustansiriyah University, Collage of science, Atmospheric science Department

Email: hassan.m.a7878@uomustansiriyah.edu.iq

Abstract Some clouds result in rain, such as cumulus clouds and cumulmbus clouds, as rain water is one of the important factors in purifying the air from plankton and impurities in air, Which also helps to soften and moisten the atmosphere, and because of the pollution that many countries of the world suffer from, and since the industrial revolutions that resulted in the rise of pollutants in the atmosphere, and the reason for this is the activity of factories that led to the rise of smoke and toxic gases, As well as car exhaust, generators, and environmental activities caused by dust storms, so the city of Baghdad was chosen to study and detect pollutants in rainwater, as samples of rainwater were collected from different areas including the center and outskirts of Baghdad for the 2018-2019 rainy season, and samples were analyzed by (xrf) technology., After examining the samples, it was found that there are different percentages of pollutants over each of these areas (the study area), as the results showed that the highest percentage of acidity (Ph) was in the Kemaliya area (7.5_{ppm}) and the highest percentage of dissolved salts (46.1_{ppm}) in the Shuala area, and the highest. The percentage of turbidity in the Abu Dashir area was (76_{ppm}).

Keyword: rainwater, (xrf) technology, pollutants

1. Introduction

The concentrations of pollutants in the atmosphere vary, which depend on the sources of pollution that are randomly distributed, for example, chimneys, factories, combustion engines, heating and thermal power plants, chemical industries and waste incinerators, these emissions affect plants, agricultural production and the soil surface, and the reason is attributed to acid rain water that leads to acidification of the soil, which leads to an imbalance in the ecosystem. As rainwater is an important component of what is known as washing the atmosphere, which can contain impurities and plankton when conducting some tests for a set of rainwater samples (Uchiyama *et al.*, 2017)**.** Where a set of studies were conducted on the effect of acid rain on the environment and on human health through understanding and studying the quantities of pollutants emitted from different sources, Wherever the chemical properties of urban rainwater are studied, which are called local pollution sources. While in the outlying and rural areas, it provides the extent of the influence of human resources on it (Bharti, Singh and Tyagi, 2017)**.** Rain water is considered one of the tools in the atmosphere to remove pollutants from the air. These pollutants can mix with pollutants, either with gases or plankton, as this is expressed by the formation of rainwater during its fall, As samples were collected, examined and pollutants separated by sedimentation, rainwater can be a means to reduce and purify the pollutants prevailing in the air, as well as being a source of pollution to plants, water and soil (Facchini Cerqueira *et al.*, 2014)**.** The sky contains many

heavy gaseous pollutants, which are emitted by industries continuously and which remain in the atmosphere for a long time, and most or more of these pollutants fall after the rains in a copious manner mixed with them, note that researchers do not care about the amount of pollutants in the atmosphere and their concentrations, because they do not represent the quality of rainwater. Rather, it is done through monitoring rainwater to assess the amount of pollution that occupies the air (Chakraborty and Gupta 2014). There is a study looking at the effect of air on rainwater pollution, as this phenomenon has become global and a source of concern to the world, and there is great fear for plants, animals and public health with the increased risk of these pollutants, Where this study recorded that there is acid rain due to the interactions caused by gases in the atmosphere with rainwater during its descent to the ground (Jirak and Cotton, 2006)**.** In addition, a mechanism for filtering loose sand and carbon absorption is used to filter the pollutants so that the water is safe, the cause of water pollution in Kalimantan, where the water has become acidic due to the presence of heavy metals such as lead and zinc. Rainwater is collected and pollutants in it are detected by filtration (Khayan *et al.*, 2019). The effect of particles in the atmosphere on the acidity of rainwater is investigated during a washing process in areas with acid rain before, after and during the rain and analyzed in the region of the Delta of China, as the pH depends on the type and extent of the concentration of pollutants in that area (Han *et al.*, 2019). The study analyzed the effect of atmospheric precipitation on filtration processes in Scotland, and the aim of this study was to evaluate the chemical substance present in precipitation as a result of various human activities, The main factor was cement, which determined the physical and chemical properties due to the dust emitted from that area (Kozłowski, Kruszyk and Małek, 2020). In this study, natural resources such as volcanoes, forest fires and various other types of air pollutants, health risks and their effects on rainwater and the extent of its pollution were reviewed, as agreements and protocols were concluded in order to mitigate or address those problems that cause an increase in rainwater pollution and reduce its reduction (Sivakumaran, 2014)**.**

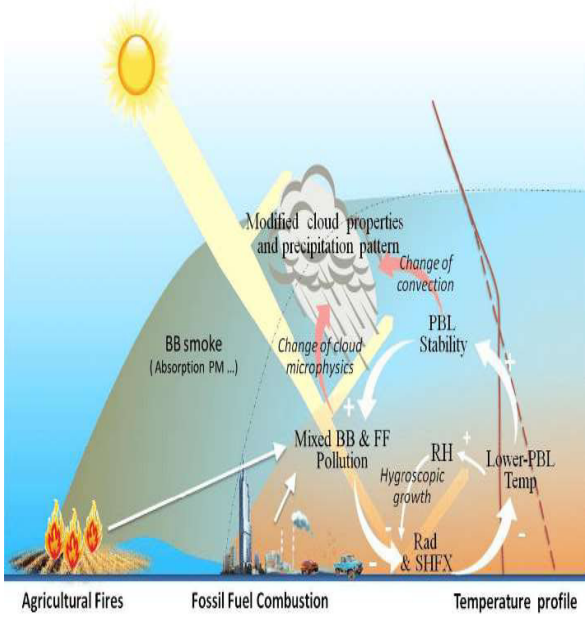


Figure 1. schematic for interactions of air pollution

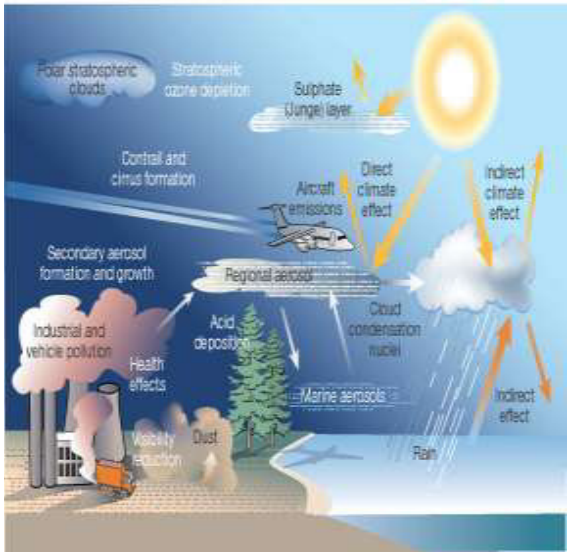


Figure 2. rain washing to the air

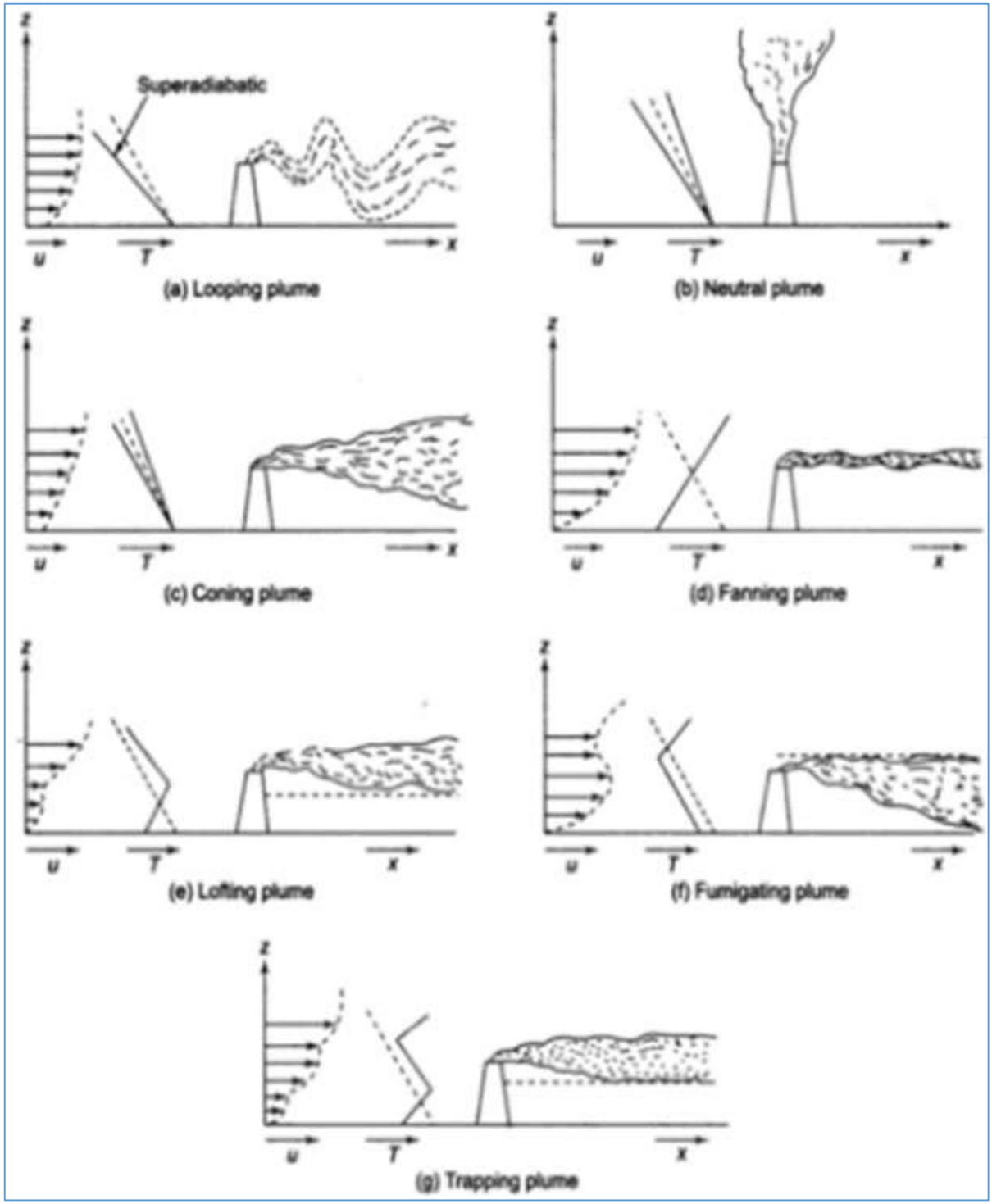


Figure 3. show distrbuting of pollution

The risk of any pollutant depends on the degree of its concentration first and the extent of exposure to it secondly, but the equal concentration and period of exposure to the pollutant becomes possible to arrange air pollutants according to their danger. Carbon monoxide is the most common pollutant, and it can be considered a criterion for measuring the severity of various major pollutants For example, the impact coefficient of the SO2 gas pollutant is equal to 15.3, and this figure represents that SO has a risk of about 15 times more than CO if they have the same concentration. The degree of risk is given through the relationship

$$\text{Dangers degree} = \frac{\text{Concentration of any pollutant}}{\text{proplity level}} \quad \ldots\ldots (1)$$

Table 1. Evaluate the probability level and impact factor of the major pollutants.

pollutants and particulate	Probability level (mg / m3)	Impact coefficient
Carbon monoxide CO	5600	1
Sulfur oxides SO	365	15.3
Particulate matter	260	21.5
NO	250	22.4
Hydrocarbons (HC)	45	125

2.Materials and methodology

To find out the type of air pollutants, it was necessary to find a way to detect these pollutants, and the best way is through rainwater, by collecting it in small bottles, where rainwater was collected in five areas above the city of Baghdad by one bottle for each area, which included the center and the outskirts of the city, As the areas of study were Bab Al-Sharqi, Alshulaa Al-Kemali Al-Husseini and Abu Dashir, samples were analyzed and examined by a (xrf) device, through which the components can be separated in the form of percentages as unit (ppm) in the table

below:-

Tabel 2. is elements in rainwater (ppm)

elements	Eastern section	kmaliyh	Alshaalh	Husseinieh	Abu Dashir
PH	6.1	7.5	6.2	7	5.1
T.D.S	24	34	46.1	38	38.9
TU	20	65	28	35	76
Ca	8	78	69	66	62
Cl	3	6	9	15	9
Mg	7	5	70	63	74
NO2	0.005	0.0011	0.09	0.003	0.010
NO3	0.1	0.4	0.2	0.3	0.2

Figure 4. symbles of rain water

Figure 5 appliance (XRF)

Figure (5) It is a device that analyzes elements by means of x-rays that are energy dispersive and it is a technique that uses X-ray spectroscopy to analyze a variety of elements.. XRF and EDXRF spectrometers are the elemental analysis tool of choice, for many applications, in that they are smaller, simpler in design and cost less to operate than other technologies like inductively coupled plasma optical emission spectroscopy (ICP-OES) and atomic absorption (AA) or atomic fluorescence (AF) spectroscopy. Examples of some common EDXRF applications are: Cement and raw meal: sulfur, iron, calcium, silicon, aluminum, magnesium, etc; Kaolin clay: titanium, iron, aluminum, silicon, etc; Granular catalysts: palladium, platinum, rhodium, ruthenium, etc; Ores: copper, tin, gold, silver, etc; Cement and mortar fillers: sulfur in ash.

3. Result and discussion

The concentration of pollutants varies from one place to another according to the geographical nature of the region, as we note that there are areas in which the proportions of pollutants depend on natural disasters such as volcanoes, forest fires or the like, but their proportions are not necessarily fixed because they disappear once they are gone, As for the pollutants resulting from human activity, these pollutants have fixed or somewhat different proportions and can be read by devices and sensors or by rainwater, so the pollutants ratios were studied through rainwater over the city of Baghdad and for the five areas of Al-Husayniyah Al-Kamaliyah Bab Al-Sharqi Al-Shula and Abu Dashir, As the results showed that the highest levels of pollutants in the Hassania area, which amounted to (65.7ppm) for calcium, and the lowest percentage for acidity (pH), which was (6.5ppm). in construction, It also contains the element of magnesium at a rate of (62.7 ppm), and we also note the turbidity that is high at about (34.8ppm) due to dust and fumes rising from the factories producing this type of pollutants. 77.3ppm), Due to the nature of this area, which is where alabaster and stone factories abound, as well as the rest of the stones used to decorate the facades of houses, so it is natural to find there is an increase in the turbidity ratios, which are (64.5ppm), and there is a surprise that the Bab Al Sharqi area we notice a clear decrease in pollutants according to Table No. 2.This is because this area is characterized by population overcrowding, as we notice low levels of pollutants and there is nothing to worry about, as for the Shula area, this region is characterized by the presence of brick factories and stone blocks used in construction, and even that it has

large areas for the sale of building materials. The results showed that the percentage of calcium in this area ranged to (68.1ppm) and the percentage of manganese to (69.6ppm) and salts amounted to (45.5ppm). As for the Abu Dashir area, there is a marked increase in the percentage of pollutants through the percentage of turbidity (75.2ppm), which is that It indicates the high levels of pollutants through high levels of magnesium (73.8 ppm), calcium (61.6ppm) and salts (37.4ppm). The reason is due to the nature of the area because of the presence of oil refineries (Al-Durah refinery), as it is an agricultural area and has large untapped areas of Before the specialists.

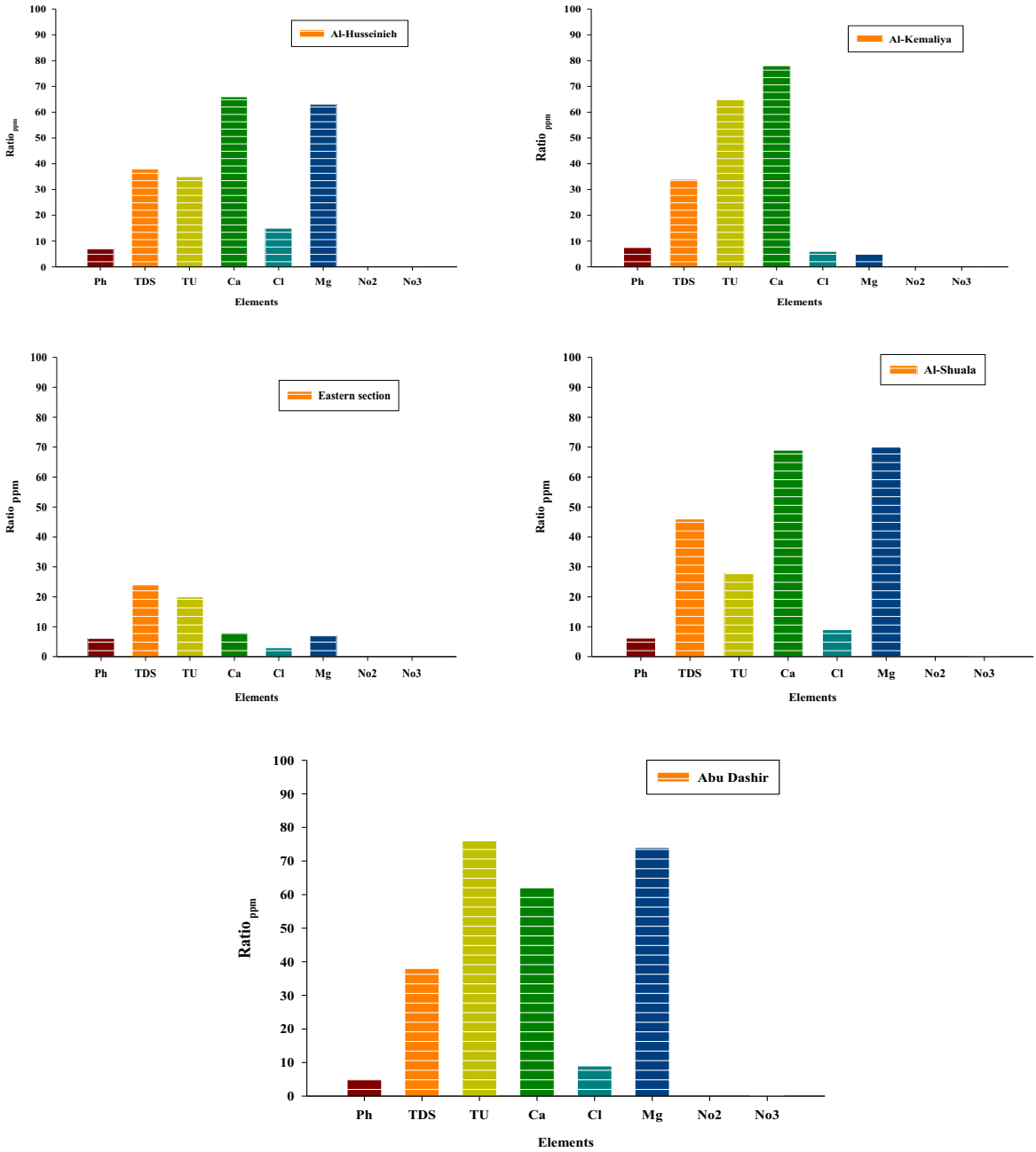


Figure 6. ratio of pollutants

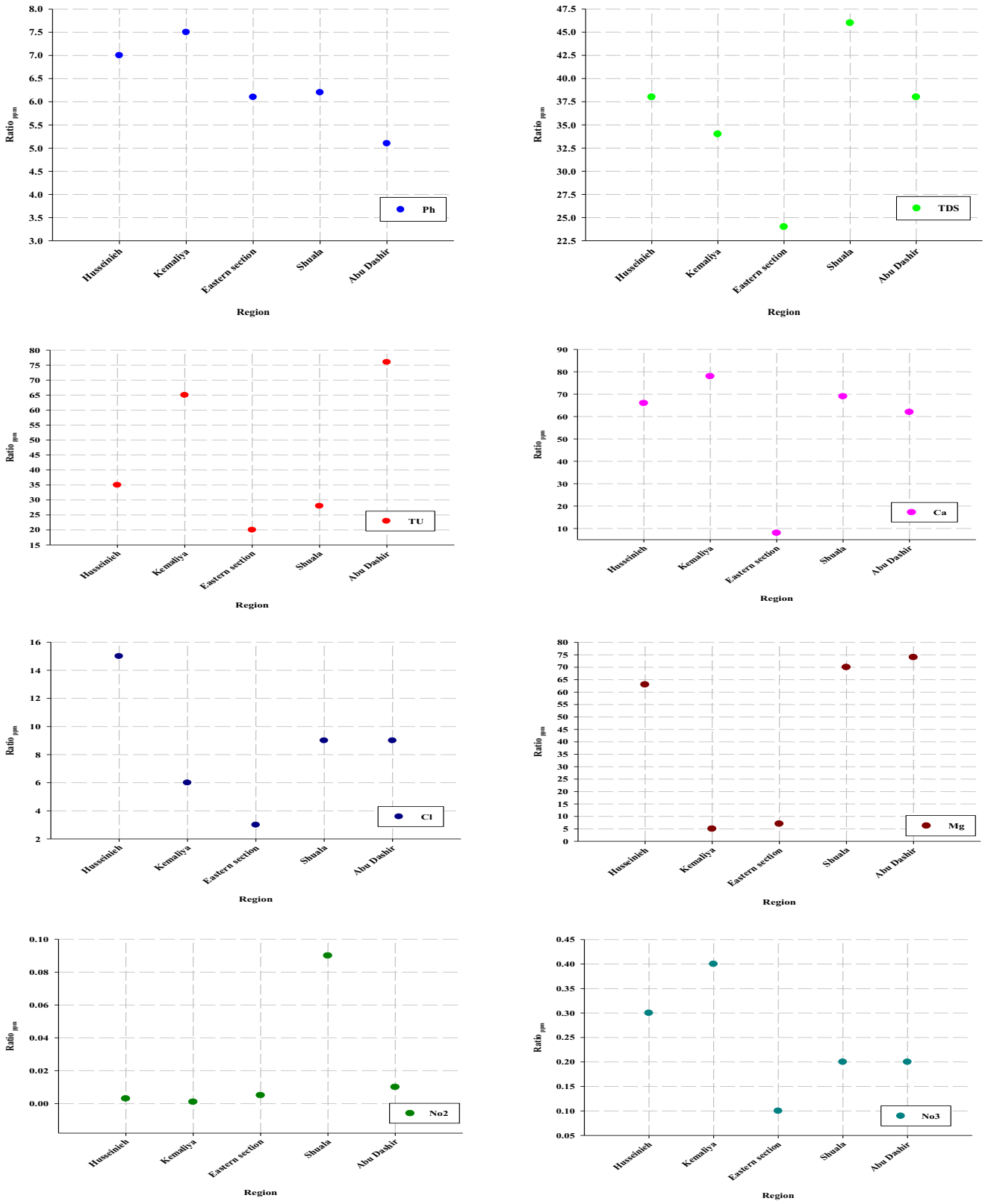


Figure 7. ratio of pollutants in region

As for Figure (7), where the results recorded that the percentage of acidity was the lowest in the Abu Dashir area and the highest in the Kamalia area, while (TDS) was the lowest value in the Bab al-Sharqi region and the highest in the Shuala region. A percentage is in Abu Dashir and the lowest is in Bab Al-Sharqi. As for calcium, it was in the Kemaliya area with the highest value and the lowest value in the Bab Al Sharqi region, and in Al Hussainia, chlorine recorded the highest value and the lowest value in Bab Al Sharqi, and magnesium had the highest value in Abu Dashir and the lowest in Al Kamaliyah, while nitrite was of the torch's share of the highest value and Kemalism less The value of nitrates was higher than the share of the city of Kamalia and the lowest in Bab al-Sharqi.

4. Conclusion

1. Pollutant concentrations depend on human activity in these areas.
2. Rainwater reduces the concentrations of pollutants in the air by a process called air washing.
3. The pollutant levels depend on what the rainwater carries as it descends from the cloud.
4. The highest percentage of acidity was in the Al Kamalia area.
5. The dissolved salts ratio (46.1ppm) was recorded in Al-Shuala area.
6. The highest value of turbidity was in Abu Dashir, reaching (76ppm).

5. Reference

[1] Uchiyama, R. *et al.* (2017) 'The impact of air pollutants on rainwater chemistry during "urban-induced heavy rainfall" in downtown Tokyo, Japan', *Journal of Geophysical Research*, 122(12), pp. 6502–6519. doi: 10.1002/2017JD026803.

[2] Bharti, P., Singh, V. and Tyagi, P. (2017) 'Assessment of rainwater quality in industrial area of rural Panipat (Haryana), India', *Archives of Agriculture and Environmental Science*, 2(3), pp. 219–223.

[3] Facchini Cerqueira, M. R. *et al.* (2014) 'Chemical characteristics of rainwater at a southeastern site of Brazil', *Atmospheric Pollution Research*. Elsevier, 5(2), pp. 253–261.

[4] Chakraborty Bidisha and Gupta Abhik (2014). Rainwater quality analysis in selected areas of eastern and northeastern India. *Proceeding of the International Conference on Advances in Civil, Structural, Environmental & Bio-Technology* – CSEB-2014. Institute of Research Engineers and Doctors. pp: 23-27.

[5] Jirak, I. L. and Cotton, W. R. (2006) 'Effect of air pollution on precipitation along the front range of the Rocky Mountains', *Journal of Applied Meteorology and Climatology*, 45(1), pp. 236–245.

[6] Khayan, K. *et al.* (2019) 'Rainwater as a Source of Drinking Water: Health Impacts and Rainwater Treatment', *Journal of Environmental and Public Health*, 2019. doi: 10.1155/2019/1760950.

[7] Han, Y. *et al.* (2019) 'The effect of atmospheric particulates on the rainwater chemistry in the Yangtze River Delta, China', *Journal of the Air and Waste Management Association*. Taylor & Francis, 69(12), pp. 1452–1466.

[8] Salam Hussein Ewaid et al 2020 J. Phys.: Conf. Ser. 1664 012143.

[9] Salam Hussein Ewaid et al 2021 IOP Conf. Ser.: Earth Environ. Sci. 722 012008

[10] Salam Hussein Ewaid et al 2021 IOP Conf. Ser.: Earth Environ. Sci. 790 012075

[11] Kozłowski, R., Kruszyk, R. and Małek, S. (2020) 'The effect of environmental conditions on pollution deposition and canopy leaching in two pine stands (West Pomerania and

[12] Świetokrzyskie mountains, Poland)', *Forests*, 11(5). doi: 10.3390/F11050535.

[13] Sivakumaran, S. (2014) 'Air Pollution sources, pollutants and mitigation measures', *Central Environmental Authority (Sri Lanka)*, pp. 1–11. doi: 10.13140/2.1.5106.8485.