Libyan Journal of Ecological & Environmental Sciences and Technology
(LJEEST)

LJEEST
ISSN: 2710-5237
www.srcest.org.ly/jou

http://aif-doi.org/LJEEST/040204

Using some Physicochemical Variables to Evaluate Ground Water in Al-Militaniya Area in Northeast Libya

Idris Basher Imneisi [1*] Salih Abrahim Albadri [2]

ARTICLE INFO

Vol.4 No. 2 Dec., 2022
Pages (20-26)

Article history:
Revised form 09 Septamber 2022
Accepted 18 October 2022

Author affiliation
[1] Department of plant production, Faculty of Agriculture, Benghazi University-Libya*
[2]Department of plant protection Technology in The Higher Institute EL-Marj – Libya.
**CorrespondingAuthor:*
idris.imneisi@uob.edu.ly.
Tel: 0915011557.

Keywords:
Al-Milaytania, groundwater, drinking, Libya region.

ABSTRACT

Al-Militaniya is a small village in a semi-arid in northeast Libya, where groundwater is an important Source of agriculture and drinking water region. The study evaluated the groundwater quality of drinking water for the 3-month from June to August 2022 by using standard methods. The samples were analyzed for 14 parameters: pH, temperature (T), electrical conductivity (EC), Total hardness (Ha), Ca- Hardness, total alkalinity, Na, Fe, Ca, Mg, Cl, NO_2, NO_3–N, and Phosphate (PO_4) at five sites in the study area. The results showed some variation in the total dissolved salt values among the five sites may be a sign of soil and rock weathering under the earth's surface during water infiltration into the aquifer. Other parameters such as Total hardness (Ha), Ca-Hardness, total alkalinity, Na, Fe, Ca, Mg, and Cl was within standard permissible limits of the World Health Organization. The concentration of NO3-N (17.3 mg/l and 12.5 mg/l) in stations 1 and 2 respectively exceeded the permissible limit, whereas the concentration of PO_4 phosphorus (0.14 mg/l and 0.15 mg/l), in stations 1 and 2 respectively. The high level of NO_3-N nitrate maybe possibly be the anthropogenic origin of these contaminants from nonpoint sources of urban effluent and diffuse source agricultural activity. In conclusion, some Physical and chemical features of groundwater indicated in the study area that some of the area's wells are drinkable, therefore it is important to ensure the water's microbial validity.

استخدام بعض المتغيرات الفيزيائية والكيميائية لتقييم المياه الجوفية بمنطقة المليطانية شمال شرق ليبيا

إدريس بشير إمنيسى [1 *] ، صالح إبراهيم البدري [2]

الميطانية قرية صغيرة في منطقة شبه قاحلة شمال شرق ليبيا ، حيث المياه الجوفية مصدر مهم للزراعة ومياه الشرب بالمنطقة. قيمت الدراسة جودة المياه الجوفية لمياه الشرب لمدة 3 أشهر من يونيو إلى أغسطس 2022 باستخدام الطرق القياسية. تم تحليل العينات لـــ 14 اختبار تشمل : درجة الحموضة ، درجة الحرارة (T) ، التوصيل الكهربائي (EC) ، الصلابة الكلية (Ha)، Ca– الصلابة ، القلوية الكلية ، Na، Fe، Ca، Mg، Cl، NO2، NO3–N ، والفوسفات (PO4) تمت هذه الاختبارات في خمس مواقع بمنطقة الدراسة. أظهرت النتائج أن بعض التباين في إجمالي قيم الاملاح الذائبة الكلية بين المواقع الخمسة قد يكون علامة على تجوية التربة والصخور تحت سطح الأرض أثناء تسرب المياه إلى الخزان الجوفي. المعلمات الأخرى مثل الصلابة الكلية (Ha)، Ca– صلابة ، القلوية الكلية ، Na، Fe، Ca، Mg ، و Cl كانت ضمن الحدود القياسية المسموح بها لمنظمة الصحة العالمية. تجاوز تركيز NO_3–N 17.3 مجم / لتر و 5.12مجم / لتر) في المحطتين 1 و2 على التوالي الحد المسموح به ، في حين أن تركيز PO_4 الفوسفور (0.14 مجم / لتر و 0.15مجم / لتر) في المحطات 1 و 2 على التوالي. قد يكون المستوى المرتفع من نترات NO3–N هو الأصل البشري لهذه الملوثات من مصادر غير محددة للنفايات السائلة الحضرية والنشاط الزراعي المصدر المنتشر. في الختام ، أشارت بعض الخصائص الفيزيائية والكيميائية للمياه الجوفية في منطقة الدراسة إلى أن بعض آبار المنطقة صالحة للشرب ، لذلك من المهم التأكد من الصلاحية الميكروبية للمياه.

1. INTRODUCTION

Both developing and developed countries are increasingly relying on groundwater resources. The highest volume of freshwater that is not frozen on the planet comes from underground sources. As an arid country, 94.5% of Libya is made up of desert, where freshwater is always in short supply. In the Libyan region, groundwater is a crucial resource for agriculture and drinking water. It is extracted through wells that range in depth from a few meters to over 1,000 meters. Only 5% of the nation receives more than 100 mm of rain annually. (Bindra1 Et al., 2013). Groundwater aquifers are either renewable or non-renewable. The northern zones and regions with high precipitation rates are located in renewable aquifers. They contribute more than 2,400 million m3 per year against recharge of fewer than 650 million m3, and their ages range from Quaternary to Cretaceous. Due to seawater intrusion and saline water invasion from nearby aquifers, this imbalance has caused a steady decline in groundwater levels and water quality. (Salem, 2007). Numerous challenges will stand in the way of the worldwide goal of ensuring that humans have access to water of sufficient quantity and acceptable quality in the upcoming decades. (Barth et al., 2009). For instance, water pollution caused by a combination of sewage, oil by-products, and industrial waste presents a threat to Libya's coast and the Mediterranean Sea overall. (ALMABRUK ALI, 1995; BINDRA1 et al., 2013). In many developing and underdeveloped nations, groundwater has been looked after as a source supply of safe drinking water, particularly for rural people. The quality of charge-up waters, the rate at which minerals dissolve and precipitate, groundwater mobility, and interactions with other types of water aquifers are all examples of natural processes that affect groundwater quality in a region. (De Andrade, Palacio, Souza, De Oliveira Leao, & Guerreiro, 2008). Chemicals at the soil surface may leak into the aquifer, contaminating groundwater. Agriculture's effects on water quality are receiving more and more attention. Natural processes (such as lithology, groundwater mobility, the quality of recharge waters, and interactions with other types of water aquifers) and human activities both play a significant role in determining the quality of the groundwater in a given area (agriculture, industry, urban development, and increasing exploitation of water resources) (Helena, 2000). wild animal waste, sewage septic systems, poor storm water management, and urban runoff are examples of non-point sources of this contamination. Point sources include industrial effluents and municipal wastewater treatment plants. (Igbinosa; & Okoh, 2009; Odjadjare & Okoh, 2009) In recent years, interest in water quality control has significantly expanded, since water quality interventions have a great influence on human health (Mehrunisa M · Mohammed S S, 2010). The physical, chemical and biological features and constituents of both surface and groundwater sources are all factors that affect the quality of water. (WHO 2003). In this study, the groundwater in the Al-Militaniya area for the number of five wells are S1, S2, S3, S4, and S5 . an attempt to evaluate whether the well's water is suitable for drinking and use by using some physicochemical parameters.

2. MATERIALS AND METHODS

2.1. DESCRIPTION OF THE SAMPLING SITE.

Al-Militaniya area has bordered on the east by the municipality of Al-Marj, on the north by the municipality of Tokra, and on the west and south by the municipality of Al-Abyar. It covers an area of about 360 square kilometers. Away from the city of Benghazi, a distance of not less than 70 km. It has a population of about 8000 people She is a herding and agricultural profession. It covers about 120 farms with an average area of 80 hectares. It has a large number of water wells, on which the neighboring regions depend for drinking water. The Al-Milaytania area depend on groundwater as the main source of water as it is The case is in the rest of Libya, where there are a number of underground wells. where was Choosing five wells for the purpose of their study, namely. As shown in Table 1.

Table 1 shows the coordination of the sampling site.

Station	Name	N	E
Station 1	South of town	32.26.912	20.65.352
Station 2	South of town	32.26.937	20.65.299
Station 3	Private well	32.26.663	20.66.832
Station 4	Private Well	32.26.159	20.67.791
Station 5	Private well	32.34.252	20.71.717

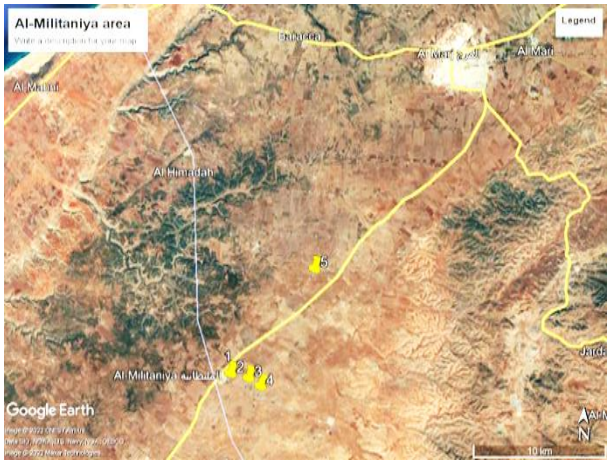

Figure 1 shows the study area in Al-Militaniya.

2.2. SAMPLING AND ANALYSIS.

The study samples were collected during the months of June, July and August 2022. The well location, date of collection, and sample number is written on each vial During sampling, taking into account the samples should be kept in a cool place according to the scientific methods used. Electrical conductivity (EC), pH, and temperature (T) were measured locally by (Multifunction Portable pH, Conductivity, temperature) field instruments (water quality tester Company). Total hardness (Ha) and total alkalinity were determined by volumetric titrimetric. nitrite (NO2), nitrate nitrogen (NO3-N), Phosphate (PO4) were determined using a HACH-DR 3900 UV-Vis Spectrophotometer. The physicochemical variables of water quality were analysed using standard methods given in American Public Health Association (APHA, 1999) that were within the limits of the standard used at laboratory of agriculture faculty in Benghazi university.

RESULTS

Physical and Chemical quality of drinking water.

The sampling site included five groundwater wells, as shown in Figure 1. The water quality variables in the water samples were identified in Tables 2, 3, and 4. in June, July and August respectively. While Tables 5 and 6 show the statistical analysis of the total results obtained for five wells in the Al-Militaniya region.

Table 2 shows the mean values of some physicochemical parameter at Al-Militaniya area.

Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
(EC)	2110	2160	1830	1804	903
T.D.S	1220	1250	1060	1040	523
pH	7.49	7.65	7.25	7.52	7.67
Temperature (C)	24.8	24.7	24.9	24.1	23.6
Total Hardness	449	460	385	380	176
Ca- Hardness	147	150	135	135	65
Total Alkalinity	215	190	180	186	190
Calcium (Ca)	174	178	165	150	78
Magnesium(Mg)	85	87	80	77	43
Chloride (Cl)	350	360	308	292	150
Nitrite (No2)	1.00	2.00	2.00	1.00	2.00
Nitrate (No3-N	17.8	12.3	5.7	7.7	5.4
Phosphate (Po4	0.058	0.048	0.06	0.039	0.15
Iron (Fe	0.09	0.23	0.05	0.04	0.01

All the Parameters Value Are Expressed in mg/l; Except pH, Conductivity EC (µS cm-1)

Table 3 shows the mean values of some physicochemical parameters in July 2022 at Al-Militaniya area for the number of five wells are S1, S2, S3, S4, and S5.

Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
(EC)	2202	2192	1651	1620	808
T.D. S	1277	1272	957	942	469
PH	7.53	7.67	7.24	7.54	7.71
Temperature C	23.1	23.2	23.7	23.8	23.1
Total Hardness	550	548	395	395	180
Ca- Hardness	180	180	140	140	68
Total Alkalinity	215	190	180	185	190
Calcium (Ca)	210	210	170	156	83
Magnesium (Mg	104	104	85	80	45
Chloride (Cl)	425	425	315	305	155
Nitrite (No2)	1.6	175	1.66	1.5	1.35
Nitrate (No3-N	17.6	12.01	5.4	7.5	5.1
Phosphate (Po4	0.2	0.19	0.09	0.039	0.079
Iron (Fe)	0.01	0.01	0.04	0.04	0.01

All the Parameters Value are Expressed in mg/l; Except pH, Conductivity EC (µS cm-1)

Table 4 shows the mean values of some physicochemical parameters in August 2022 at Al-Militaniya area for the number of five wells are S1, S2, S3, S4, and S5.

Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
(EC)	2160	2029	1649	1648	865
T. D. S	1250	1176	957	953	501
PH	7.45	7.65	7.25	7.50	7.70
Temperature C	24.1	24.6	24.2	24.5	24.6
Total Hardness	510	460	385	380	180
Ca- Hardness	160	160	140	140	65
Total Alkalinity	215	190	180	190	190
Calcium (Ca)	210	215	170	150	80
MagnesiumMg)	90	90	80	80	45
Chloride (Cl)	390	390	300	150	150
Nitrite (No2)	11	5	5	2	5
Nitrate (No3-N	18.2	11.7	12.3	10.5	5.7
Phosphate (Po4)	0.18	0.23	0.027	0.089	0.052
Iron (Fe)	0.06	0.09	0.09	0.06	0.03

All the Parameters Value are Expressed in mg/l; Except pH, Conductivity EC (µS cm-1)

Statistical analysis.

Table 5 shows the mean values of some physicochemical parameters such as pH, TDS, hardness, Nitrite (NO2), Nitrate (NO3-N), and Phosphate (PO4) for the different locations in the Al-Militaniya area are presented in Table 5.

Table 5 shows the mean values of some physicochemical parameters in Al-Militaniya area for the number of five wells are S1, S2, S3, S4, and S5.

Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
(EC)	2126.6	2116.3	1769.6	1752	890
T.D. S	1230	1225.3	1025.6	1011	515
PH	7.47	7.65	7.25	7.51	7.68
Temperature C	24.56	24.66	24.6	24.23	23.9
Total Hardness	469.3	460	385	380	177.3
Ca- Hardness	151.3	153.3	136.6	136.6	65
Total Alkalinity	215	190	180	187.3	190
Calcium (Ca)	186	190.3	166.6	150	78.6
MagnesiumMg)	86.6	88	80	78	43.7
Chloride (Cl)	363.3	370	305.3	244.6	150
Nitrite (No2)	4.33	3	3	1.33	3
Nitrate (No3-N	17.9	12.1	7.9	8.63	5.5
Phosphate(Po4)	0.14	0.15	0.059	0.055	0.093
Iron (Fe)	0.08	0.18	0.063	0.046	0.02

All the Parameters Value are Expressed in mg/l; Except pH, Conductivity EC (µS cm-1).

Table 6 shows the mean, Std. Deviation and Std-error of some physicochemical parameters in Al-Militaniya area.

Parameter	Mean	Std. Deviation	Std. Error
Electro conductivity (EC)	1730.9	503.52	205.93
Total Dissolved Soiled	1001.38	291.39	119.17
PH	7.512	0.1715	0.066
Temperature C	24.39	0.320	0.130
Total Hardness	374.32	117.606	48.08
Ca- Hardness	128.56	36.394	14.88
Total Alkalinity	192.46	13.247	5.27
Calcium (Ca)	154.3	45.280	18.52
Magnesium (Mg)	75.26	18.144	7.424
Chloride (Cl)	286.64	91.667	37.34
Nitrite (No2)	2.932	1.0647	0.415
Nitrate (No3-N)	10.406	4.80969	1.93
Phosphate (Po4)	0.1	10.317	4.06
Iron (Fe)	0.0778	0.0612	0.024

All the Parameters Value are Expressed in mg/l; Except pH, Conductivity EC (µS cm-1).

Discussion.

According to water quality guidelines for drinking water, the results indicated that

pH

The obtained results indicate that the average pH varied from (7.24 pH) to (7.70 pH) during June, July and August. Most of the pH values of water samples in the study area are within the permissible limits according to the Libyan standard specifications and the World Health Organization (standards, 82; WHO, 2011).

Total Dissolved Salts (T.D.S)

Total Dissolved Salts (T.D.S) generally indicate the nature of water quality or salinity. Table 5 shows the average values of total dissolved salts in the study area, estimated in mg/litre while The total dissolved soiled concentration during three-month monitoring period is shown in Figure 1. Total Dissolved Soiled varied from 1230 mg/l (station 1) to 515 mg/l (station 5). This variation in the total dissolved salt values among the five sites may be a sign of soil and rock weathering under the earth's surface during water infiltration into the aquifer.

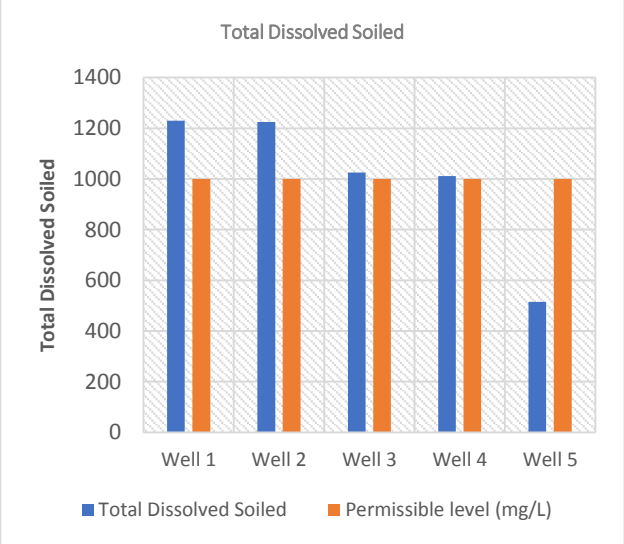

Figure 2 shows total dissolved solid (T.D.S) during the 3-month sampling period in study area.

The total hardness

The total hardness of the water depends mainly on the amount of calcium or magnesium salts or both. In table 5 the value of the total hardness in the study area varies from (177.3 mg/l) to (469.3 mg/l) during three months in the five stations that were within the legal limits(standards, 82; WHO, 2011).

Nitrite and nitrate

Figure 3 shows the Nitrite (NO2)concentration during the 3-month sampling period. the Nitrite (NO2) concentration ranged between 1.33 mg/l (station 4) and 4.3 mg/l (station 1). While, Figure 4

shows the Nitrate (NO3-N) concentration during the 3-month sampling period. the Nitrate (NO3-N)concentration ranged between 5.5 mg/l (station 5) and 17.9 mg/l (station 1).

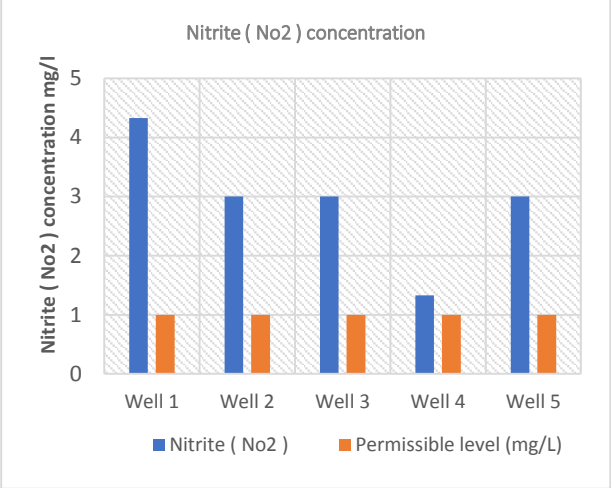

Figure 3 shows the Nitrite (NO2)concentration during the 3-month sampling period in study area.

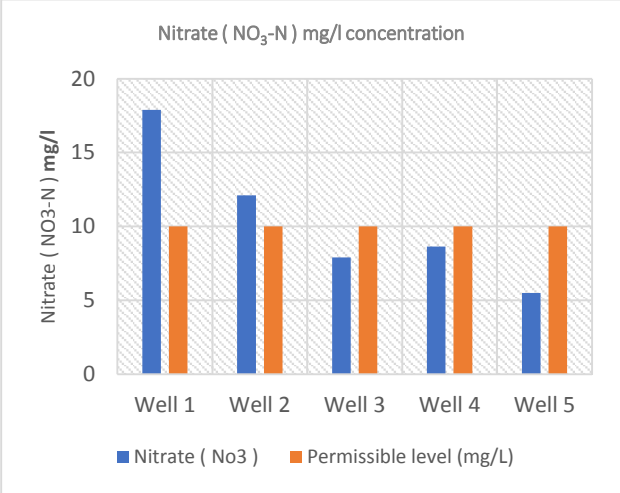

Figure 4 shows the Nitrate (NO3-N)concentration during the 3-month sampling period in study area.

The highest concentration of nitrates in the study area was on average (17.3 mg/l and 12.5 mg/l) in the first and second stations, respectively according to table 5. The concentration of nitrate in groundwater samples in stations 1 and 2 was exceeded the permissible limit.(WHO, 2011). The high nitrate concentration of groundwater in the study area might be due to the leaching with percolation water of agriculture waste and animals waste into aquafer water(Elmi, Madramootoo, Egeh, & Hamel, 2004).

Phosphate (Orthophosphate) (PO4).

In nature, phosphorus generally exists as a part of a phosphate molecule (PO4). Phosphorus in aquatic structures occurs as natural phosphate and inorganic phosphate.

The total orthophosphate test is mostly a measure of orthophosphate. Because the sample is now not filtered, the method measures each dissolved and suspended orthophosphate.(Spellman, 2013). Phosphate compounds are found in sedimentary and volcanic rocks, sediments containing animal bones and apatite rocks. When they come into contact with water, they dissolve and increase their concentration in water, as well as human and animal water waste that contains concentrations of phosphate compounds. Figure 5 shows the orthophosphate (PO4) concentration during the 3-month sampling period. the orthophosphate (PO4) concentration ranged between 0.15 mg/l (station 2) and 0.14 mg/l (station 1). There are many sources of phosphorus, both natural and human. Both organic and inorganic phosphorus can both be dissolved with inside the water or suspended connected to particles in the water column(Spellman, 2013).

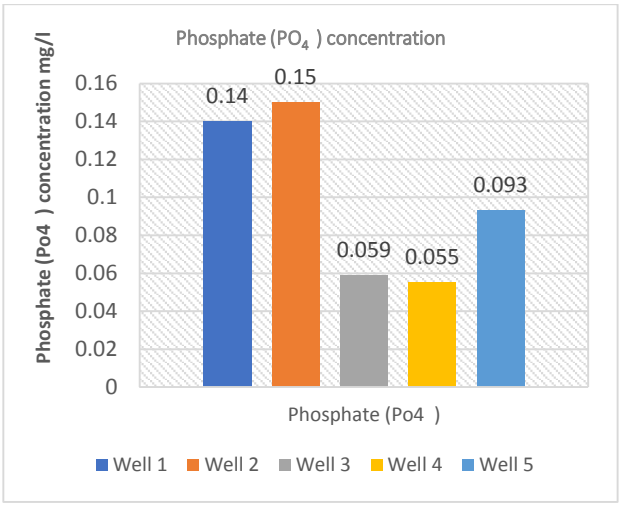

Figure 5 shows the phosphate (PO4) concentration during the 3-month sampling period in study area.

Several anions and cations such as Ca, Mg, Cl, and Fe.

A few anions and cations were inspected in the collected samples. The results showed that all anions and cations were underneath the acceptable levels of guidelines, as displayed in table 5. The concentrations of calcium range from 78.8 to 190.3

mg/l, which is gotten from calcium-rich minerals. While The groupings of calcium range from 43.7 to 88 mg/l. The significant source of magnesium (Mg) in the groundwater is because ion exchange of minerals in rocks and soils by water.

Conclusions and Recommendation.

This study evaluated the quality of drinking water in some groundwater in the Al-Militaniya region by using some physicochemical parameters. The results reveal is:

- During this study the average values of Most of the pH values of water samples in the study area are within the permissible limits according to the Libyan standard specifications and the World Health Organization.
- Total Dissolved Soiled varied from 1230 mg/l (station 5) to 515 mg/l (station 1). This variation in the total dissolved salt values among the five sites may be a sign of soil and rock weathering under the earth's surface during water infiltration into the aquifer.
- A few anions and cations were inspected in the collected samples such as Na, Ca, Mg, Cl... etc. The results showed that all anions and cations were under the acceptable levels of guidelines.
- The value of the total hardness in the study area varies from (177.3 mg/l) to (469.3 mg/l) during three months in the five stations that were within the legal limits(standards, 82; WHO, 2011).
- the Nitrite (NO2) concentration ranged between 1.33 mg/l (station 4) and 4.3 mg/l (station 1)
- The Nitrate (NO3-N) concentration ranged between 5.5 mg/l (station 5) and 17.9 mg/l (station 1). The concentration of nitrate in groundwater samples in stations 1 and 2 was exceeded the permissible limit.(WHO, 2011). The high nitrate concentration of groundwater in the study area might be due to the leaching of agriculture waste and animals waste into aquafer water.
- The orthophosphate (PO4) concentration ranged between 0.15 mg/l (station 2) and 0.14 mg/l (station 1). There are many sources of phosphorus, both natural and human. Both organic and inorganic phosphorus can both be dissolved with inside the water or suspended connected to particles in the water column.(Spellman, 2013)

References

Almabruk Ali. (1995). Reflections On Climate Variability Within Selected Monthly Mean Time Series In Libya And Neighboring Countries, Geographia Polonica. Polish Academy Of Sciences Institute Of Geography And Spatial Organization, , 65, Pp. 51-62..

APHA. (1999). Standard Methods For The Examination Of Water And Wastewater. © Copyright 1999 By American Public Health Association, American Water Works Association, Water Environment Federation.

Barth, J. A. C., Grathwohl, P., Fowler, H. J., Bellin, A., Gerzabek, M. H., Lair, G. J., . . . Smidt, H. (2009). Mobility, Turnover And Storage Of Pollutants In Soils, Sediments And Waters: Achievements And Results Of The EU Project Aquaterra. A Review. Agronomy For Sustainable Development, 29(1), 161-173. Doi: 10.1051/Agro:2007060

Bindra1, S. P., , S. A., , A. H., , H. S. A. R., , H., & Abdalla5, K. (2013). Assessment Of Impacts On Ground Water Resources In Libya And Vulnerability To Climate Change. Scientific Bulletin Of The „Petru Maior University Of Tîrgu Mureş Vol. 10 No. 2, Issn-L 1841-9267 (Print), Issn 2285-438x (Online), Issn 2286-3184 (Cd-Rom).

De Andrade, E. M., Palacio, H. A., Souza, I. H., De Oliveira Leao, R. A., & Guerreiro, M. J. (2008). Land Use Effects In Groundwater Composition Of An Alluvial Aquifer (Trussu River, Brazil) By Multivariate Techniques. Environ Res, 106(2), 170-177. Doi: 10.1016/J.Envres.2007.10.008

Elmi, A. A., Madramootoo, C., Egeh, M., & Hamel, C. (2004). Water And Fertilizer Nitrogen Management To Minimize Nitrate Pollution From A Cropped Soil In Southwestern Quebec, Canada. Water, Air, & Soil Pollution, 151(1-4), 117-134. Doi: 10.1023/B:Wate.0000009910.25539.75

Helena, B. (2000). Temporal Evolution Of Groundwater Composition In An Alluvial Aquifer (Pisuerga River, Spain) By Principal Component Analysis. Water Research, 34(3), 807-816. Doi: 10.1016/S0043-1354(99)00225-0

Igbinosa;, E. O., & Okoh, A. I. (2009). Impact Of Discharge Wastewater Effluents On The Physico-Chemical Qualities Of A Receiving Watershed In A Typical Rural

Community. Int. J. Environ. Sci. Tech., 6 (2), 175-182, Spring.

Mehrunisa M · Mohammed S S, M. S. A., Kazi S M. (2010). Drinking Water Quality Assessment In Southern Sindh (Pakistan). Environ Monit Assess DOI 10.1007/S10661-010-1616-Z. Doi: 10.1007/S10661-010-1616-Z

Odjadjare, E. E. O., & Okoh, A. I. (2009). Prevalence And Distribution Of Listeria Pathogens In The Final Effluents Of A Rural Wastewater Treatment Facility In The Eastern Cape Province Of South Africa. World Journal Of Microbiology And Biotechnology, 26(2), 297-307. Doi: 10.1007/S11274-009-0174-4

Salem, O. M. (2007). Management Of Shared Groundwater Basins In Libya. Policies And Strategic Options For Water Management In The Islamic Countries, 89.

Spellman, F. R. (2013). Handbook Of Water And Wastewater Treatment Plant Operations. 3rd Edition, CRC Press, Boca Raton.

Standards, L. S. A. (82). Libyan Standard Specification For Drinking Water.

WHO. (2011). Guidelines For Drinking-Water Quality Fourth Edition.