مجلة غريان للتقنية / المعهد العالي للعلوم والتقنية غريان
Gharyan Journal of Technology, High Institute of Science & Technology Gharian
Issue (8), September- 2022-العدد الثامن، سبتمبر

Investigation of Physicochemical Analysis Of Water Sources In Al- Jabal Al-Gharbi region, Libya

Abdulbasit M. Abeish

Chemistry Department-Faculty of Science/Assabaa- Gharyan University, Libya

*Corresponding author: abeesh_200875@yahoo.com

الملخص

مصادر المياه في منطقة الجبل الغربي محدودة للغاية وتحتاج إلى اجراء الدراسات اللازمة لمعرفة إمكانية استخدامها إما كمياه شرب أو في الأنشطة البشرية الأخرى. لذلك تم دراسة العديد من المعايير الفيزيائية والكيميائية لمصادر المياه في منطقة الجبل الغربي الواقعة شمال غرب ليبيا. تمت الدراسة على ثلاثة مصادر للمياه غير المعالجة وهي الآبار الجوفية ومياه الأمطار ومياه النهر الصناعي. أما بالنسبة لمياه الشرب تم فحص المياه التجارية المعالجة سواء المعبأة أو غير المعبأة. الخواص التي تم فحصها هي الأس الهيدروجيني pH ، التوصيلية ، الملوحة ، العكارة ، المواد الصلبة الذائبة الكلية TDS ، الكلور ، النترات (NO3) ، النتريت ، الكبريتات ،الفوسفات ، الحديد و النحاس. أظهرت النتائج المتحصلة عليها أن المياه الجوفية ومياه النهر الصناعي تحتوي على تراكيز عالية من المواد الصلبة الذائبة TDS تراوحت ما بين 1115 و 4090 ملجم / لتر مما أدى إلى زيادة العسر الكلي TH في هذه العينات. بينما احتوت معظم عينات المياه المعالجة على تراكيز منخفضة جدًا من المواد الصلبة الذائبة مما قد يسبب فقدان الأملاح المعدنية المفيدة للمستهلكين. من جهة أخرى ، فإن عينات مياه الأمطار احتوت على القيم المثلى للمواد الصلبة الذائبة بالإضافة إلى المعلمات الأخرى. أما فيما يتعلق بتركيز النترات NO_3 ، كانت جميع العينات ضمن الحدود المسموح بها وتراوحت من 0.02 إلى 15 ملغم / لتر. علاوة على ذلك ، كانت جميع الأيونات الكيميائية التي تم فحصها في هذا البحث مثل الحديد والنحاس ضمن إرشادات منظمة الصحة العالمية.

ABSTRACT

Water sources in Al-Jabal Al-Gharbi area are very limited and need to be studied for use either as drinking water or human activities. Therefore, several physical and chemical parameters of water sources in Al-Jabal Al-Gharbi region located in Northwest of Libya were investigated. For untreated water three sources were studied including groundwater wells, rain water, and Man-Made River (MMR). However, for drinking water packed and unpacked treated commercial water were investigated. The examined properties were pH, conductivity, salinity, turbidity, total dissolved solids (TDS), chlorine, nitrates (NO^-_3), nitrites, sulfate, phosphate, iron, and cupper. The results showed that the groundwater and MMR water had high TDS concentrations between 1115 and 4090 mg/L leading to increase the total hardness in these samples. Most of the treated waters had very low of TDS concentrations causing loss the useful salts for consumers . However, the rain water samples had optimum values of TDS and other parameters. Regarding NO^-_3 all samples were within the limitation and in the range of 0.02 to 15 mg/L. Furthermore, all metal ions examined in this work such as iron and Cupper were within the WHO guidelines.

Key Words: Physicochemical properties, Water quality, Water Sources, Libya

1.Introduction

Water pollution has become one of the main threats that face humanity today. Increasing everyday people activities lead to contamination of water sources including oceans, rivers, lakes and groundwater. This contamination contributes to generating large amounts of polluted water that people cannot use in their daily life. Contaminated water is generated from many different sources involving petroleum refineries, dyes, drugs, paper, textile dye, detergents, surfactants, pesticides, herbicides, insecticides and pharmaceutical manufacturers [1]. These chemical contaminants can be organic pollutants such as alkanes, aliphatic, alcohols and aromatic compounds or inorganic like heavy metals, including lead, mercury, nickel, silver and cadmium. In addition, water can be contaminated by pathogens such as bacteria, viruses and fungi [2]. The negative impact of different polluted components on the environment, human health and aquatic live is extremely significant [3].

Released waters without monitoring their specifications can be absorbed by soil layers leading to contaminate surfaces and groundwater [4]. Some of organic hazardous substances can be decomposed during the time, however; most of them remain for longer time. According to that the most of the groundwater generates from rain and snow so these biorefractory pollutants can be precipitated with this water and entered the earth layers [5]. Heavy metals can be generated from many different ways such as natural sources, mining, and industrial activities [6]. These toxic pollutants like Hg, Pb, and Cd are categorized as carcinogen compounds causing various dangerous diseases [7]. Libya is one of the semi-arid countries due to the low rainfall and limited amounts of groundwater. Water resources in Libya can be categorized to two types including conventional water resources (surface and groundwater) which represents about 97.3% and non-conventional water resources (seawater desalination and treated water) that represents about 2.7% [8]. Hence, the life in this country especially Al Jabal Al Gharbi area totally depends on the groundwater that is treated to use it as drinking water. However, there is also two other sources originally coming from out of the study area which are rainwater and Artificial Al Naher water. For rain water there is no significant amounts can be collected except that from roofs of some houses and people use it as drinking water. However, for Artificial Al Naher water can be considered as an important source due to the large amount of water that can be obtained from it, but people in this area do not use it as drinking water. Water purification stations are rapidly growing as a source of drinking water in the world [9]. In general, for drinking water people in the study region use packed and unpacked treated water that mainly come from groundwater. The treatments are performed to reduce the salts and hardness to give the water acceptable taste. However, the water comes from purification stations can be contaminated ether chemically or biologically. All these sources should be investigated to see the degree of pollution and to what extent they follow the standard specifications of the quality water. Therefore, the aim of this study is to investigate the physical and chemical quality of all water sources in Al Jabal Al Gharbi region and keep track of any potential contamination sources. Furthermore, it focuses on how much treated water fulfills the WHO guidelines for drinking water.

2. Materials and Methods

2.1 Samples Collection

Seventeen samples were collected from different water sources located in Al Jabal Al Gharbi district in Jul, 2020. The study area as shown in (Fig. 1) located Northwest in Libya and coordinates 31°45'0.00" N 12°30'0.00" E.

Figure 1 Al Jabal Al Gharbi District Location

These samples were Four groundwater samples, six packed treated water, four unpacked treated water, one sample of rainwater, and one sample of Man-Made River (MMR) water. All fresh samples were obtained directly from the head of the wells for groundwater and from the taps for unpacked treated water. The samples were stored at $4C^0$ to avoid any type of degradation and the investigations were carried out in the laboratory immediately next day of work.

2.2 Materials and Equipment

All experiments were conducted using distilled water. chemicals used in these experiments were checked for expire dates. Sodium hydroxide (NaOH 0.02N) and sulphuric acid (H_2SO_4 0.02N) were prepared and used. EDTA (0.8N). Potassium chromate, Phenol Phthelene and Methyl Orange Indicators.

2.3 Laboratory Procedures

The physical and chemical investigations of the samples were performed according to different laboratory methods. Various quality parameters were effectively investigated including Colour, smell, taste, pH, conductivity (Ec), salinity (Sal.), turbidity (NTU), total dissolved solids (TDS), chloride (Cl^-), nitrates (NO^-_3), nitrites (NO^-_2), sulfate (SO^{-2}_4), phosphate (PO^{-3}_4), iron (Fe^{-2}), and cupper (Cu^{+2}). Spectrophotometer HACH DR/2010 was used to detect most of the variables

3. Results and Discussion

Seventeen water samples were analyzed in order to determine the physical and chemical parameters. All results achieved were validated using WHO standards. Table 1-3 shows the obtained results of untreated water samples including five groundwater wells, MMR water and the rainwater.

Table 1 Untreated Water Analysis

Water Source	Location	pH	Ec ms/cm	Sal	Turb NTU	TDS mg/L	SO^{-2}_4 mg/L	NO^-_3 mg/L	NO^-_2 mg/L	Cl^- mg/L	PO^{-3}_4 mg/L	Fe^{+2} mg/L	Cu^{+2} mg/L
Well 1	Gharian	9.0	1541	0.04	7	**1115**	400	15	0.1	0.4	0.06	0.04	0.01
Well 2	Gharian	8.2	1230	0.03	5	**1070**	365	8	0.09	0.2	0.05	0.07	0.02
Well 3	Assabaa	8.0	1123	0.04	4	**1000**	321	5	0.1	0.3	0.07	0.03	0.01
Well 4	Arabta	8.1	2994	1.8	6	**1488**	600	16.3	4.3	0.06	0.06	0.21	0.09
Well 5	Mizda	9.1	6000	8.6	7.5	**4090**	1400	6	0.1	0.05	1.71	0.02	2.37
MMR	Assabaa	8.2	2750	1.2	5	**1248**	415	17	6	0.3	0.37	0.02	0.52
Rain	Gharian	7.4	286	o.1	3	134	16	5.6	.001	1.08	0.004	0.04	0.01

It can be noticed that most of the samples except rainwater have a bit high of pH between 8.0 and 9.0 which might be due to the presented salts in these samples. This fact can be supported by the high concentrations of TDS leading to unacceptable taste and scale formations in the pipes. These salts include SO^{-2}_4, CO^{-2}_3 and HCO_3 in terms of magnesium and calcium. However, the other parameters involving NO^-_3, NO^-_2, Cl, PO^{-3}_4, Fe^{+2} and Cu^{+2} were within the limitations. Figures 2 and 3 illustrate the most important factors in this study which are TDS and NO^-_3 concentrations of all samples and compare them with standard values.

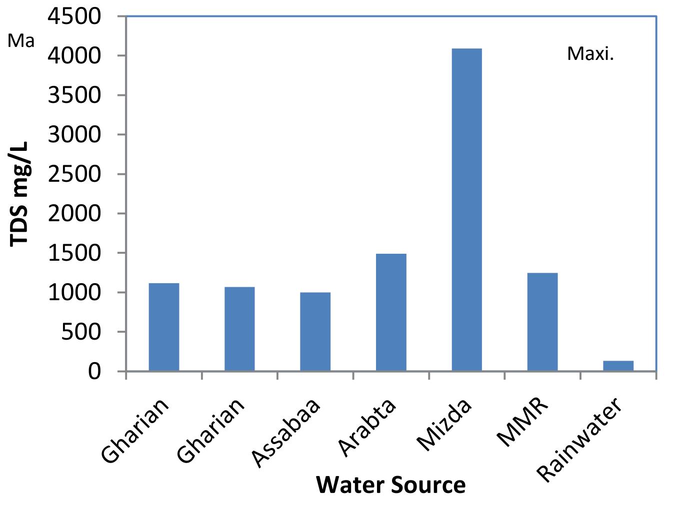

Figure 2 TDS Concentrations of various untreated water

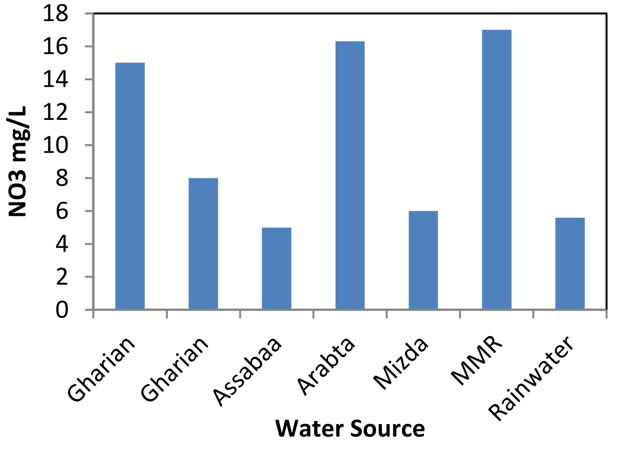

Figure 3 NO^-_3 Concentration of various untreated water

Table 2 gives results of the same parameters for unpacked treated water. It can be seen that all factors within the standard ranges and some of them below the minimum values. For instance, the sample of station 2 has just 99 mg/L of TDS which means that there is no enough salts. This result can lead to extract all beneficial compounds from water and becomes unhealthy. However, most people in the study area consume this type of water. Figure 4 shows the TDS concentrations of four unpacked treated water samples and compares the result with the maximum acceptable value.

Table 2 Unpacked Treated Water Analysis

Station NO.	Location	pH	Ec ms/cm	Sal	Turb NTU	TDS mg/L	SO_4^{-2} mg/L	NO_3^- mg/L	NO_2^- mg/L	Cl^- mg/L	PO_4^{-3} mg/L	Fe^{+2} mg/L	Cu^{+2} mg/L
1	Gharian	8.5	220	0.03	3.8	128	18	3	0.04	0.05	0.08	0.06	0.01
2	Gharian	8.2	112	0.09	1.5	99	12	1	0.001	0.07	0.08	0.05	0.06
3	Gharian	7.6	221	0.09	3.6	198	14	0.06	0.001	0.02	0.02	0.16	0.08
4	Assabaa	8.2	144	0.03	3	142	12	0.05	0.03	0.04	0.03	0.13	0.04

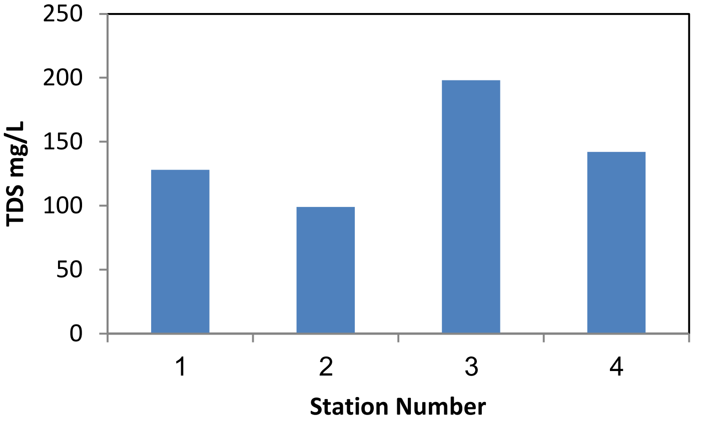

Figure 4 TDS Concentrations of various unpacked treated water

Table 3 shows the obtained results of packed treated water samples of different commercial brands. Even though there is no a big difference compared to unpacked water but TDS concentrations still very low especially Al Safia and Al Jazeera brands. However, this type of drinking water can be considered as more safe than unpacked one due to safe packing processes. In other word, in an unpacked treated water sector all people deal in a direct way to fill their bottles leading to a possibility of biological pollution.

Table 3 Packed Treated Water Analysis

Water Brand	pH	Ec ms/cm	Sal	Turb NTU	TDS mg/L	SO^{-2}_4 mg/L	NO^-_3 mg/L	NO^-_2 mg/L	Cl^- mg/L	PO^{-3}_4 mg/L	Fe^{+2} mg/L	Cu^{+2} mg/L
Dagela	8.2	98.1	0.05	1.8	93	7	0.06	0.001	0.07	0.01	0.17	0.07
Maida	7.4	105	0.01	2	97	6	0.4	0.02	0.2	0.07	0.12	0.01
Sagi	8.4	146	0.07	1.9	144	17	0.04	0.01	0.19	0.04	0.03	0.02
Salahat	8.9	156	0.01	2.3	151	16	0.02	0.01	0.22	15	0.08	0.05
Safia	8.3	96	0.01	2.4	82	12	0.06	0.01	0.11	0.05	0.11	0.01
Jazeera	7.6	183	0.01	2.2	87	18	0.08	0.02	0.13	0.03	0.04	0.03

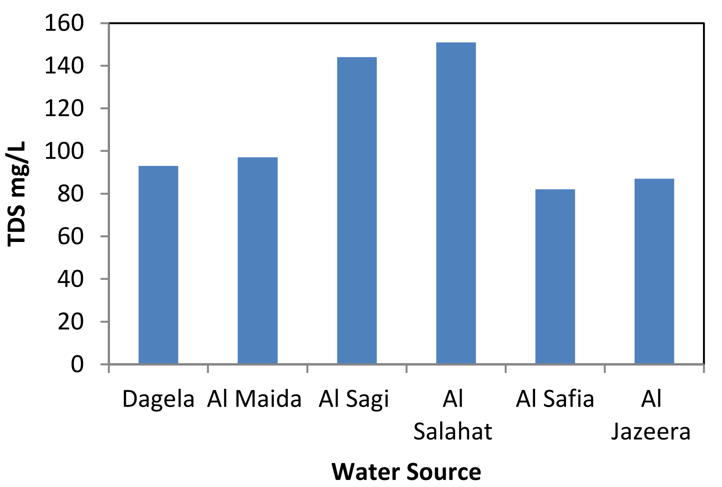

Figure 5 TDS Concentrations of various packed treated water

Figure 5 illustrates the TDS results of six packed treated water samples and compares the results with the maximum acceptable value.

4. Conclusion

In conclusion, the TDS concentrations of all groundwater and MMR water samples were very high especially the sample of Mizda city. This high parameter gives the water unacceptable taste and raises the total hardness causing scales in water equipment and ineffective washing. However, the all other properties particular NO^-_3 were within the limitations of standard water quality. The packed and unpacked treated water samples had good quality due to the reduction of TDS using commercial treatment systems. However, it can be noticed that some of these kinds of drinking water have very low TDS meaning lack of useful chemical elements. This can cause reduction of these beneficial elements in the human bodies and lead to poor blood diseases. The rainwater was the optimum value for all parameters and had very high quality of drinking water. To increase and enhance the water sources more water treatment stations should be implemented.

References

[1] Chong, Meng Nan, Bo Jin, Christopher WK Chow, and Chris Saint. 2010. "Recent developments in photocatalytic water treatment technology: a review." *Water research* no. 44 (10):2997-3027.

[2] Gogate, Parag R, and Aniruddha B Pandit. 2004. "A review of imperative technologies for wastewater treatment I: oxidation technologies at ambient conditions." *Advances in Environmental Research* no. 8 (3):501-551.

[3] Smołka-Danielowska S., 2006. Heavy Metals in Fly Ash from a Coal-Fired Power Station in Poland. University of Silesia, Faculty of Earth Sciences, ul. Będzińska 60, 41–200 Sosnowiec, Poland. Polish J. of Environ. Stud., 15(6), 943–946.

[4] Demaku S., Shehu I., Jusufi S., Arbneshi T., Dobra B., 2011. Heavy Metals in Coal Ash, Soil, Water and Sludge near the Two Coal-Fired Power Stations in Kosovo. J. Int. Environmental Application & Science, Vol. 6, 412–416.

[5] Jaguś A., Skrzypiec M., 2019. Toxic Elements in Mountain Soils (Little Beskids, Polish Carpathians). Journal of Ecological Engineering, 20(1), 197–202.

[6] Chen J.P, Wang L.K, Wang M.H.S, Hung Y.T, Shammas N.K., 2017. Remediation of heavy metals in the environment. CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487–2742.

[7] Fulekar M.H, Dave J.M., 2007. Release and behavior of Cr, Mn, Ni and Pb in a fly ash/soil/water environment: column experiment. International Journal of Environmental Studies, 38(4), 281–296.

[8] Brika, B. 2019 "The water crises in Libya: causes, consequences and potential solutions. Desalination and Water Treatment, 351-358.

[9] Amy. G., Ghaffour, N., Li, Z, Francis, Li., Linares, R. V., Missimer, T., & Lattemann, S. 2017 "Membrane-based seawater desalination present and future prospects" Desalination, 401, 16-21.

