مجلة جامعة بني وليد للعلوم الإنسانية والتطبيقية

تصدر عن جامعة بني وليد – ليبيا

Website: https://jhas-bwu.com/index.php/bwjhas/index

العدد التاسع والعشرون، 2023

تقييم مياه الشرب في بعض انظمه تنقيه المياه التجارية بمدينه سرت

عائشة فرج رحيل

قسم النبات، كلية العلوم، جامعة سرت، سرت، ليبيا

* **botchy_33@su.edu.ly**

Assessment Drinking Water of Some Commercial Water Purification Systems at sirte city- Libya.

Aisha F. Rahel

Faculty of Science-Botany Department, Sirte University, Sirte, Libya.

تاريخ الاستلام: 2023-07-15 تاريخ القبول: 2023-08-29 تاريخ النشر : 2023-09-18

المستخلص

الماء ضروري لبقاء الحياة والاحتياجات الأساسية لأن الماء مذيب أساسي. ويجب ألا تكون الملوثات والمواد الخطرة ومسببات الأمراض والمواد المشعة موجودة فى الماء. تناولت هذه الدراسة في تقييم مياه الشرب المتوفرة في بعض أنظمة تنقية المياه التجارية في منطقة سرت. تم جمع عينات المياه من خمس محطات في منطقة سرت. كجزء من هذا العمل، تم فحص بعض الخواص الكيميائية للعينات التي تم اختبارها، بما في ذلك الرقم الهيدروجيني والقلوية (مجم / لتر) والكلوريد (مجم / لتر) والنترات (ملجم / لتر)، كبريتات، مغنيسيوم (ملجم / لتر)، كالسيوم (ملجم / لتر)، صوديوم (ملجم / لتر)، بوتاسيوم (ملجم / لتر) وإجمالي المواد الصلبة الذائبة (مجم/لتر). وتبين النتيجة أن جميع هذه القياسات وجدت أنها أقل من المبادئ التوجيهية لمنظمة الصحة العالمية، والمركز الوطني الليبي للمواصفات والمقاييس. تشير النتائج التي تم الحصول عليها في الدراسة الحالية إلى وجود تباين بين المحطات، حيث تراوحت قيم المواد الصلبة الذائبة 6.19 – 45.04 ، وتراوحت قيم القلوية (1- 3 ملغم / لتر)، وتراوحت قيم الكالسيوم من(1.04 – 0.2) ملغم / لتر). ، والمغنسيوم(0.002-0.43) مجم/ لتر)، الصوديوم (4 -0.1) مجم/ لتر)، البوتاسيوم(0.094-0) مجم/ لتر)، والكلوريد(0.04-0.03) مجم/ لتر) والنترات (2.6-4.8) مجم/ لتر) . باستثناء الرقم الهيدروجيني وقد وجد أنه ضمن منظمة الصحة العالمية والمركز الوطني الليبي للمواصفات القياسية تتراوح بين 7.6 إلى 8.5، ولم تتجاوز القيم المعيارية. تكشف النتائج ان أنظمة تنقية المياه التجارية في منطقة سرت لا تتبع الإرشادات القياسية وخطوات مراقبة الجودة بشكل صحيح. وبالتالي، هناك حاجة ماسة إلى تحسين عملية التشغيل القياسية لضمان الامتثال الصارم لإرشادات منظمة الصحة العالمية والمركز الوطني الليبي. وكشفت النتائج البكتريولوجية أن بكتيريا الاشريشيا كولى في جميع العينات غير موجودة، وأن المياه خالية من التلوث البكتيري.

الكلمات المفتاحية: التجارية، أنظمة، الفيزيائية والكيميائية ,البكتريولوجي، القياسات، التلوث، توحيد، سرت.

Abstract:

Water is required for life's survival and fundamental needs because water is a basic solvent. Pollutants, hazardous substances, pathogens, and radionuclides should not be present. This study investigated the quality of drinking water supplied in Some Commercial Water Purification Systems in Sirte area. Water samples were collected from five stations in the Sirte region. As part of this work, some chemical properties of the tested samples were investigated, including, pH, Alkalinity(HCO_{-3}) (mg/l), Chloride(Cl^{-}) (mg/l),Nitrate(NO^{-3}) (mg/l), Sulfate(SO_4^{-2}), Magnesium(Mg^{+2})(mg/l), Calcium(Ca^{+2}) (mg/l), Sodium(Na^{+})(mg/l), Potassium(K^{+})(mg/l) and Total Dissolved Solids(TDS) (mg/l). The result shows that all these parameters were found to be less than Word Health Organization (WHO) guidelines and the Libyan National Centre for Standardization and Metrology (LNCSM). The results obtained in the current study indicate that there are variation among stations, TDS values were ranged (6.19 – 45.04), Alkalinity values were ranged (1– 3 mg/l), Ca^{+2}values were ranged (0.2–1.04 mg/l), Mg++ (0.002–0.43 mg/l), Na^{+} (0.1– 4 mg/l), K^{+} (0–0.094 mg/l), Cl^{-} (0.03–0.04 mg/l) and NO3− (2.6–4.8 mg/l). except PH. Was found to be within WHO and (LNCSM), between 7.6 to 8.5 , and the values have not exceeded the standard . The results reveal Commercial Water Purification Systems in the Sirte area. may not be following standard guidelines and quality control steps properly. Thus, improvement in their standard operating process is urgently needed to ensure strict compliance with (WHO)guidelines and (LNCSM).The result bacteriological revealed that E. Coli bacteria of all the sample's water do not contain bacteria the water is free from bacterial contamination.

keywords: Sirte; commercial; station; physicochemical; bacteriological; parameters; contamination, standardization; metrology.

INTRODUCTION

Having access to potable water is essential for human survival Water regulates body temperature and serves as the primary component of body fluids and metabolism (Staci,2005). Water is an effective solvent because it easily binds to impurities, altering taste, colour, and scent When water is polluted, it damages both its regular features and functionality and is impacted by both factors(Trivedi et al.,2010) The Water, as a universal solvent, is necessary for living and fundamental human requirements. Pollutants, poisonous chemicals, pathogens, and dangerous radionuclides should not be present(keleb et al.,2022). The water is required for life on Planet Earth. Human survival is mostly dependent on freshwater supplies, which accounts for less than 1% of all available water on the planet.

Water quality is critical to health and economic development. Water chemistry changes with the seasons, human influences and natural processes . (Reagen & Bookins-Fisher, 1997).

Access to quality drinking water and sanitation for all is a major development and public health issue, set out in the sixth goal of the Sustainable Development Goals (SDGs), approved by all countries in the world. However, more than 663 million people worldwide still do not have access to improved drinking water. water (UNDP, 2017) (UNICEF & JMP, 2017). A great quality drinking water is consumable water that's free from maladies creating microorganisms and chemical substances harmful to wellbeing (WHO, 2011;WHO,2000) . At the Global Balneological Congress in Awful Nauheim, Germany, mineral water was first recommended in 1911 and it was specified that water containing more than 1000 mg/L of minerals should be considered mineral water (Uddin, et al., 2021;keleb et al.,2022) Continuous improvement of water quality drinking, domestic use, personal hygiene and specific medical situations is one of the major global issues. Waterborne diseases around the world are a cause of death and suffering for millions, especially children indeveloping countries, where contaminated water kills around 3,900 children every day.

(Schafera,et al.,2009) Nonetheless, a variety of disease-causing waterborne organisms can contaminate drinking water at any step in the chain from the source to the household container (WHO/UNICEF, 2015; Leclerc et al., 2002). Fecal-borne bacteria in water are the primary cause of most waterborne illnesses, Therefore, it is crucial to identify the most prevalent fecal contamination markers, such as TC and E. Coli. (Barrell et al., 2000)(Odonkor and Ampofo,2013) These coliforms are utilized as a sign of the presence of pathogens in drinkable water. (WHO, 2011)(Odonkor & Ampofo, 2013)

The goal of this study was to look at the concentration of ions in drinking water samples from purification and treatment stations, comparing these results with and their compliance with the guidelines of the World Health Organization (WHO, 2017) and the Libyan National Centre for Standardization and Metrology (LNCSM, 2020).

MATERIAL AND METHODS

Drinking water samples (15 sample) were collected from five different Water Purification System randomly, at sirte district in October, 2022. The area of study (Figure 1) was located within sirte city scheme

limits, which is located in north in Libya, and about 450 km away west of the capital Tripoli ,and The city of Sirte, is located in the north of Libya between 31° 12’ 32.11’’ North and 16° 35’ 19.18’ East (Figure 1). Its climate is classified as arid affected by the Mediterranean Sea in the north and the desert in the south. (Iman &fayyaz,2018)

Figure 1. Location of Sirte city, Libya (Latitude.to 2017)

The experimental work was Physicochemical and Bacteriological analyses such as pH, , Chloride, Nitrate, Sulfate ,Magnesium, Calcium, Sodium, Potassium, Bicarbonate, TDS and E. coli for carrying out the testes were used (pH meter TDS meter The analyses of water samples were carried out according to the standard methods for examination of water and wastewater (APHA,2017). The values of physico-chemical and microbiological parameters were compared to (WHO).(WHO,2017) guideline and (LNCSM)Libyan national center for standarzation and metrology (LNCSM,2020).

Chemical Analysis

The analyses of water samples were carried out according to the standard methods for examination of water and wastewater (APHA,2017).

pH

The pH was measured using BOECO PT-370 pH/mv meter, Germany.

Total Dissolved Solids (TDS)

Gravimetric method is being used to determine TDS. A well-mixed sample was filtered through a standard glass fiber filter. The filtrate was evaporated and dried to constant weight using the evaporating porcelain dishes and oven model HI-9321 at 103-105°C.

Anions analysis

Sulfate (SO_4^{-2}): The sulfate was determined by spectrophotometer which detected the absorption at 540 nm (APHA,2017).

Chloride (Cl^-): The chloride was determined by (MOHR) method which used silver nitrate solution and potassium chromate as indicator (APHA,2017).

Nitrate (NO^{-3}): The nitrate was determined by spectrophotometer at 220 nm. The presence in the ground water or surface water is good indicator for water contamination which product by chemical activity (APHA,2017).

Bicarbonate (HCO_{-3}): The bicarbonate was determined by titration with diluted hydrochloric acid and methyl orange indicator (APHA,2017).

Cations analysis

The concentration of Calcium, Potassium, Manganese and Sodium determined using Flame Atomic Absorption Spectrophotometer (GBC Scientific Equipment SAVANTAA) according to condition shown in the Table (1)

Samples were filtered using filtration system through 0.45 μm-pore-diameter filter paper then analyzed for ions using atomic absorption spectrophotometer (iCE 3000 Series AA Spectrometer–Thermo Scientific) (Kafia et al., 2009).

Table (1): Conditions of Flame atomic absorption spectrophotometer.

Element	Wave length (nm)	Slit width(nm)	Fuel	Oxidant	Measurement
Ca^{++}	422.7	0.5	C_2H_2	Air	Absorbance
K^+	766.5	0.2	C_2H_2	Air	Emission
Mg^{++}	285.2	0.5	C_2H_2	Air	Absorbance
Na^+	589.0	0.2	C_2H_2	Air	Emission

Bacteriological Analysis

A sterile 250 ml plastic bottle was used to collect the sample. Remove the cap with caution, then fill the bottle by holding it just below the well's surface. 100 ml of each water sample was filtered through a sterile membrane that held the bacteria on its surface in accordance with the membrane filters (MF) method as reported by(Noble et al.2003). The membrane was cut off aseptically and then put on a macconkey medium, which was incubated for 24 hours at 37°C. Coliform colonies that were growing on the membrane's surface and suggesting fecal contamination were counted and recorded as colony forming units (CFU) or coliform density (total coliform colonies per 100 ml).

Results and Discussion

Physicochemical parameters

Mineral water contains numerous amounts of dissolved minerals, including cations (Na^+, K^+, $Mg^{2+,}$ Ca^{2+}) and anions (Cl^-, Hco_{3-}), as well as particular compounds with therapeutic use. There are various health advantages to these dissolved mineral ion concentrations. Lower TDS values indicate that the water is not meeting the standard limits of the drinking water standards set by numerous international organizations'. Potential nutritional minerals for human health include calcium, magnesium, and sodium. Magnesium protects against cardiovascular illness, potassium is beneficial to muscles and the brain system, and calcium is a possible mineral for bone development .We refer to hard water as having high concentrations of calcium (Ca^{++}), magnesium (Mg), bicarbonate (HCO_{3-}), and sulfate (So^{4-}), all of which show at mg/L values and include high amounts of mineral (Rosborg&Kozisek,2016) . Aside from cancer and diabetes, hard water has been shown to be protective against osteoporosis, deteriorated cognitive function in the elderly, lower birth weight, and cancer.(Yasmin et al,.2018)Worldwide, rickets in children and osteoporosis in women are caused by low(Ca^{++}) and Mg intake(NAS,1997),(WHO,2005). For instance, high quantities of calcium, magnesium, sodium, and other minerals provide health benefits, including lowering blood pressure, preventing heart attacks and strokes, and reducing the chance of preterm birth (Munir et al.,2015). Because it contains fluoride, it helps to prevent dental cavities and also promotes the health of bones and teeth (Khalid et al.,2013)

PH

The pH level of water is an important indicator of its quality.The pH scale is used to determine whether water is acidic or alkaline. If the pH of a sample is less than 7.0, it is called acidic. Meanwhile, if the pH is greater than 7.0, it is alkaline. Corrosion of metal pipes and the plumbing system can be caused by acidic water (Hassan & Khalaf,. 2022).The normal drinking water pH range indicated by World Health Organization (WHO) (6.5-8.5) (WHO,2017)and the Libyan National Center for Standardization and Metrology (LNCSM) (6.5-8.5) (LNCSM,2020) (Table 2). The pH values of all the drinking water samples are found to be in the range between 7.6 and 8.46 (Table 2) where the sample No 5 shows the lowest value of pH, while the sample No 1 and 2 for the source water appear the highest values. (Table 2). In general, the pH was within the limits of the standard values (Table 2). As per the findings it was observed that the water was slightly alkaline in nature which might be due to the presence of dissolved salts in the water. Thus, the samples water was potable as per the WHO and LNCSM standards.

Total Dissolved Solid (TDS)

TDS is a term used to describe the amount of Total Dissolved Solids. The inorganic matter and small amounts of organic matter that are present as solutions in water are referred to as TDS (Rahmanian et al.,2015). The results in the (Table 2) in our study indicate that the Total dissolved solids (TDS) values range from (6.19 - 45 mg/l) in treatment and purification water stations.

In general, the values of Total dissolved solids (TDS) recorded in this study did not exceed permissible limits for international standards of drinking water for each of the WHO (1000 mg/l) (WHO,2017) and LNCSM (1000 mg/l) (LNCSM,2020).

Nitrate (NO^{-3})

The majority of nitrate present in natural streams comes from organic and inorganic sources, with the former encompassing waste discharges and the latter comprising chiefly consisting of manmade fertilizers. However, both bacterial oxidation and plant nitrogen fixation can yield nitrate. Nitrate concentrations are of particular interest for a variety of reasons. as well, results clear that the concentration of nitrate ranges from 2.6–4.8 mg/l, these results indicate that the quantity of nitrate in study sites is less than WHO and Libyan national center for standardization and metrology (LNCSM),that may threat on the health of inhabitants.

Chloride (Cl^-)

Chloride anions (Cl^-) are commonly found in natural waterways. Water that has come into touch with Cl–containing geological formations has a high Cl^- content. Otherwise, a high Cl^- level could indicate sewage or industrial waste pollution, as well as the entry of seawater or salty water into a freshwater body or aquifer. The ions with which the Cl^- is linked determine the salty taste of water. The taste of Na ions is discernible at about 250 mg/l, although the flavor of Ca or Mg may be imperceptible at 1,000 mg/l. Because chlorides are extremely soluble, they are found in all waterways, but the concentration is generally relatively low in natural waters (Estefan,2013). The chloride value in the study ranges from 0.03–0.04 mg/l. Thus, these results indicate that the quantity of Chloride in study sites is less than WHO and Libyan national center for standardization and metrology (LNCSM),that may threat on the health of inhabitants.

Sulphates (SO_4^{2-})

The concentration of Sulfate range from (0– 3 mg/l), the results exhibit that concentration of sulfate in Water Purification Systems was lower from standard limit. the results exhibit that concentration of sulfate in Water Purification Systems was lower from (WHO,2017)guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Total alkalinity (HCO_{-3})

Alkalinity (as HCO_{-3}) is not a pollutant. It is a total measure of the substances in water that have acid neutralizing ability (Fadaei & Sadeghi,2014) (Tariq,2022).current study revealed the concentration of Bicarbonates ranges, 1-3 mg/l, the results exhibit that concentration of Bicarbonates in Water Purification Systems was lower from (WHO,2017)guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Potassium (K^+)

Potassium is found in all human and animal tissues, notably in plant cells, because it is required for the proper functioning of living organisms (Fadaei & Sadeghi,2014).Although potassium (K^+) is a plentiful element, it rarely exceeds 20 mg/l in natural freshwater (Estefan,2013). Finding shows that potassium concentration ranges were low (0 -0.094)in the study area, Lack of potassium may cause diseases associated for human. the results exhibit that concentration of potassium in Water Purification Systems was lower from (WHO,2006) guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Mangnesium (Mg^{2+})

Magnesium (Mg^{+2}) is a common ingredient of natural water because it is very abundant in the earth's crust in the form of salts with a high solubility in water. It is the second most important component of hardness, accounting for 15-20% of overall hardness expressed as $CaCO_3$ (Estefan,2013).

in study are magnesium was ranges from0.042 - 0.437mg/l, Such a low may cause some long term public health problems and could be associated with health risks of residents. the results exhibit that concentration of magnesium in Water Purification Systems was lower from (WHO,2017) guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Sodium (Na^+)

Sodium (Na^+) is a common element that is found in most natural waters. It is the sixth most prevalent element. Sodium can be found in a variety of minerals, the most common of which is rock salt (sodium chloride). In many parts of the world, increased pollution of surface and groundwater has resulted in a significant increase in the Na content of drinking water over the last decade(tariq,2021) (Estefan,2013). Proper quantity of sodium in human body prevents many fatal diseases like kidney damages, hypertension, headache etc (Fadaei & Sadeghi,2014).Finding shows that sodium concentration ranges were(0.12- 4) in the study area, Lack of sodium may cause diseases associated for human. the results exhibit that concentration of potassium in Water Purification Systems was lower from (WHO,2017)guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Calcium (Ca^{++})

This is the most significant and abundant element in the human body, and an adequate intake is essential for normal growth and health. The maximum daily requirement is in the range of 1 to 2 grams, which is primarily derived from dairy products. There is some evidence that places supplied by a public water supply with a high degree of hardness, the principal constituent of which is calcium, have a lower incidence of heart disease, implying that the element's presence in a water supply is advantageous to health (EPA,2001)(tariq,2021). Calcium (Ca^{++}) is dissolved easily out of almost all rocks and is, consequently, detected in most waters (Rahmanian et al.,2015).

In study areas, results show that the concentration of calcium ranges from (0.080-1.04 mg/l), the results exhibit that concentration of Calcium in Water Purification Systems was lower from (WHO,2017)guidelines and Libyan national center for standardization and metrology (LNCSM,2020).

Table 2: Laboratory Analysis of Physical and Chemical Parameters of Study Areas and (WHO,2017) Standards and Libyan National Center for Standardization and Metrology permissible limit (LNCSM,2020).

Parameter	Unit	Stations					WHO Guideline	LNCSM permissible limit
		1	2	3	4	5		
PH	-	8.41±0.03	8.5±0.03	8.30±0.03	7.92±0.06	7.6±0.001	6.5-8.5	6.5-8.5
TDS	mg/l	45.04±0.01	12.09±0.01	6.19±0.003	17.53±0.001	39.4±0.03	500-1000	100-500
NO^{3-}	mg/l	4.1±0.001	2.8±0.003	4.0±0.001	2.6±0.03	4.8±0.001	10-45	10
CL^{-}	mg/l	0.03±0.001	0.04±0.001	0.04±0.001	0.03±0.006	0.04±0.001	200-600	150

$SO^{2}-_{4}$	mg /l	2±0.001	3±0.001	0±0.001	0±0.001	1±0.001	200−400	150
HCO^{-1}	mg /l	1±0.001	1±0.001	1±0.001	2±0.001	3±0.002	10	10
K^{+}	mg /l	0.094±0.001	0±0.00	0±0.00	0±0.00	0.032±0.001	12	12
Mg^{2+}	mg /l	0.31±0.006	0.072±0.001	0.048±0.001	0.02±0.00	0.437±0.002	30−150	150
Na^{+}	mg /l	3.2±0.023	0.12±0.00	0.6±0.00	0.9±0.058	4±0.001	200−400	100
Ca^{2+}	mg /l	0.56±0.001	0.44±0.001	0.2±0.001	1.04±0.003	0.080±0.001	75−200	75

Bacteriological analysis

The data in Table 3 showed that all simple (from Water Purification Systems At sirte) the bacteriological result revealed that bacteria E.coli all of the studied stations do not contain bacteria the water is free from bacterial contamination .Thus, the samples water was potable as per the(WHO,2021) and (LNCSM,2020) standards.

Table (3) Bacteriological results in the of the Study Areas

Station	Count per 100 ml	Remarks
1	0	In conformity with WHO,2021 guidelines
2	0	In conformity with WHO,2021 guidelines
3	0	In conformity with WHO,2021 guidelines
4	0	In conformity with WHO,2021 guidelines
5	0	In conformity with WHO2021 guidelines

CONCLUSION

In This study evaluated the quality of drinking water Commercial Water Purification Systems at Sirte area. evaluated Physical, chemical and biological parameters investigate and compared with the (WHO,2017) and Libyan national center for standardization and metrology (LNCSM,2020), In general, most of the values were mismatched with (WHO,2017) and (LNCSM,2020). low in most chemical and physical parameters, except ph, it matches WHO and Libyan national center for standardization and metrology (LNCSM), standards pH of water should be 6.5 to 8.5 Hence, in study area the ph values were between 7.6 to8.46, the values were not exceeded the standard . The results reveal that Commercial Water Purification Systems at Sirte area. may not be following standard guidelines and quality control steps properly. As a result, they urgently need to update their standard operating procedure to ensure rigorous adherence to requirements Libyan national center for standardization and metrology (LNCSM,2020) (WHO,2017). The bacteriological results revealed that no E. coli bacteria were found in any of the water samples, indicating that the water is free of bacterial contamination. compared with the (WHO,2021) and Libyan national center for standardization and metrology (LNCSM,2020). to ensure public health, competent authorities should closely monitor the quality of drinking water supplied to consumers.

Recommendations

bottled water must have significant specific health values relevant government agencies should implement rigorous inspections to improve water quality and improve water bottle labels to show the correct water characteristics.

If safe bottled water is required, keep the source water as clean as possible, have a well-maintained water distribution system, proper treatment, including disinfection, and additional steps to remove or inactivate contaminants. We need to be prepared and protect our water sources.

Finally, ensuring safe drinking water requires strict water quality standards, regular observations, inspections, operator training, monitoring, certification, reporting, public service announcements, emergency planning, adequate

Reference

1. APHA, (American Public Health Association) (2017). Standard methods for the examination of waters and wastewaters. APHAAWWA- WEF, Washington, DC.
2. Barrell, R. A. E., Hunter, P. R., and Nichols, G. (2000). Microbiological Standards for Water and Their Relationship toHealth Risk. Commun. Dis. Public Heal 3 (1), 8-13.
3. EPA, (Environmental Protection Agency), E. P. A. (2001). Parameters of water quality: interpretation and standards: Environmental Protection Agency Ireland.

4. Estefan, G. (2013). Methods of soil, plant, and water analysis: a manual for the West Asia and North Africa region: International Center for Agricultural Research in the Dry Areas (ICARDA).

5. Fadaei, A., & Sadeghi, M. (2014). Evaluation and assessment of drinking water quality in Shahrekord, Iran. Resources and Environment, 4(3): 168-172.

6. Hassan S.H., Khalaf Ali, J.K., (2022). Study the quality of drinking water in the holy city of Karbala.Revis Bionatura. 7(2): 26. http://dx.doi.org/ 10.21931/RB/2022.07.02.26.

7. Iman,a ,Fayyaz & M,.Raziyeh ,F .international conferece on urban drainage modeling (2018)

8. Kafia, M. S., Slaiman, G. M., & Nazanin, M. S. (2009). Physical and chemical status of drinking water from water treatment plants on Greater Zab River. Journal of Applied Sciences and Environmental Management.

9. keleb A, Ademas A, Sisay TLingerew M and Adane M (2022)Bacteriological Quality of BottledDrinking Water and Municipal TapWater in Northeastern Ethiopia. Frontiers in Environmental Science ww.frontiersin.org 1 March 2022 | Volume 10 | Article 82835.

10. Khalid, N.; Ahmad, A.; Khalid, S.; Ahmed, A.; Irfan, M. Mineral Composition and Health Functionality of ZamzamWater: A Review. Int. J. Food Prop. **2013**, 17, 661–677.

11. Latitude.to2017.Availablefrom: http://latitude.to/map/ly/libya/cities/sirte (Accessed 03/11/2017)

12. Leclerc, H., Schwartzbrod, L., and Dei-Ca, E. (2002). Microbial Agents Associated with Waterborne. Crit. Rev. Microbiol. 28 (4), 371–409.

13. LNCSM (Libyan National Center for Standardization and Metrology), (2020). Drinking Water. LNS 82, Second edition.Tripoli-Libya.

14. Munir, N.; Shoaib, M.; Asad, M.J.; Tanooli, A.Y.; Munir, N.; Sherwani, S.K. Physio-Chemical differences between Aab-E-ZamZam and mineral water effect of water intake on blood pressure. Am. Eurasian J. Toxicol. Sci. **2015**, 7, 83–87.

15. National Academy of Sciences. Drinking-Water and Health; National Academy Press: Washington, DC, USA, 1997; Volume I,

16. Noble, R.T.; Leecaster, M. K.; McGee, C. D.; Weisberg, S.B. and Ritter, K. (2003): "Comparison of Total Feacal Coliform and Enterococcus Response for Ocean Recreational Water Quality Testing," Water Research, 37, No. 7, pp. 1637-1643.
17. Odonkor, S. T., and Ampofo, J. K. (2013). Escherichia coli as an Indicator ofBacteriological Quality of Water: An Overview. Microbiol.
18. Rahmanian, N., Ali, S. H. B., Homayoonfard, M., Ali, N., Rehan, M., Sadef, Y., & Nizami, A. (2015). Analysis of physiochemical parameters to evaluate the drinking water quality in the State of Perak, Malaysia. Journal of Chemistry, 2015
19. Reagen, P., and Bookins-Fisher, J., (1997). Community health in the 21st century, Water quality, Masssachussets, Allyn & Bacon.
20. Rosborg, I.; Kozisek, F. DrinkingWater Minerals and Mineral Balance; Springer: Berlin/Heidelberg, Germany, 2016; p. 175.
21. Schafera, A.I., Rossitera, H.M.A., Owusub, P.A., Richardsc, B.S. and Awuah, E., (2009). Physico-chemical water quality in Ghana: Prospects for water supply technology implementation. Desalination, 248: 193–203.
22. Staci, N. (2005). Willaim's Basic Nutrition and Diet Therapy. ELSEVIER MOSBY. 1: 156-165.
23. Tariq A. M.Tyeb,Galal M. Elmanfe and Jibreel A. Asbeeh.(2022) Chemical Analysis of Drink Water Samples for some Water Purification and Treatment Stations in El-Beida City - Libya and Compared with Residential and Mineral Wate SEBHA UNIVERSITY JOURNAL OF PURE & APPLIED SCIENCES VOL.21 NO. 4 2022.
24. Trivedi, P., Bajpai, A. and Thareja, S., (2010). Comparative Study of Seasonal Variation in Physico- ChemicalCharacteristics in Drinking Water Quality of Kanpurndia with Reference To 200 MLD Filtration Plant and Ground Water .

25. Uddin, M.R.; Khandaker,M.U.; Abedin, M.J.; Akter, N.; Molla Jamal, A.S.I.; Sultana, R.; Sultana, S.; Hasan, M.; Osman, H.; Elesawy, B.H.;et al. Quality Assessment of Bottled and Unbottled Drinking Water in Bangladesh. Water 2021, 13, 2026.

26. UNDP (2017). Sustainable Development Goals. Geneva Switzerland: UNDP.

27. UNICEF & JMP (2017). Progress on Household Drinking Water, Sanitation and hygiene, 2000-2017. New York, United States: UNICEF.

28. WHO (2011). Guidelines for Drinking-Water Quality.Geneva, Switzerland.

29. WHO (2000) Guidelines for drinking water quality, 1, W.H.O. Geneva 2000).

30. WHO, (Word Health Organization),(2017). Guidelines for drinking-water quality: Incorporating first addendum.

31. WHO, (Word Health Organization),(2021). Aglobal overview of national regulation and standards for drinking-water quality.

32. WHO/UNICEF (2015). Progress on Sanitation and Drinking Water. Geneva:Switzerland

33. World Health Organization. Nutrients in Drinking Water; (No. WHO/SDE/WSH/05.09);World Health Organization: Geneva,Switzerland, 2005;

34. Yasmin, S.; Barua, B.S.; Khandaker, M.U.; Kamal, M.; Rashid, A.; Sani, S.A.; Ahmed, H.; Nikouravan, B.; Bradley, D. The presence of radioactive materials in soil, sand and sediment samples of Potenga sea beach area, Chittagong, Bangladesh: Geological characteristics and environmental implication. Results Phys. 2018, 8, 1268-1274