

RESEARCH ARTICLE

ASSESSMENT IMPACT OF SOLID WASTEWATER ON GROUNDWATER SAMPLES IN GANFOUDA AREA LOCATED IN BENGHAZI CITY

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ABSTRACT

Groundwater is an essential component for most people in the world. It meets the drinking water needs of more than fifty percent of the world's population. Unfortunately, groundwater can become contaminated. This occurs in cases where some man-made solid waste or several heavy metals such as nitrate, cadmium, chromium, lead, and mercury come into contact with underground water. This paper aims to evaluate the quantity of groundwater contamination in the Ganfouda area, west of the city of Benghazi, where some samples of water were collected from eight from several underground wells in the Ganfouda area. The results of this work showed high concentrations of dissolved solids, Sodium ion, Cadmium, lead and Bacteria Leachate in all collected samples. Through the results of the study that indicated groundwater contamination in the selected areas, we urge local authorities to monitor the quality and content of groundwater in landfills in the Ganfouda area in particular and in cities with high population density in general and to monitor water quality periodically.

KEYWORDS

Solid Waste, Groundwater, Heavy Metals, Concentrations, Qanfouda, Benghazi.

1. INTRODUCTION

Managing the consequences of solid waste dumping on groundwater boreholes requires taking into account the amount of heavy metals in groundwater contaminants in subterranean wells (Slomczynska and Slomczynski, 2004). The concentration of heavy metals in groundwater wells may vary depending on the physical, chemical, and bacteriological features of the samples. It can spread infection and be bacterially harmful (Pohland and Stephen, 1987). The groundwater well samples contained high concentrations of lead and cadmium, above the permitted limit for inorganic drinking water in Ganfouda (0.005-0.003 mg/l). Lead, cadmium, chromium, and mercury concentrations varied from 0.005 to 0.017%, 0.005 to 0.013%, 0.010 to 0.027, and 0.001 mg/L, respectively, while those for nitrate ranged from 1.260 to 8.150 mg/L, compared to information about drinking water that is inorganic (Bably and Bose, 2001). It was finished. Lead and cadmium levels were examined in water samples since they were unwanted minerals in drinking water compared to standard (Nartey et al., 2012).

Furthermore, the level of heavy metals in groundwater wells close to a solid waste landfill was significantly higher than the level in drinking water samples. The number of heavy metals in the groundwater is influenced by its location. It can be explained in terms of the kind and volume of solid waste landfill present as well as how the landfill influences groundwater samples (Lee et al., 2005). Lead and cadmium concentrations were higher in this study than in Ganfouda records, even though zinc and chromium levels were also found (Calo and Mario, 2009). Groundwater samples were analyzed for Ph, EC, TDS, and other important ions in the studies by authors on evaluating the quality of groundwater for drinking purposes in the city of Sorman, Libya (Abbas et al., 2017). In a study, the authors examined the pollution of groundwater with toxic heavy elements and their carcinogenic and non-carcinogenic effects on health in the study area and analyzed the content of the elements (Pb, As, and Cr) using the

ICP-MS device in the ACME laboratory in Vancouver, Canada (Hasseb et al., 2020).

In a study the authors detected coliform, faecal coliform, and pseudomonas aeruginosa bacteria and the pollution of toxic ions (No^3 , B^{+3} , pb^{+2} , and Cd^{+2}) in well water that was contaminated by coliforms and Aeruginosa bacteria that affected the quality, but chemical pollution isn't found in well water because constrictions of toxic ions lower them to World Health Organization (WHO) standards (Hasan and Tariq, 2015). In a study, the authors discuss some groundwater sources and problems, including hot and mineral waters that become very important in our lives and to our health due to their chemical and radioactive characteristics (Wakida and David, 2005). In the level of heavy metals chromium, cadmium, copper, lead, zinc, manganese, and iron was estimated in the water of Sulphur wells located in northwestern Libya, and this study was represented in the concentrations of elements that were within the permissible limit compared to the Libyan, while the iron element was high during the summer (Elosta and Amal, 2022).

In Aziz's study aims to apply the Canadian water quality model to water and estimate the following: PH, total dissolved solids, total hardness, total alkalinity, and cation concentrations (Al-Saffawi, 2018). In a study, this research included conducting periodic physical and chemical analyses and measurements of heavy elements in the water of surface and groundwater sources and comparing them with the approved standard specification (Mohamed et al., 2021). In the author's study aims to apply a quality model to water to be evaluated for drinking purposes (Al-Saffawi, 2018). Monthly water samples were collected from each well to estimate the following: PH, total dissolved solids, total hardness, total alkalinity, and anions and cations concentrations.

In the authors study the possible impact of leachate percolation on groundwater quality. Concentrations of various physicochemical

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parameters, including heavy metals (Cd, Cr, Cu, Fe, Ni, Pb, Fe, and Zn), were determined in leachate samples and are reported (Nagarajan et al., 2012). In the authors studies reported in this special issue focus on contaminants in groundwater of orogenic and anthropogenic origin distributed over a wide geographic range (Li, 2021). In the study, the quality of ground water around a municipal solid waste disposal site was evaluated, and chemical analyses were 120 | The North African Journal of Scientific Publishing (NAJSP) carried out on the water and leachate collected from the site, which showed the presence of heavy metals (Vasanthi et al., 2008). In the authors investigated the effects of solid waste disposal sites on underground water quality through the examination of some physical and chemical properties of water (Aliyu, 2023).

This work is set up like follows: In Section 1, we collected eight groundwater samples from the vicinity of the Benghazi landfill's Ganfouda solid waste disposal facility. The chemical, physical, and bacteriological experiments mentioned in Section (2) were carried out by the food laboratory of the Arab Medical University. In Section (3), we carried out bacterial testing and identified bacteria in one of the samples. We also learned that the total salt level was high and that chemical testing revealed significant percentages of heavy metals including cadmium and chromium. Section (4) of the study also examined diseases caused by heavy metals and bacteria, while Section (5) concentrated on a bacteriological analysis. • The objective of this study: Study of the quality of household wells in neighborhoods close to a solid waste dump in the Ganfouda neighborhood of Benghazi by performing physical, chemical, and bacteriological analyses (odor, color, TDS, sodium ion, chromium metal, cadmium metal, nitrate metal, mercury metal, lead metal, and total number of bacteria and coliform bacteria), as well as assessing the suitability of groundwater sources for drinking and contrasting them with the app.

Proposed Solution Mythology: Study and evaluate the physical, chemical, and bacteriology tests of the groundwater sources in Khi Ganfouda, close to the solid waste dump, and create the best strategies and tactics to address the issue of groundwater contamination and its effects on human health. This will help people and reveal the threat that the Ganfouda landfill poses to the quality of nearby water. The drilling industry's workers will identify and handle the issues from the locals.

Problem formulation: The color, taste, smell, and T.D.S. of the groundwater in the Ganfouda region have all changed as a result of pollution. Residential portions were near to a solid waste landfill, and the region also relied on underground boreholes for domestic drinking water. Locals have expressed concern over the lack of a water system, the prevalence of bacterial illnesses including gastroenteritis, and the smelly nature of the water. Concern among the people has been raised by the lack of a water system, the high prevalence of bacterial infections including diarrhea, and the presence of an unpleasant scent in the water.

Consequently, to accomplish our objective, the following issues must be resolved: Rapid population growth, unacceptable urban expansion, and

unwelcome economic growth are all indicated by the effect of a solid waste landfill on groundwater wells in the Ganfouda neighborhood of Benghazi City. Consequently, unclean open landfills and dumps It is a pressing matter. Household, medical, and industrial trash are all included in municipal solid waste; nevertheless, they are not separated and are all disposed of in the same landfill (Rodic and David, 2017). The main site for disposing of solid waste is a landfill, which has caused pollution, a dangerous environment, and the spread of illnesses (Giusti, 2009; Recep and Tuncan, 2011). Groundwater flow or precipitation seepage may affect the garbage dumped in landfills, particularly with Water picks up a range of inorganic particles when it filters through garbage. The resultant contaminated water is referred to as a "solid matter dump" via the soil leaks. However, environmental quality may be seriously threatened by landfills. Even though it was completely secure, it was being used improperly. Perhaps it is hazardous to treat surface water and groundwater. This danger is about the size of a hand. It depends on the kind, volume, and proximity of the leachate to the water sources and the landfill. the landfill A highly concentrated, complicated wastewater known as solid waste comprises dissolved organic matter as well as inorganic substances like ammonium, calcium, magnesium, sodium, potassium, iron, sulphates, and chlorides (Slomczynska and Slomczynski, 2004). The heavy metals cadmium, chromium, lead, and zinc were found in high proportions in the salt we investigated for our research(Ogundiran and Afolabi, 2008; Tengrui, 2007). Some researchers which demonstrates that due to the physical, chemical, and microbiological processes that occur in sedimentary waste, each is present in varying amounts (Aziz, 2010). The composition of the filtered material is influenced by a variety of parameters and landfill concentrations are influenced by several variables, including the type of waste, the size of the particles, the degree of compaction, the hydrology of the site, the age of the landfill, the humidity, temperature, and oxygen levels (Lee et al., 1993; Christensen, 2001). The stabilization of buried garbage occurs during the procedure. Preservative materials persist for a very long period after the occurrence of waste stabilization, but non-preserving landfill components—which are mostly organic in nature— tend to breakdown and become stable over time (Giusti, 2009).

2. MATERIALS AND METHODS

2.1 Study area details

The study area is situated in the western neighborhood of Qanfouda in Benghazi. It is next to the landfill, which was built in 1970. It is roughly 17 km away and is owned by the public works company for services; it is regarded as the city's primary dump. The institution is situated on terrain with fertile, saline soil, covering a total area of around 35 hectares. The landfill is located 3 km from the closest populated center, and the target is no more than 2 km from the sea. Its borders are the sea to the north, Carrefour to the south, the Qaryounis region to the east, and Mankato Al-Hails to the west. Even though the landfill has been in use for 53 years, just around half of its overall space has been utilized.

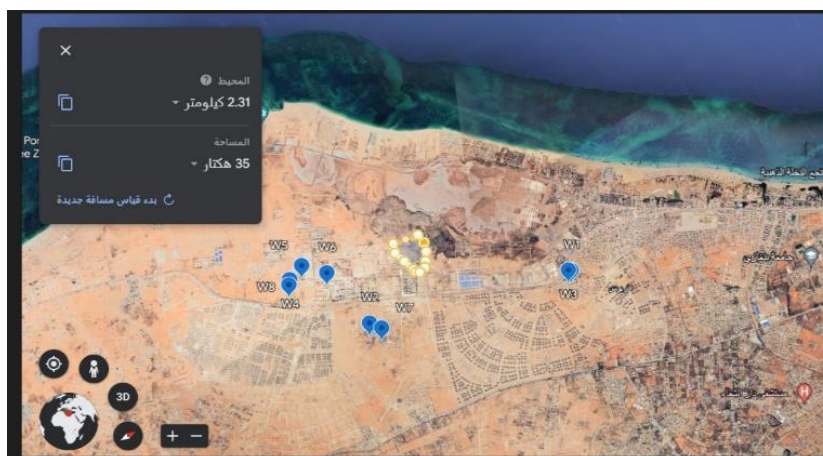


Figure 1: Study area

2.2 Sample Collection Method

Then they took 8 water samples from household wells in the Qanfouda neighborhood of Benghazi. The samples were from residential buildings close to the Qanfouda landfill and were taken at random. They were maintained at room temperature until the necessary laboratory tests were run on them during the collecting period in May 2023 (see Table 1 below). The data, sizes, locations where the test samples were collected and tested

are depicted in the diagrams and figures in the Arab Medical University water and food analysis laboratory.

2.3 Analytical methods

2.3.1 Absorption Spectroscopy Analysis

Atomic absorption spectroscopy was used to measure the amount of

heavy metals in drinking water. Zn, Pb, Cd, Cr, and Hg contents in groundwater samples using an atomic absorption spectrophotometer with a blank. Then precisely weigh the sample, averaging 1 gram and 10 mL of concentrated nitric acid (heat the dish's contents using a gentle flame, such as a Bunsen burner, until any flammable or easily combustible elements have been eliminated). Then, transfer the solution to the volumetric flask and dilute with water to volume. By utilising the same steps as for the sample and the same amounts of reagents, including water, for the sample and the blank, one can make a sample solution blank, giving the sample and sample blank the same treatment (such as the amount of time in heat, etc.).

Adjust the device in accordance with the present ideal circumstances or with the recommendations in the instruction manual (included with the device). Below are the recommended settings for an atomic absorption spectrophotometer. and m n Find the absorbance of the sample solution(s) and the blank, determine the mineral content from the standard curve, and then, after positioning the instrument optimally, read the absorbance of a series of the standard mineral solution(s) in the atomic absorption spectrophotometer. Plot of absorbance against metal solution/ml.

2.3.2 Bacteriological Tests

A microscope was used to calculate the quantity of direct bacterial cells in a water sample. This is done by determining the average number of bacteria in each square on a microscope slide (a red blood cell counting slide) after placing a tiny portion of the mixed sample on it in squares with defined dimensions and areas. We may calculate the number of bacteria in one cubic centimeter of the sample by multiplying the value by the microscopic coefficient. This value is multiplied by the reciprocal of the dilution ratio in the case of diluted samples. Bacteria count per milliliter is equal to ((number of bacteria counted in the fields * 2000* reciprocal of dilution)). This examination is carried out to look for coliform bacteria.

3. DISCUSSION

The physiochemical characteristics of the leachate depend primarily upon the waste composition and water content of the total waste. The characteristics of the leachate samples collected from landfill sites are presented in the Qanfouda region. Typically regarded as a major pollutant, TDS is used as an indicator of both the general characteristics of drinking water and the presence of a variety of chemical contaminants. The current range of water sample concentrations is 21560 mg/L to 4735 mg/L. TDS should not exceed 1000 mg/L, which is also the acceptable maximum in the absence of a source. A substitute is 2000 mg/L. The Food and Nutrition Board of the National Research Council recommends that the healthiest adults consume at least 500 mg of sodium per day and that sodium intake be limited to no more than 2,400 mg per day. M agrees with this low level of anxiety. Due to legitimate criticism of the EPA's 20 mg/L (Drinking Water Equivalent Level (DWEL) or Guideline Level) for sodium, the

maximum allowed sodium content is 200 mg/l according to WHO guidelines. Nitrates, lead, cadmium, chromium, and mercury concentrations ranged from 1.260 to 8.150, 0.005 to 0.017%, 0.005 to 0.013%, 0.010 to 0.027, and 0.001 mg/L, respectively. High levels of lead and cadmium were found in the groundwater well samples, above the permitted limit for inorganic drinking water in Qanfouda (0.005-0.003 mg/l). For inorganic drinking water, Analysis of water samples for cadmium, chromium, and lead concentrations since it was successfully identified as a mineral heavy in water for drinking compared to the water system.

The analysis of the lead metal values for all samples It was discovered that every sample complied with the requirements for drinking water, with the exception of the first, fourth, and eighth samples, which did not, and the second sample, which was entirely at the maximum level. The brain, liver, kidneys, and bones are all affected by lead, which is dispersed throughout the body. It is kept in the bones and teeth, where it builds up over time. The usual method for determining human lead exposure is to measure blood lead levels. During pregnancy, lead enters the blood from the bones, where it is then exposed to the developing fetus.

The comparison of the results for cadmium metal for all samples to the requirements for drinking water All of the samples were discovered to contain cadmium metal. Cadmium can induce kidney failure, pulmonary crises, inflammation, and chronic emphysema leading to lung cancer in amounts greater than the maximum allowable level of cadmium pollution. Blood, bones, liver, and damage. Based on the analysis of the results for coliform bacteria for all samples in comparison to drinking water standards, Sample (3) was discovered to have colon-specific bacteria.

The results for coliform bacteria for all samples to drinking water standards illustrate the analysis. There were bacteria unique to the colon in sample (3), it was found. The following are some indicators that a person may be infected with the E. coli bacteria: Acute diarrheal: Diarrhoea can become painful and bloody during ache. In addition to cramps, stomach aches, and a lot of gas, flatulence also involves these symptoms. Loss of appetite is a symptom of anorexia. Fever: An infection with coliform bacteria may result in a fever. Vomiting and nausea are caused by illnesses that have an impact on the digestive system and intestines. Exhaustion, particularly when hunger and eating habits decline.

4. RESULTS AND ANALYSIS

4.1 Physical Examinations

4.1.1 PH Analysis

Results in Table (2) below and Figure (2) below. indicate that the samples were within the permitted ranges, which are the pH concentrations for groundwater boreholes between 6.5 and 8.

Table 2: Compares The Results of PH Measurements to The Permitted Drinking Water Standards

Sample	Sample NO	Result	Permissible limits
Fire at the landfill versus vnfodh	1	7.3	6.5-8
against the landfill	2	7.1	6.5-8
Qanfouda is to the left of the office, across from the landfill.	3	7.3	6.-8
Village of al muroos (A)	4	7.7	6.5-8
Village of al muroos (C)	5	7.2	6.5-8
Immigration tool	6	7.5	6.5-8
The region across from the landfill	7	7.5	6.5-8
Village of al muroos (B)	8	7.4	6.5-8

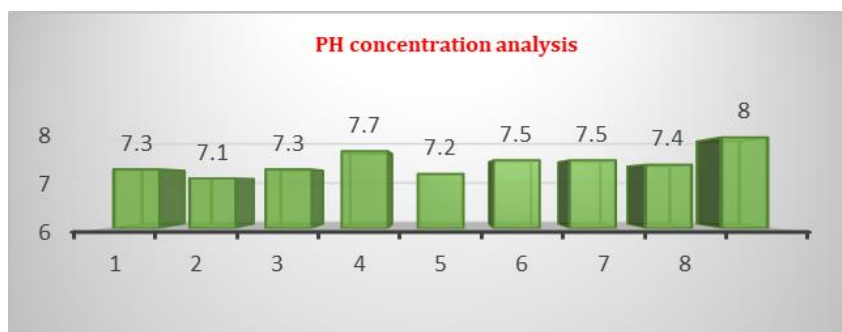


Figure 2: Analysis PH in comparison to the permitted maximum level for drinking water

4.1.2 Dissolved Salts Total T.D.S

Results in Table (3) below and Figure (3) below showed that the samples

did not satisfy Libya's standards for drinking water. Additionally, it was found that the lowest sample concentration is (6) Immigrating tools, with a concentration of 1560 ppm, which is brought on by the ground's vicinity.

Three samples were taken: (1) Fire at the landfill versus vnfodh, which had a concentration of 4560 ppm; (2) Against the landfill, which had a concentration of 4270 ppm; as well as (3) Ganfouda, which was across from the landfill and to the left of the office.)

(Qanfouda), which is situated to the left of the office and across from the dump. include the proximity to the sewage system that detected coliform bacteria.

4.1.3 Odour

Samples are within the allowed limit, according to the data in Table (4) below and Figure (4) below. With the exception of Sample No. 3

4.1.4 Color

All samples, except for sample No. 3, which is grey in color, are transparent and range within the permitted distances, as shown by the results in Table (5) below.

Table 3: Compares the Results of T.D.S Measurementst to The Permitted Drinking Water Standard

Sample	SampleNo	Result	Permissible limits
Fire at the landfill versus vnfodh	1	4560	1000
Against the landfill	2	4270	1000
Qanfouda is to the left of the office, across from the landfill.	3	4735	1000
Village of al muroos (A)	4	2250	1000
Village of al muroos (C)	5	3600	1000
Immigration tool	6	1560	1000
The region across from the landfill	7	3165	1000
Village of al muroos (B)	8	3895	1000

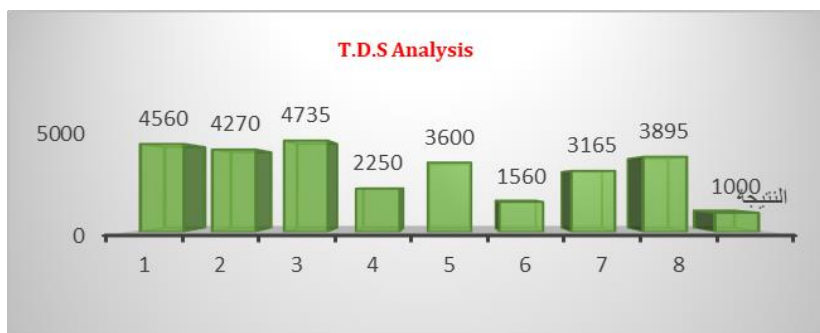


Figure 3: Analysis T.D.S in comparison to the permitted maximum level for drinking water

Table 4: Compares the Results of Smiling Testing to The Permitted Drinking Water Standard.

Sample	Sample No	The result
Fire at the landfill versus vnfodh	1	acceptable
against the landfill	2	acceptable
Qanfouda is to the left of the office, across from the landfill.	3	acceptableun
Village of al muroos (A)	4	acceptable
Village of al muroos (C)	5	acceptable
Immigration tool	6	acceptable
The region across from the landfill	7	acceptable
Village of al muroos (B)	8	acceptable

Table 5: The Results of The Color Tests in Relation to The Standards of Drinking Water.

Sample	Borehole No	The result
Fire at the landfill versus vnfodh	1	Transparent
Against the landfill	2	Transparent
Qanfouda is to the left of the office, across from the landfill.	3	grey
Village of al muroos (A)	4	Transparent
Village of al muroos (C)	5	Transparent
Immigration tool	6	Transparent
The region across from the landfill	7	Transparent
Village of al muroos (B)	8	Transparent

4.2 Chemical Test

4.2.1 Sodium element (Na)

Based on the results in Table (6) below and Figure (4) below, it was found that samples No. (2) and No.(4) had values of 215,070 and 202,862, respectively. we find that all samples were within the permissible limits and this result is consistent with Libyan standard specifications.

4.3 Results and Analysis of Heavy Metals

4.3.1 Nitrate Metal (NO₃)

The sample No (1) had the lowest concentration, while the sample (4) which had a concentration of 8.150 ppm, had the highest. These data are shown in Table (7) below and Figure (5) below. The inorganic concentration of each sample was within the permissible ranges.

Table 6: Results of Comparing the Sodium Element Concentration to The Drinking Water's Permissible Limits

Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	169,120	200
Against the landfill	2	215,070	200
Qanfouda is to the left of the office, across from the landfill.	3	188,001	200
Village of al muroos (A)	4	202,862	200
Village of al muroos (C)	5	179,500	200
Immigration tool	6	153,244	200
The region across from the landfill	7	191,111	200
Village of al muroos (B)	8	170,109	200

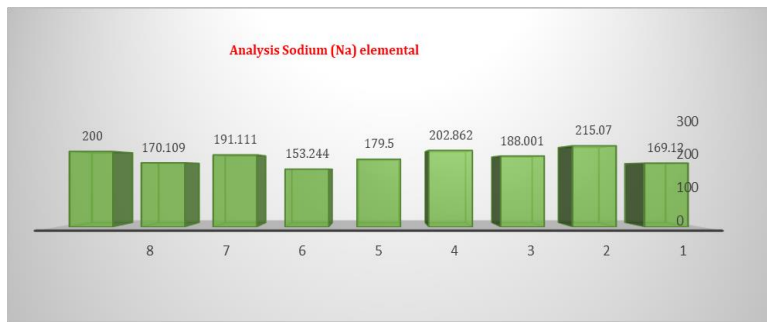


Figure 4: Analysis Sodium(Na) element was compared to the permitted drinking water concentration.

Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	1,190	10
Against the landfill	2	6,850	10
Qanfouda is to the left of the office, across from the landfill.	3	4,560	10
Village of al muroos (A)	4	8,150	10
Village of al muroos (C)	5	1,260	10
Immigration tool	6	6,200	10
The region across from the landfill	7	3,605	10
Village of al muroos (B)	8	6,890	10

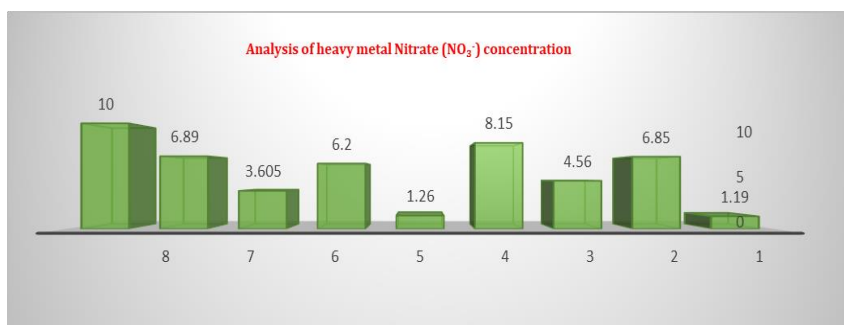


Figure 5: Analysis Nitrate metal (NO₃⁻) was compared to the permitted drinking water concentration

4.3.2 Lead (Pb)

Three samples, (1), (4), and (8) were found to have concentrations of (0.00014ppm, 0.017ppm, and 0.015ppm) that were higher than what was permitted based on the results given in Table (8) below and Figure (6) below, and the concentration of samples No. (2), No. (3). And No. (6), was (0.010/0.008, and 0.009ppm). Two samples (5) and (7) were below the allowed limits for inorganic levels in drinking water.

4.3.3 Cadmium (Cd)

Based on the results shown in Table (9) below and Figure (9) below, sample analysis for all samples tested showed that the concentrations

were higher than the permitted limits. The sample No (1) had a concentration of (0.009ppm). The highest concentration of inorganic contents for drinking water, which is 0.013ppm, was found in sample No. 7, Paraphrase Three samples (3/5/8) were outside the maximum permissible limits.

4.3.4 Chromium (Cr)

Results in Table (10) below and Figure (7) below show that sample No. (6) had the lowest value at 0.010 and sample No. (5) had the greatest concentration at 0.027ppm, and remain the inorganic concentration of each sample was within the permissible ranges.

Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	0.014	0.005
Against the landfill	2	0.010	0.005
Qanfouda is to the left of the office, across from the landfill.	3	0.008	0.005
Village of al muroos(A)	4	0.017	0.005
Village of al muroos(C)	5	0.005	0.005
Immigration tool	6	0.009	0.005
The region across from the dump	7	0.005	0.005
Village of al muroos(B)	8	0.015	0.015

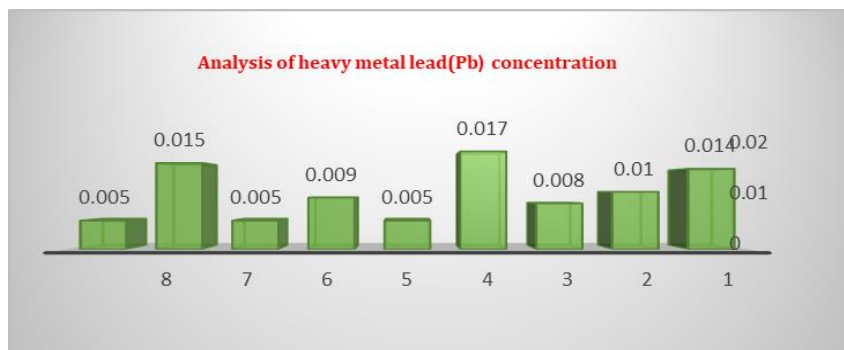


Figure 6: Analysis Lead metal (Pb) was compared to the permitted drinking water concentration.

Table 9: Results of Comparing the Chromium Metal (Cd) Concentration to The Drinking Water's Permissible Limit			
Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus VNFODH	1	0.009	0.003
Against the landfill	2	0.012	0.003
Qanfouda is to the left of the office, across from the landfill.	3	0.005	0.003
Village of al muroos(A)	4	0.008	0.003
Village of al muroos(C)	5	0.005	0.003
Immigration tool	6	0.010	0.003
The region across from the dump	7	0.013	0.003
Village of al muroos(B)	8	0.005	0.003

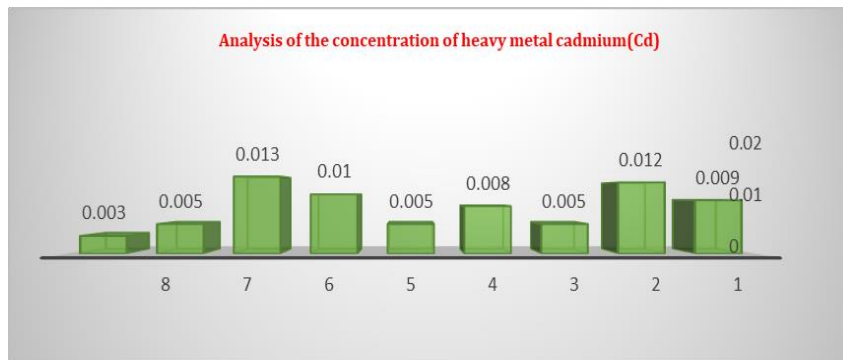


Figure 7: Analysis Cadmium metal (Cd) was compared to the permitted drinking water concentration

Table 10: Results of Comparing the Chromium Metal (Cr) Concentration to The Drinking Water's Permissible Limit			
Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	0.016	0.05
Against the landfill	2	0.020	0.05
Qanfouda is to the left of the office, across from the landfill.	3	0.011	0.05
Village of al muroos(A)	4	0.012	0.05
Village of al muroos(C)	5	0.027	0.05
Immigration tool	6	0.010	0.05
The region across from the dump	7	0.019	0.05
Village of a muroos(B)	8	0.0125	0.05

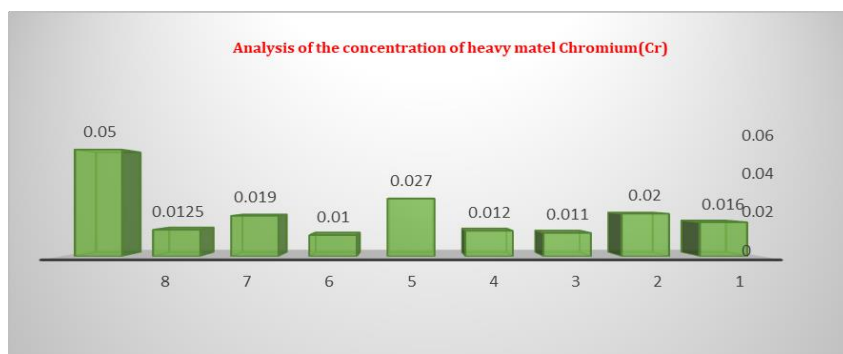


Figure 7: Analysis Chromium metal (Cr) was compared to the permitted drinking water concentration.

4.4.4 Mercury (Hg)

Results are shown in Table (11) below and Figure (8) below. It was found that all samples were less than 0.001. The samples were found to be within the permitted limits for the inorganic content of drinking water and devoid of mercury.

4.5 Bacteriological Examinations

4.5.1 Determine How Many Bacteria Are Present Overall.

Based on the results in table (12) below and figure (9) below, the samples

(1/3/4/5/7) were taken from the locations had bacteria. While the other samples satisfied the standards for drinking water, which are, respectively, (2/6/8), the samples that were tested did not reach the permissible limits for bacteria in drinking water.

4.5.2 Estimation of the Coli Bacterium

Based on the results in Table (13) below and Figure (10) below, the sample (3) had Coliform Bacteria at a level of 16 colonies/ml, above the permitted limits for coliform bacteria in drinking water. The remaining samples, which are (1/2/4/5/6/7/8) we are found in permissible standard drinking water

Table 11: Results of Comparing the Mercury Metal (Hg) Concentration to The Drinking Water's Permissible Limit			
Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	0.001	0.01
Against the landfill	2	0.001	0.01
Qanfouda is to the left of the office, across from the landfill.	3	0.001	0.01
Village of al muroos(A)	4	0.001	0.01
Village of al muroos(C)	5	0.001	0.01
Immigration tool	6	0.001	0.01
The region across from the dump	7	0.001	0.01
Village of al muroos(B)	8	0.001	0.01

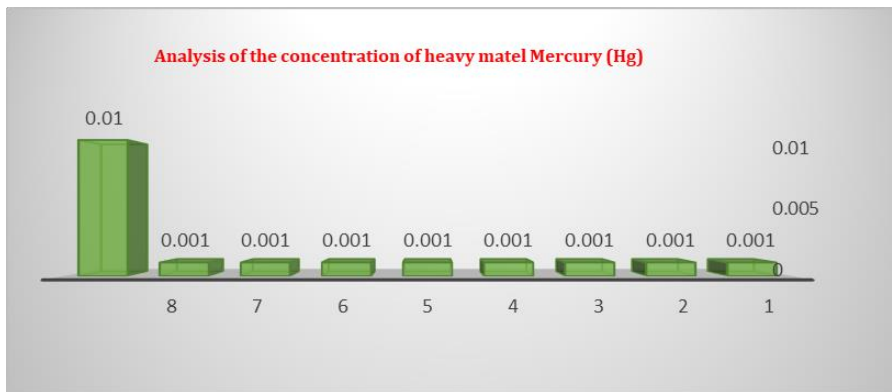


Figure 8: Analysis Mercury metal (Hg) was compared to the permitted drinking water concentration

Table 12: Results of Comparing the Total Bacteria Concentration to the Drinking Water's Permissible Limit				
Sample	Sample No	Result	100X Score convertible to ml	Maximum permissible limits
Fire at the landfill versus VNFODH	1	Colony/1m	100 ml	100 ml
against the landfill	2	There is no growth	There is no growth	100 ml
Qanfouda is to the left of the office, across from the landfill.	3	Colonies/69 mL	690 ml	100 ml
Village of al muroos(A)	4	Colonies/4 ml	400 ml	100 ml
Village of al muroos(C)	5	Conoly/1 ml	100 ml	100 ml
Immigration tool	6	There is no growth	There is no growth	100 ml
The region across from the dump	7	Colonies/3 ml	300 ml	100 ml
Village of al muroos(B)	8	There is no growth	There is no growth	100 ml

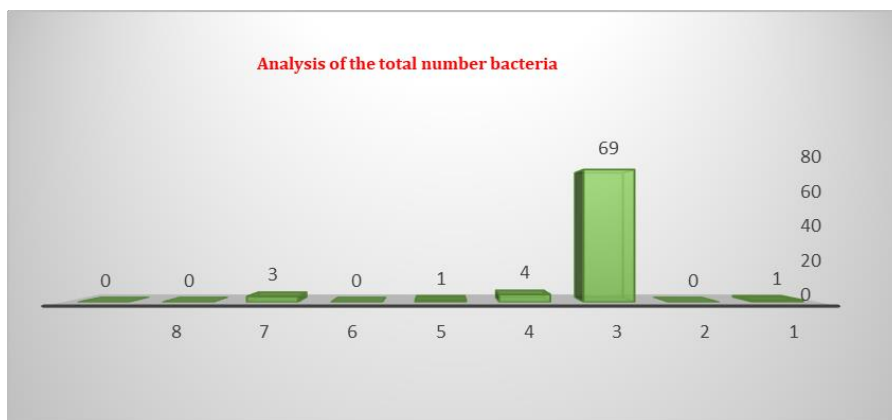


Figure 9: Analysis Total Bacteria was compared to the permitted drinking water concentration.

Table 13: The Results of Total Coli Bacteria Concentration Compared to The Allowable Limits for The Inorganic Components of Drinking Water.			
Sample	Sample No	Result	Maximum permissible limits
Fire at the landfill versus vnfodh	1	There is no growth	0/100 ml
Against the landfill	2	There is no growth	0/100 ml
Qanfouda is to the left of the office, across from the landfill.	3	Colonies /16 ml	0/100 ml
Village of al muroos(A)	4	There is no growth	0/100 ml
Village of al muroos(C)	5	There is no growth	0/100 ml
Immigration tool	6	There is no growth	0/100 ml
The region across from the dump	7	There is no growth	0/100 ml
Village of al muroos(B)	8	There is no growth	0/100 ml

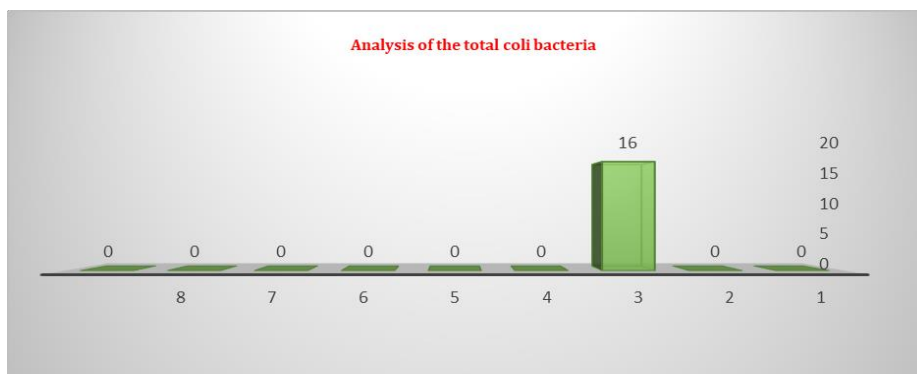


Figure 10: Analysis Total Coli Bacteria was compared to the permitted drinking water concentration

5. CONCLUSION

Groundwater quality for drinking and other household applications was shown to be diminished in areas close to landfills due to TDS, Cd, Pd, and bacterial concentrations that were found to be rather high. It can be concluded that leachate has a significant impact on groundwater quality in the vicinity of all three dump sites because there is no natural explanation for the high concentration of these contaminants. The depth of the well and its distance from the disposal site were both found to improve the quality of the groundwater. Yet some pollutants do not exceed the limits for drinking water in the concentrations found in groundwater. It was discovered that a certain set of dissolved salts included in all domestic well water tests was above the maximum permissible level of pollutants. Samples Nos. 1, 4, and 8 were found to contain more lead metal than is permitted, which is bad for the kidneys, neurological system, bones, liver, and blood. In excess of the permitted amount for pollutants in domestic well water, all samples contain levels of cadmium metal, which damages the kidneys, bones, liver, and blood.

REFERENCES

- Abbas, A.H.A., Ammar, S.D., and Zainab, M.A., 2017. Evaluation of groundwater quality for drinking purpose in Basra governorate by using application of water quality index. *Kufa Journal of Engineering*, 8 (1).
- Aliyu, M.S., 2023. Investigation of the Impacts of Solid Waste Disposal Sites on Groundwater in Nasarawa Metropolis, Nigeria.
- Al-Saffawi, Abdul-Aziz, Y., 2018. Application of the CCME WQI to Evaluate Water Quality for Drinking Purpose: A Case Study for Groundwater Quality of Al-Mahalibiyah Sub District, Nineveh Province/Iraq. Pp. 193-202.
- Al-Saffawi, Abdul-Aziz, Y., 2018. Application of the CCME WQI to Evaluate Water Quality for Drinking Purpose: A Case Study for Groundwater Quality of Al-Mahalibiyah Sub District, Nineveh Province/Iraq. Pp. 193-202.
- Aziz, S.Q., 2010. Leachate characterization in semi-aerobic and anaerobic sanitary landfills: A comparative study. *Journal of environmental management*, 91 (12), Pp. 2608-2614.
- Bakis, R., and Ahmet, T., 2011. An investigation of heavy metal and migration through groundwater from the landfill area of Eskisehir in Turkey. *Environmental monitoring and assessment*, 176, Pp. 87-98.
- Calo, F., and Mario P., 2009. Waste management and problems of groundwater pollution in karst environments in the context of a post-conflict scenario: The case of Mostar (Bosnia Herzegovina). *Habitat International*, 33 (1), Pp. 63-72.
- Christensen, T.H., 2001. Biogeochemistry of landfill leachate plumes. *Applied geochemistry*, 16 (7-8), Pp. 659-718.
- Dunya, N.H., and Al-Jumaily, H.A., 2020. Assessment of Levels of Elements Concentrations (Pb, As, Cr) in Groundwater and its Environmental Impacts in the Yaychi Region, Kirkuk/Northern Iraq. *Kirkuk University Journal-Scientific Studies*, 15 (1), Pp. 34-52.
- Elosta, S.G., and Amal, G.A., 2022. Estimation of heavy metals levels in hot sulfur water sources in northwestern Libya.
- Giusti, L., 2009. A review of waste management practices and their impact on human health. *Waste management*, 29 (8), Pp. 2227-2239.
- Giusti, L., 2009. A review of waste management practices and their impact on human health. *Waste management*, 29 (8), Pp. 2227-2239.
- Hasan, K.U., and Hussain, T.A., 2015. Investigation of Contaminated Bacteria and Some Toxic Elements of Groundwater in Some Wells in the Abu Ghraib Area/Baghdad. *Iraqi Journal of Science*, 56 (4), Pp. 3203-3209.
- Lee, G.F., and Jones-Lee, A., 1993. Groundwater pollution by municipal landfills: Leachate composition, detection and water quality significance. *Proc. Sardinia*.
- Lee, J.S., Chon, H.T., and Kim, K.W., 2005. Human risk assessment of As, Cd, Cu and Zn in the abandoned metal mine site. *Environmental geochemistry and health*, 27, Pp. 185-191.
- Li, P., 2021. Sources and consequences of groundwater contamination. *Archives of environmental contamination and toxicology*, 80, Pp. 1-10.
- Mohamed, A.M.O., Djaouida, C., and El-Shahed, S., 2021. eds. *DARE's dictionary of environmental sciences and engineering*. CRC Press.
- Nagarajan, R.K., Subramanian, T., and Elango, L., 2012. Impact of leachate on groundwater pollution due to non-engineered municipal solid waste landfill sites of erode city, Tamil Nadu, India." *Iranian journal of environmental health science & engineering*, 9, Pp. 1-12.
- Nartey, V.K., Ebenezer, K.H., and Smile, K.A., 2012. Assessment of the impact of solid waste dumpsites on some surface water systems in the Accra Metropolitan Area, Ghana. *Journal of Water Resource and Protection*, 4 (8), Pp. 605.
- Ogundiran, O.O., and Afolabi, T.A., 2008. Assessment of the physicochemical parameters and heavy metals toxicity of leachates from municipal solid waste open dumpsite. *International Journal of Environmental Science & Technology*, 5, Pp. 243-250.
- Pohland, F.G., and Stephen, R.H., 1987. Retrospective evaluation of the effects of selected industrial wastes on municipal-solid-waste stabilization in simulated landfills. No. PB-87-198701/XAB. Georgia Inst. of Tech., Atlanta (USA). School of Civil Engineering.
- Prasad, Bably, and Bose, J., 2001. Evaluation of the heavy metal pollution index for surface and spring water near a limestone mining area of the lower Himalayas. *Environmental geology*, 41 (1-2), Pp. 183-188.
- Rodić, L., and Wilson, D.C., 2017. Resolving governance issues to achieve priority sustainable development goals related to solid waste management in developing countries. *Sustainability*, 9 (3), Pp. 404.
- Ślomożyńska, B., and Ślomożyński, T., 2004. Physio-chemical and toxicological characteristics of leachates from MSW landfills. *Polish Journal of Environmental Studies*, 13 (6), Pp. 627-637.
- Ślomożyńska, B., and Ślomożyński, T., 2004. Physio-chemical and toxicological characteristics of leachates from MSW landfills. *Polish Journal of Environmental Studies*, 13 (6), Pp. 627-637.
- Tengrui, L., 2007. Comparison between biological treatment and chemical precipitation for nitrogen removal from old landfill leachate. *American Journal of Environmental Sciences*, 3 (4), Pp. 183-187.
- Vasanthi, P., Kaliappan, S., and Srinivasaraghavan, R., 2008. Impact of poor solid waste management on ground water. *Environmental monitoring and assessment*, 143, Pp. 227-238.
- Wakida, F.T., and David, N.L., 2005. Non-agricultural sources of groundwater nitrate: a review and case study. *Water research*, 39 (1), Pp. 3-16.

