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An assessment of Drinking Water Quality in AfgoyeTown

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ABSTRACT

Background: Water as a universal solvent has the capability to dissolve many substances, including organic and inorganic compounds. Water quality usually relates to the water element at the optimum rate for plant and animal development. Temperature, turbidity, nutrients, hardness, alkalinity, dissolved oxygen, etc. are some of the important factors that determine the growth of living organisms in the water body. This paper aims to assess the Physical, Chemical, quality of drinking water in the Afgoye district

Methods: Drinking water was collected from the common water sources of the Afgoye town and sent for Physical, Chemical analysis laboratory

Results: The results showed that the water sources of a filtered of Hijra well free from harmful chemical and bacteriological factors based on their physical and biological characteristics. Water samples for physical and chemical assessment all the water samples show the physical parameters of the water, such as PH, electrical conductivity (EC), total dissolved solids (TDS) were within the normal limits. The water sources of Saajid, Towfiq and River water does not free from harmful chemicals. Therefore, not considered potable water for human consumption

Conclusions: from the results of this study, the groundwater in the study area can be regarded as being of good quality for drinking and agriculture purposes, except for Towfiq, Sajid wells and river do not free from harmful chemicals and bacteriological factors based on their physical and biological characteristics.

Keywords: Water Quality,Afgoye, Safe Drinking Water, Analysis

Introduction

Every living thing needs water. Man must always have an adequate supply of potable water for his various daily needs. Specifically, the man needs water for drinking, cooking, bathing, washing, agricultural purpose, manufacturing, and industrial purposes. Water is equally used for the disposal of sewage. In the developed nations of the world, the average domestic use of water, including that for all purposes per person is 180-230 liters per day. An average daily use per person of 450 liters is not uncommon, particularly in the highly industrialized countries. A source of clean and safe drinking water is through the government water supply or pipe-borne water. Since this source is erratic and cannot meet our daily needs, many of the inhabitants of most rural and urban communities in most developing countries of the world turn to the construction and digging of shallow wells to fetch water and collecting water from streams and rivers, which in most cases is not clean (Efe et al.2005)

Water is a vital resource for human survival. In 1981 the 34 the World Health Assembly in a resolution emphasized that safe drinking water is a basic element of "Primary health care" which is the key to the attainment of "Health for all" by the year 2000.Safe drinking water is a basic need for human development, health and wellbeing and hence drinking water accepted human right. Somalia is heading towards a freshwater crisis, mainly due to improper management of water resources and environmental degradation, which has led to a lack of access to the safe water supply to millions of people.Quality of groundwater may vary from place to place and from stratum to stratum. It also varies from season to season.

The chemical composition of natural water is variable. This could be due to the geologicalnature of the soil from which it originates and also

the reactive substances that it may have encountered during flow (Matiniet al.2009).The supply of drinking water of sufficient quality and quantity remains a crucial public health challenge in most African countries (Jessica et al.2014).Some noteworthy statistics from the WHO/UNICEF Joint Monitoring Program 2017 (JMP) for Water and Sanitation reveal that about 2.1 billion human beings lack good quality water, 4.5 billion do not have access to adequate sanitation and roughly 1.5 million deaths every year are attributed to diarrheal disease. Additionally, it is estimated that 58% of the latter figure (842,000 deaths per year), is due to unsafe water supply, insufficient hygiene, and sanitation, and includes 361,000 deaths of children below five years, especially in developing countries (WHO,2014). Water for human consumption must not contain organisms and chemical substances in concentrations sufficiently high to affect health (Brian, 2007).

This work explores certain physical and chemical characteristics of water from three sources, river, well and borehole. The current work is justified by the reality that the region concerned lacks science data on water quality Objectives of the study.

The study aimed assessment of the water quality for domestic water supply in Afgoye district. The specific objectives are:

1. Assess the water quality in Afgoye district
2. Comparative analysis with WHO water quality standards
3. Recommendation for future water supply

Study Area

The water samples were collected from three main sources in the city. Namely Hijra, Towfiq ,Sajin, and Shabbele river .Afgoye is a town in the south-western Somalia Lower Shebbele region of Somalia. It is located 2.14 latitude and 45.12 longitudes [decimal degrees] and it is situated at elevation 87 meters above sea level.

Literature Review

The quantity, as well as quality of clean water supply, is of vital significance for the welfare of mankind. Water supplied to the consumer should not have any impurities which cause taste, odor, color, toxicity, and injuries to human health. The different impurities in water, which cause undesirable effects may be classified into physical, chemical, bacteriological and radiological.

Water quality is impacted by a rise in anthropogenic activity and any physical or chemical pollution triggers changes in the quality of the recei ving water body (Aremu et al. 2011).

The World Health Organization estimated that up to 80 % of all sicknesses and diseases in the world are caused by inadequate sanitation, polluted water or unavailability of water (WHO, 1997).

A study of 28 research conducted by the World Bank shows that the i ncidence of certain water-borne diseases, water-
based washing and water-based and water-
based sanitation linked to the quality and amount of water and sanitation accessible to customers (Abebe ,1986).

Temperature

Temperature plays a significant role in regulating water's physicoche mical and biological parameters and is regarded one of the most significa nt factors for fresh water in the aquatic environment particularly for fresh water (Singh RP et al,2005).

Electrical conductivity

Water capability to transmit electric current is known as electrical conductivity and served as a tool to assess the purity of water.

Pure water is more of a solid insulator than a good conductor of electr ical current.

Increasing of ions increases water's electrical conductivity. Generally, the amount of dissolved solids in water determines the electrical conductivity. Electrical conductivity (EC) actually measures the ionic process of a solution that enables it to transmit current. According to WHO standards, EC value should not exceed 400 μS/cm.

Total dissolved solids (TDS)

Water can dissolve a broad variety of inorganic and certain organic m inerals or salts such as potassium, calcium, sodium, bicarbonates, chlorid es, magnesium, sulfates, etc. These minerals produced the unwanted taste and diluted color in appearance of water. This is an important parameter for the use of water. The water with high TDS value indicates that water is highly mineralized. The desirable limit for TDS is 500 mg/l and maximum limit is 1000 mg/l which prescribed for drinking purpose (Soylak et al (2001).

PH of water

PH is an important parameter in evaluating the acid-base balance of water. It is also the indicator of the acidic or alkaline condition of water status. WHO has recommended maximum permissible limit of pH from 6.5 to 8.5. The current investigation ranges were 6.52–6.83 which are in the range of WHO standards.

Chloride (Cl)

Chloride is mainly obtained from the dissolution of salts of hydrochloric acid as table salt (NaCl), NaCO2 and added through industrial waste, sewage, sea water, etc.

Compared to groundwater, surface water bodies often have low chlori de concentrations. It is essential for the activity of metabolism in the hum an body and other major physiological procedures.

High concentrations of chloride damage metal tubes and structure, as wel l as damage to increasing crops. According to WHO standards, concentration of chloride should not exceed 250 mg/l

Nitrate (NO3)

Nitrate one of the most significant illnesses in babies causing water q uality parameters, especially blue baby syndrome. Nitrate sources are the cycle of nitrogen, industrial waste, nitrogen fertilizers, etc. The WHO allows a maximum permissible limit of nitrate 5 mg/l in drinking water

Table: 1: WHO drinking water guideline

Parameter	Max. Acceptable concentration	Max. Allowable concentration
Total solids	500 mg/1	I500 mg/1
Turbidity	5 units	50 units
Taste	unobjectionable	-
Odor	unobjectionable	-
pH range	7.0-8.5	Less than 6.5 or greater than 9.2

Effect of water quality for residence healths

Drinking water contamination-related diseases are a significant burden on human health. Interventions to enhance drinking water quality provide substantial health advantages. Water is vital for sustaining life, and a satisfactory (sufficient, secure and accessible) supply must be available to everyone (Ayenew 2004).

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provide substantial health advantages. Water is vital for sustaining life, and a satisfactory (sufficient, secure and accessible) supply must be available to everyone (Ayenew 2004).

Table 2. Examples of information useful in assessing a drinking-water system

Component of drinking-water system	Information to consider in assessing component ofdrinking-water system
Catchments	✓ Geology and hydrology ✓ Meteorology and weather patterns ✓ General catchment and river health ✓ Wildlife ✓ Competing water uses ✓ Nature and intensity of development and land use Other activities in the catchment that potentially release contaminants into source water ✓ Planned future activities
Surface water	✓ Description of water body type (e.g., river, reservoir, dam) ✓ Physical characteristics (e.g., size, depth, thermal stratification, altitude) ✓ Flow and reliability of source water ✓ Retention times ✓ Water constituents (physical, chemical, microbial) Protection (e.g., enclosures, access) ✓ Recreational and other human activity ✓ Bulk water transport

Component of drinking-water system	Information to consider in assessing component ofdrinking-water system
Groundwater	✓ Confined or unconfined aquifer ✓ Aquifer Hydrogeology ✓ Flow rate and direction ✓ Dilution characteristics ✓ Recharge area ✓ Wellhead protection ✓ Depth of casing ✓ Bulk water transport

Source: (WHO, 2008)

Materials and Method

This study was conducted in the Afgoye district. The study was conducted during the month of (6^{th}July 2019 –1 August 2019). Drinking water was gathered from town ' prevalent water sources and sen t for physical, chemical and microbiological assessment, in collaboration with the Mumtaz Engineering Company, Mogadishu, Somalia.

The water samples were collected from the surface of the river. The water samples were collected early in the morning between 7 am – 10 am according the study of (Dunn et al, 2007) to reduce the effect of temperature on the collected samples. Water quality parameters such as pH, electrical conductivity, temperature, TDS, DO, Nitrate, COD, Alkalinity, Phosphate, HCO_3, chloride, sulfate, total coliform, sodium, calcium, and zinc were analyzed using Atomic Absorption Spectrophotometer. The results obtained were compared with WHO (2010) threshold for drinking water quality.

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Tap water samples were gathered throughout the town of Afgooye fro m four different sources. All the gathered samples were colorless and wit hout order.

Samples were taken into three kinds of Polyethylene bottles using a Plastic drawer . During the sampling, extra care was taken to avoid contamination and bottles were rinsed times the water being collected. Electriscal conductivity (EC) and PH were urgently determined when receiving the sample in the laboratory because of the unstable nature.

Analysis of water samples

Determination of pH

The Hanna microprocessor pH meter was used to determine the pH of the water samples. It has been standardized with a pH range buffer soluti on from 4 to 9.

Measurement of temperature

This was done using a portable thermometer at the sample collection site. This was performed by dipping into the sample the thermometer and recording the stable reading.

Determination of conductivity

This was performed with a conductivity meter from Jenway. The sam ple was immersed in the sample container until a stable reading is acquire d and registered

Determination of total dissolved solids (TDS)

This was evaluated using Gravimetric Method: Filtering out a part of water and measuring 10 ml of the filtrate into a pre-weighed evaporating jar. At a temperature of 103 to 105 ° C for 212212 h, filtrate water samples were dried in an oven. The platform was transmitted to a desiccator and permitted to cool to room temperature.

TDS = [(A−B)×1000]/ml Sample

A stands for the weight of the evaporating plate + filtrate in this form ula, and B stands for the weight of the evaporating plate on its own (Mahmud et al. (2014).

Results and Discussions

The drinking water sources and perception of water quality

All the water samples show the physical parameters of the water, such as pH, Electrical conductivity (EC), Total Dissolved Solids (TDS) were within the normal limits (Table 3).

Table 3: Water Sample for HIJRA WELL

Parameter	Unit	Symbol	Result	Guide High	Low	Optimum	High
pH	…….	pH	7.07	8.50			
Electrical Conductivity	mS cm -1	EC	1570	< 5000			
Temprature	°C	T	27.8	35			
Coliforms	CFU	CFU	upsent	0CFU/100ml			
Chlorine	mg/L	Cl	0.01	< 0.2			
Total Dissolved Solids	ppm	TDS	780	< 2500			
Turbidity	NTU	TUB	5	≤ 5			
Odour	……	….	Unobjectionable				
Colour	…….	…..	Unbjectionable				
Nitrates	ppm	NO3	0	< 50.0			

NB: Optimum= safe element. High= Risk element

Turbidity

The turbidity of water depends on the quantity of solid matter present in the suspended state. It is a measure of light-emitting properties of water and the test is used to indicate the quality of waste discharge with respect to colloidal matter. The mean turbidity value obtained for Hijra Well (5 NTU) is same the WHO recommended value of 5.00 NTU.

Total dissolved solids (TDS)

Water has the ability to dissolve a wide range of inorganic and some organic minerals or salts such as potassium, calcium, sodium, bicarbonates, chlorides, magnesium, sulfates, etc. These minerals produced the unwanted taste and diluted color in appearance of water. This is an important parameter for the use of water. The water with high TDS value indicates that water is highly mineralized. The desirable limit for TDS is 500 mg/l and maximum limit is 1000 mg/l which prescribed for drinking purpose. The concentration of TDS in the present study was observed in 780 mg/l. it is within the limit of WHO standards.High

values of TDS in groundwater are generally not harmful to human beings, but high concentration of these may affect persons who are suffering from kidney and heart diseases. Water containing high solid may cause laxative or constipation effects

Electrical conductivity (EC)

Pure water is not a good conductor of electric current rather's a good insulator. Increase in ion concentration enhances the electrical conductivity of water. Generally, the amount of dissolved solids in water determines the electrical conductivity. Electrical conductivity (EC) actually measures the ionic process of a solution that enables it to transmit current. According to WHO standards, EC value should not exceed 5000 µS/cm.the study was observed in 1570 µS/cm. Can be consumed by humans, although most would prefer water in the lower half of this range if available.

PH of water

PH is an important parameter in evaluating the acid-base balance of water. It is also the indicator of acidic or alkaline condition of water status. WHO has recommended the maximum permissible limit of pH from 6.5 to 8.5.TheHijra well was observed 7.07. Which are in the range of WHO standards. The overall result indicates that the Hijra well water source is within a desirable and suitable range. Basically, the pH is determined by the amount of dissolved carbon dioxide (CO2), which forms carbonic acid in water.

Nitrate (NO_3)

Nitrate one of the most important diseases causing parameters of water quality, particularly blue baby syndrome in infants. The sources of nitrate are nitrogen cycle, industrial waste, nitrogenous fertilizers, etc.

The WHO allows a maximum permissible limit of nitrate 5 mg/l in drinking water. In Hijra well with an average value of 0 mg/l.

The findings of this study showed that the water sources of a filtered of Hijra free from harmful chemical and bacteriological factors based on their physical and biological characteristics. All these indicators remained a normal range of quality water standards, therefore, considered potable water for human consumption.

Table 4: Water Sample for Towfiq well

Parameter	Unit	Symbol	Result	Guide High	Low	Optimum	High
pH	…….	pH	6.20	8.50			
Electrical Conductivity	mS cm -1	EC	1960	< 5000			
Temprature	°C	T	27.5	35			
Coliforms	CFU	CFU	upsent	0CFU/100ml			
Chlorine	mg/L	Cl	0.01	< 0.2			
Total Dissolved Solids	ppm	TDS	980	< 2500			
Turbidity	NTU	TUB	5	≤ 5			
Odour	……	….	objectionable				
Colour	…….	…..	Unbjectionable				
Nitrates	ppm	NO3	0	< 50.0			
NB: Optimum= safe element. High= Risk element							

Table 4, shows that Temperature was observed the Towfiqwell 27.5 C. However, high-temperature values would not be harmful to human health but pose a problem of acceptability because cool water is generally more palatable than warm water.

EC measures the capacity of a solution to conduct electric current. It also makes it possible to estimate the number of salts dissolved in water. The average value of the EC of Towfiq well water (1960 µs/cm). The value of EC Turbidity, Nitrate and PH area also well within permissible limits.

The findings of this study showed that the water sources of filtered Towfiq do not free from harmful chemicalsand bacteriological factors based on their physical and biological characteristics. All these indicators remained up a normal range of quality water standards, therefore, considered not potable water for human consumption.

Table 5: Water Sample forSAJID

Parameter	Unit	Symbol	Result	Guide High	Low	Optimum	High
pH	…….	pH	6.32	8.50			
Electrical Conductivity	mS cm -1	EC	2120	< 5000			
Coliforms	CFU	CFU	upsent	0CFU/100ml			
Chlorine	mg/L	Cl	0.2	< 0.2			
Temprature	°C	T	27.5	35			
Total Dissolved Solids	ppm	TDS	1060	< 2500			
Turbidity	NTU	TUB	5	≤ 5			
Odour	……	….	objectionable				
Colour	…….	…..	Unbjectionable				
Nitrates	ppm	NO3	0	< 50.0			

NB: Optimum= safe element. High= Risk element

Table 6: Shabbele River runs through the Afgoye Town

Parameter	Unit	Symbol	Result	Guide High	Low	Optimum	High
pH	…….	pH	7.6	8.50			
Electrical Conductivity	mS cm -1	EC	2300	< 5000			
Coliforms	CFU	CFU	10	0CFU/100ml			
Temprature	°C	T	28.4	53			
Chlorine	mg/L	Cl	0.1	< 0.2			
Total Dissolved Solids	ppm	TDS	1160	< 2500			
Turbidity	NTU	TUB	7	≤ 5			
Odour	……	….	Unobjectionable				
Colour	…….	…..	Unbjectionable				
Nitrates	ppm	NO3	0	< 50.0			

NB: Optimum= safe element. High= Risk element

Table 5: indicates that pH values of water samples from SAJID well was obtained 6.32. The World Health Organization (WHO, 2010) recommends a pH value of 6.5 or higher for drinking water to prevent corrosion. Conductivity values of the groundwater samples are presented in Table 3. The value of EC Turbidity, Nitrate and PH area also well within permissible limits

The findings of this study showed that the water sources of Saajiddo not free from harmful chemicals and bacteriological factors based on their physical and biological characteristics. All these indicators remained up a normal range of quality water standards, therefore not considered potable water for human consumption

Table 6: shows that the pH value is in the Shabbele river in Afgoye Town. It complies with water quality standards for water sources WHO (6.5to 8.5). The minimum pH value of Shabbele river in Afgoye Town was recorded in July and August. The turbidity of the Shabbele river in Afgoye Town was obtained 7 NTU, The value of EC Turbidity, Nitrate and PH area also well within permissible limits

The findings of this study showed that the water sources of River do not free from harmful chemicals and bacteriological factors based on their physical and biological characteristics. All these indicators remained up normal range of quality water standards, therefore considered to be no potable water for human consumption.

Conclusion

On the basis of the findings, it was concluded that drinking water of the study areas was that all physicochemical parameters in all the College drinking water sampling sites and they were consistent with World Health Organization standard for drinking water (WHO). The samples

were analyzed for intended water quality parameters following internationally recognized and well established analytical techniques.

The results were discussed in three parameters such as pH, Turbidity and Electrical conductivity. The Ph ranges, Hijra,Towfiq,Saajid in Afgoye city were agreed with the WHO standard. The turbidity of the river was quite higher than the groundwater.

Therefore, from results of this study, the groundwater in the study area can be regarded as being of good quality for drinking and agriculture purposes except forTowfiq, Sajid wells and river does not free from harmful chemicals and bacteriological factors based on their physical and biological characteristics.

Further studies with reference to the chemical and microbial analyses will have to be done to have a broader picture of this water quality.

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