ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Evaluation of Drinking Water Quality at Water Distribution points in Nigerian Defence Academy Kaduna

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Manuscript Info

Manuscript History:

Received: 18 August 2015
Final Accepted: 22 September 2015
Published Online: October 2015

Key words:

Drinking water quality, Evaluation, Afaka community

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Abstract

Water is essential to life and lack of access to drinking water adversely affects public health in many developing countries like Nigeria. As in most cities in Nigeria, public water supply in Kaduna is erratic and inadequate for local consumers. Moreover, not all water supplies meet the national's drinking water quality standards. Consequently, many organizations and institutions, public and private relied on underground water for domestic and commercial applications. The quality of underground water is rarely assessed. Therefore, determining reasonable water quality changes and influence of various factors on water quality is important for improving drinking water quality. The objective of this study is to investigate underground water quality in Afaka Military community of the Nigerian Defence Academy (NDA) Kaduna. The results show that the main influencing factor is the same at all the monitoring points. The main factor is the residence time. The Physico-chemical analysis show that over 90% of water samples were in conformity with Nigerian Standard for Drinking Water Quality and over 50% of the samples were contaminated by coliform. Although underground water is the sole source of water in the NDA Afaka community and may be suitable for commercial application and human consumption is only recommended after treatment to monitor its quality and eliminate coliform risk. Protection of boreholes and water abstraction monitoring are strongly advised.

INTRODUCTION

Water is critical for the sustenance of human life and a key determinant of sustainable human health (Egboh and Emeshili, 2007). Adequate supply of potable water greatly improves the social and economic activities of the people (Faniran, 1977; Akujuru, 2001; Oyebande, 1986). However, increasing growth in population and urbanization has put tremendous pressure on the already scarce water resources. Industrialization and agricultural activities further aggravated the problems of environmental degradation resulting in waste generation and pollution. Evidence from World Health Organization (WHO) continues to show the link of poor sanitation and diseases. About 2.2 million children mostly under the age of 5 die annually as a result of water borne diseases (WHO, 2010).

This attracted global attention and it is now considered a human right, defined as the right to equal and non discriminatory access to a sufficient amount of safe drinking water for personal and domestic uses to sustain life and health (en.wikipedia.org/wiki/Right_to_water {access December, 2012}). Thus, access to safe drinking water and sanitation is a right of all Nigerians.
The Nierian water policies are concerned with water quality monitoring and pollution control. However, water quality is rarely assessed partly owing to lack of capacity and poor investment. Public water supply in most cities of

Nigeria is under intense pressure due to low investment, irregular maintenance of existing infrastructure, poor morale of personnel and negative public attitude to social services. Rapid population growth and rampant urbanization have put enormous pressure on the poorly maintained utilities. Most of the population growth has occurred in peri-urban slum neighborhoods, and utilities have not extent their networks fast enough. This resulted in the decline in the share

Thus water supply network gets to the old existing communities, businesses and institutions within the metropolis. Other new development areas at the outskirt of the metropolis are not connected to the mains. Consequently, many institutions, businesses and communities are cut-off from the mains. The result is exploitation of underground water for drinking and other domestic applications. The irregularity of public water supply is also responsible for the use of underground water in most industries and households across the metropolis.

The public water supplies require treatment before distribution. This is often rarely done due to poor funding. The result is water contamination and pollution. Diseases associated with unclean water and inadequate sanitation accounted for more than 70% of child mortality and morbidity in Nigeria (Ince et al, 2010). Groundwater quality comprises the physiological, physical, chemical, and biological qualities of ground water. Taste and odour are subjective and secondary phenomenon arising from the presence of trace quantities of chemicals. The physical qualities include temperature, turbidity, colour suspended matter and froth. Organic pollution is the most common form of water pollution and the presence of bacteria and viruses are inducted into water through faeces. Generally, the quality of groundwater in Nigeria is better than that of surface water in terms of public health, but much of the groundwater is corrosive, and some areas have iron, nitrate or fluoride concentrations above WHO guideline values. (NWSSP, 2000).
Groundwater pollution which is a product of human activities has profound impacts on the quality of water bodies due to the introduction of various pollutants such as organic compounds, heavy metals, agricultural wastes etc. (Adeyeye et all., 1996; Manahan, 1994). Various studies confirmed the effect of heavy metals on the human health (Davis and Jixiang, 2002). This combined with poor waste management and sanitation strategies are responsible for contamination of groundwater. The ground water sources are not often protected both in terms of water abstraction rate and quality assessment. This is attributed to the lack of clear legislations and strict monitoring by the policy implementation agencies. The aim of this study is to assess the quality of groundwater in the Nigerian Defence Academy permanent site Kaduna.

2.0 Materials and Methods

2.1 Sampling sites

Afaka is in the North-west of Kaduna metropolis and falls in Igabi Local Government Area of the state. Figure 1 below shows the study area (Nigerian Defence Academy permanent site) and its neighboring communities. Water samples were collected from five different distribution points. There are four cadet's battalion lines, each with water distribution point and the fifth point was the cadet's mess of the Nigerian Defence Academy permanent site. The samples were collected using 2 liter plastic containers which were thoroughly washed and rinsed with de-ionized water and dried before use. The samples were immediately taken to laboratory for analysis. Table 1 shows the sampling locations and their respective coordinate within the permanent site of NDA Kaduna.

Preparation of solutions

All metal salts and chemical reagents used were of analytical grade (Aldrich U.K). Standard Stock solutions of all metals were prepared to the required concentrations in mg/L by dissolving the appropriate amount of the metal in de-ionized water. De-ionized water was used for the preparation of standard solutions.

Instrument and Apparatus

The metal ions concentrations under study were determined by using Buck Scientific Model (210 VGP) Atomic Absorption Spectrometer (AAS) equipped with deuterium lamp background correction. All pH measurements were taken with a Jenway model (33305) and calibrated with buffer solutions of pH 4.0, 7.0 and 10.0.

4.0 RESULTS AND DISCUSSION

4.1 PRESENTATION OF RESULTS

The results obtained from physico-chemical and microbial analyses of water samples obtained from the five points within Nigerian Defence Academy permanent site are shown on the tables below.

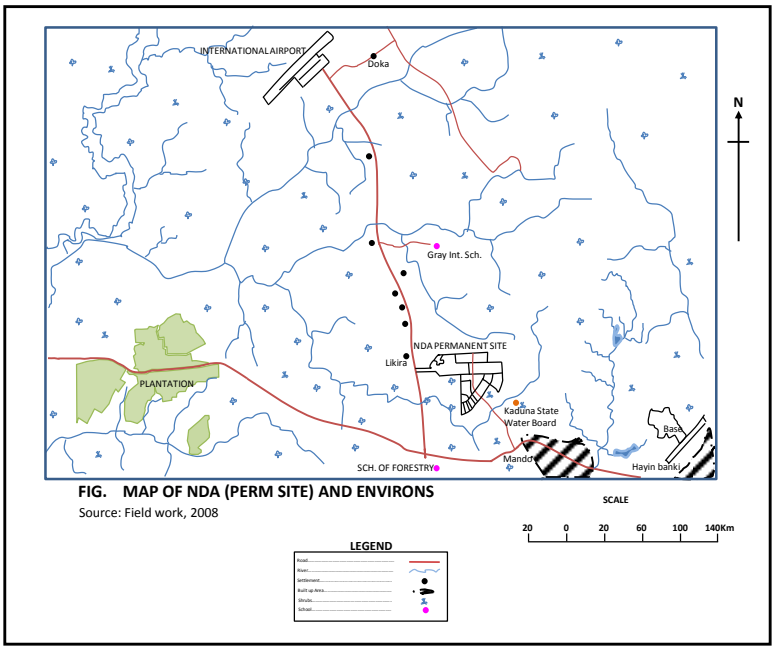


Figure 1: Map of NDA permanent site and its Environs

Tabel 1: Ground Water Distribution Points

S/N	Sampling Location	GPS Coordinate	Legend
1	Abyssinia Battalion	10˚37.011` N: 007˚22.230'E	Point A
2	Burma Battalion	10˚37.001'N: 007˚22.220'E	Point B
3	Dalet Battalion	10˚37.071'N: 007˚22.270'E	Point C
4	Mogadishu Battalion	10˚37.001'N: 007˚22.290'E	Point D
5	Cadets Mess	10˚37.0 01'N: 007˚22.240'E	Point E

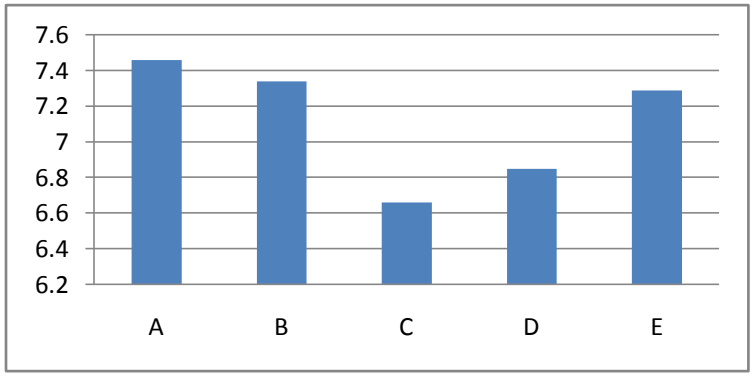


Figure 2.0: pH value of the samples

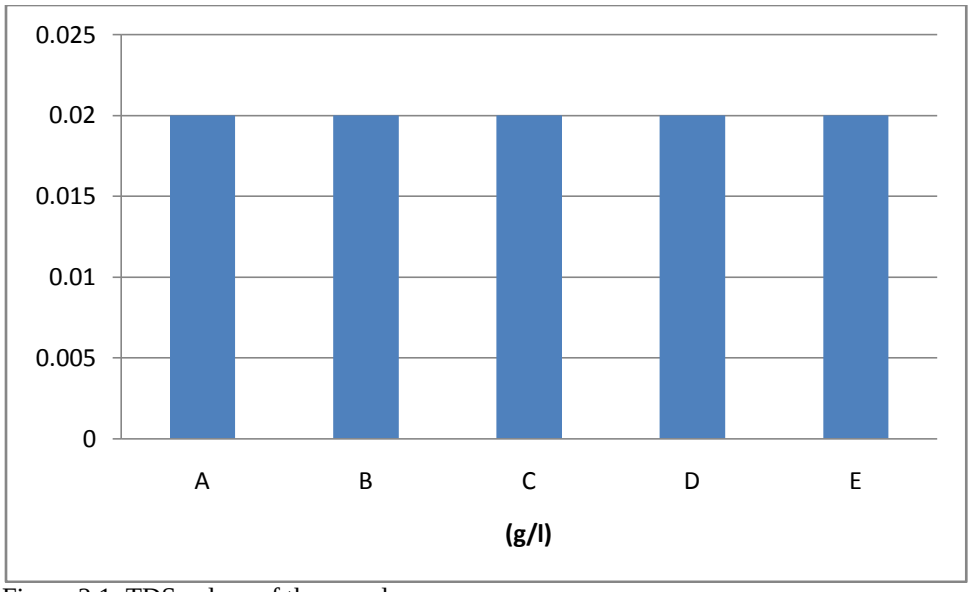


Figure 2.1: TDS values of the samples

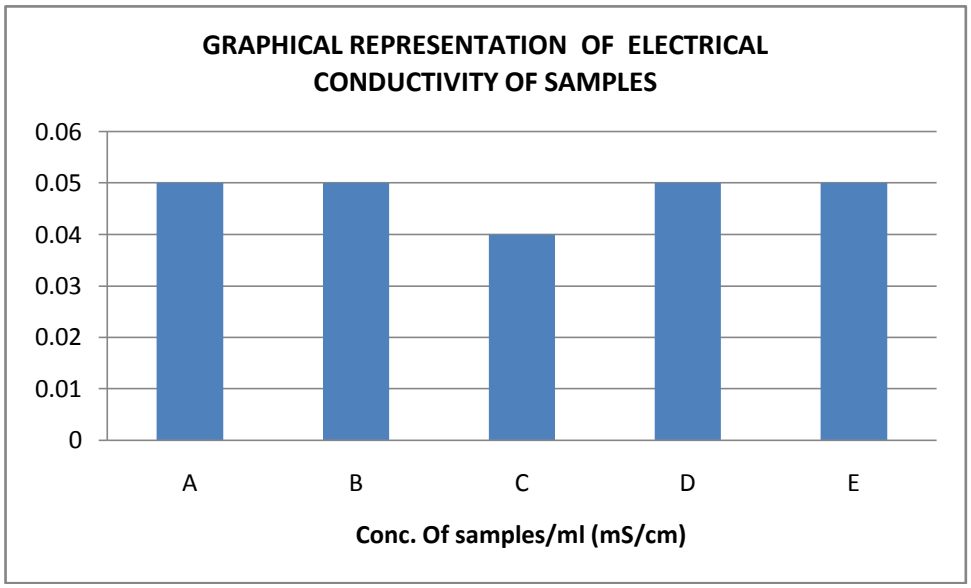


Figure 2.2

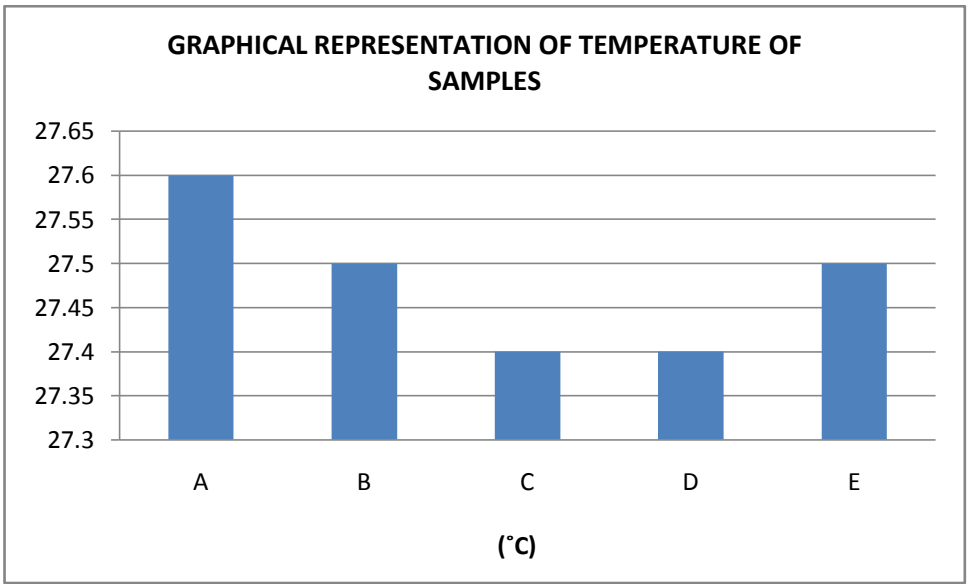
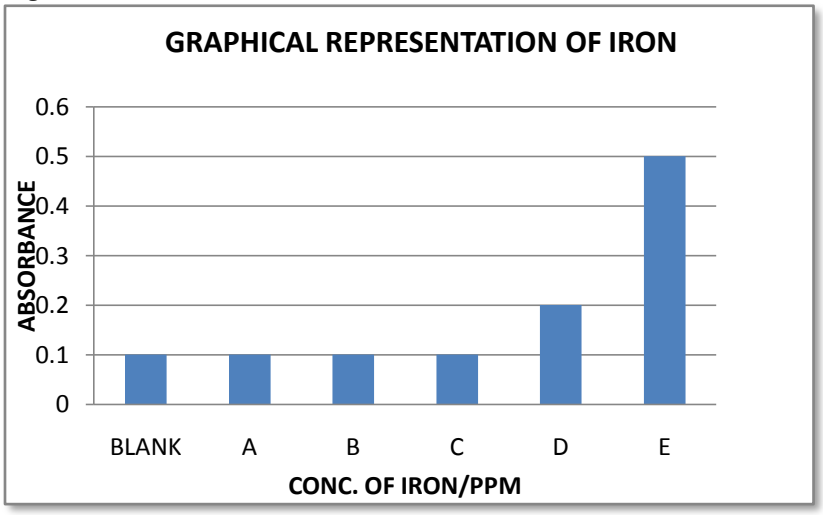


Figure 2.3



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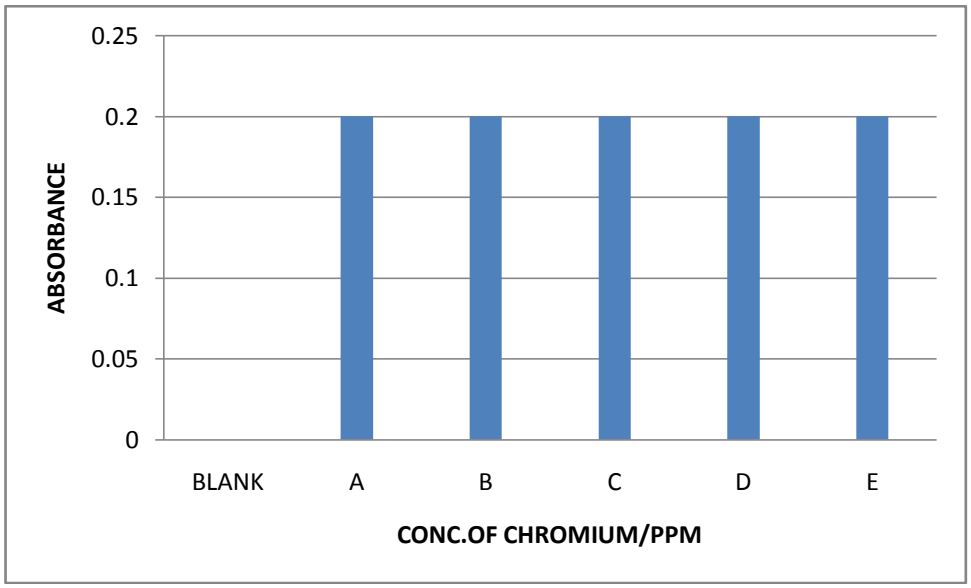

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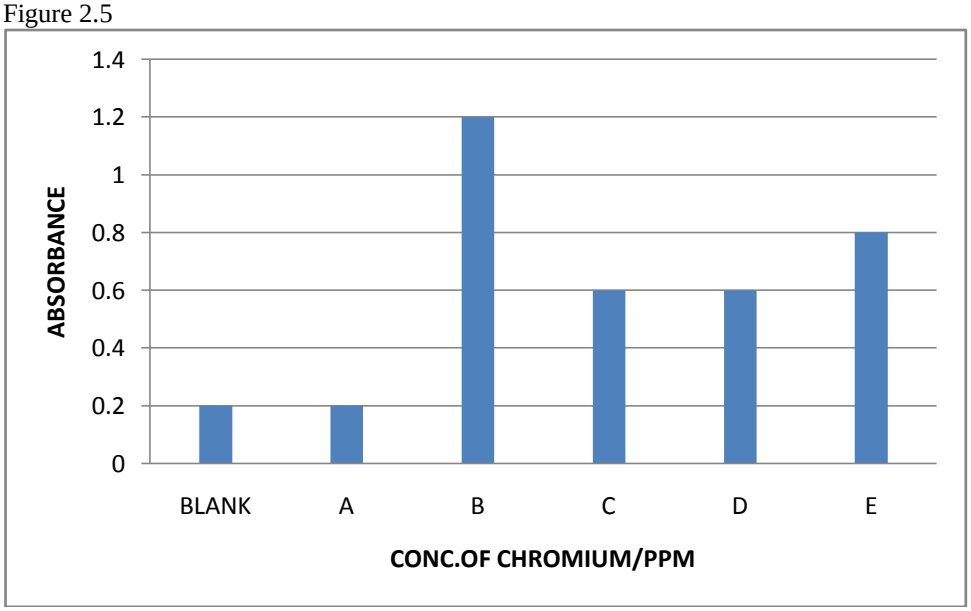

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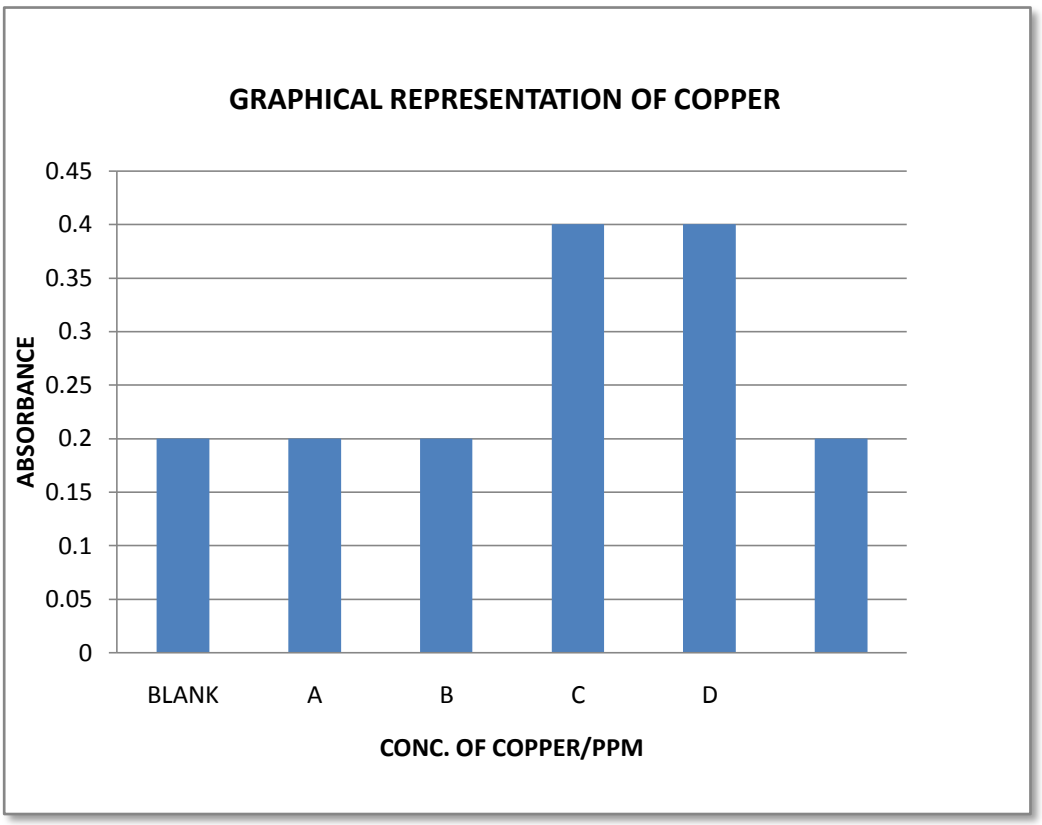

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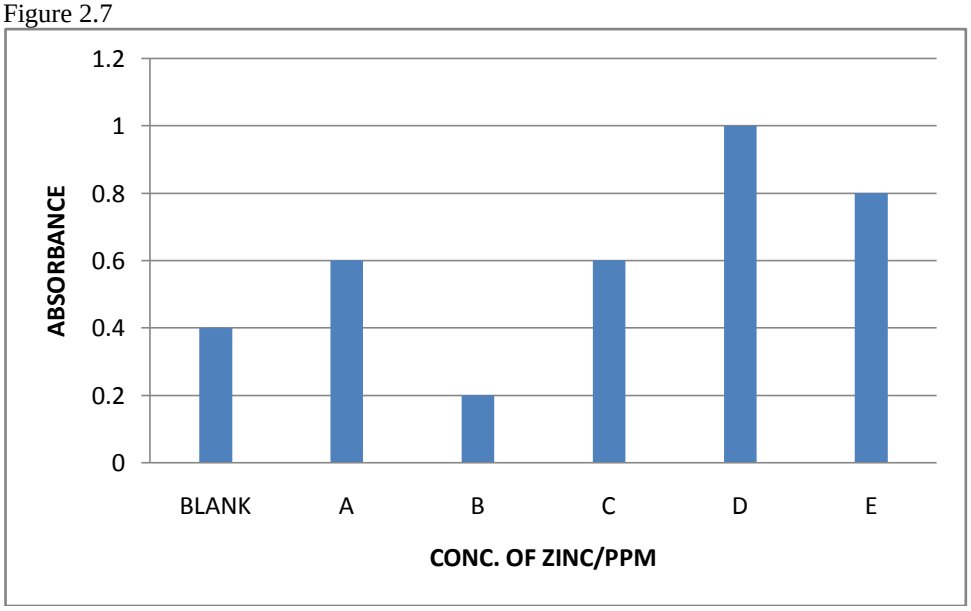

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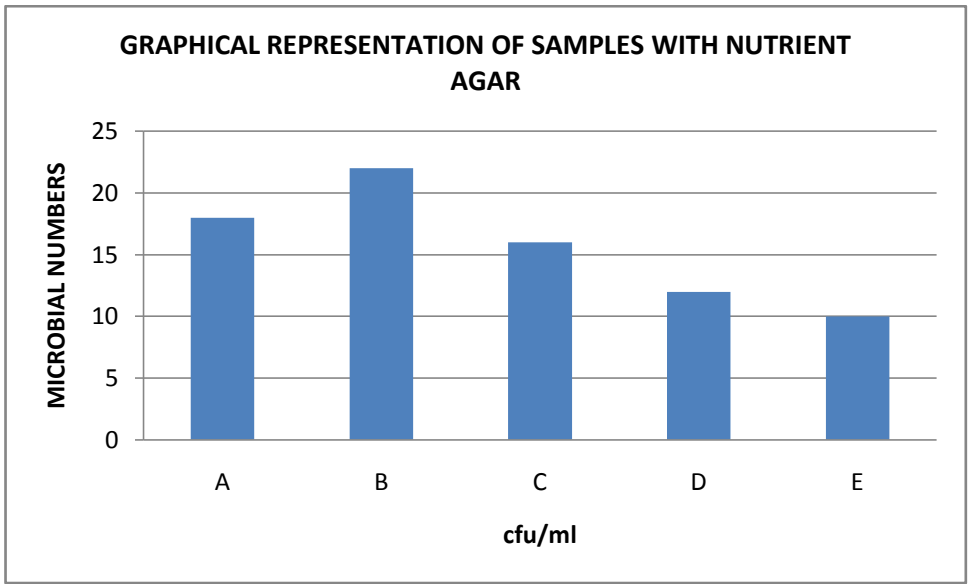

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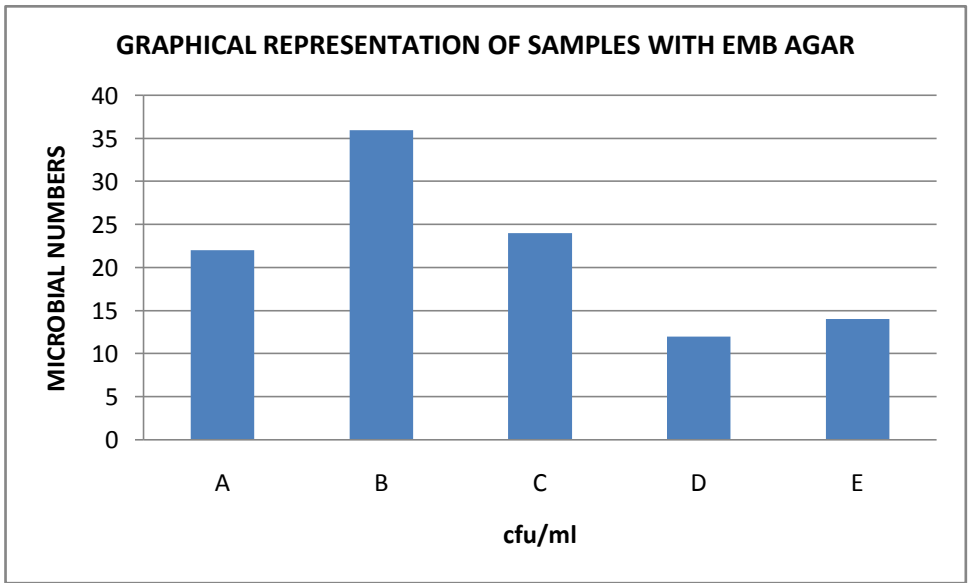

Figure 2.10

4.2 DISCUSSION

From the results obtained and presented in chapter 4.1 above, the water samples collected from various points within the Nigerian Defence Academy permanent site, Kaduna, showed that some physico-chemical parameters were conformed to WHO standards for drinking water while some contravened.

The physico-chemical parameters obtained from the analysis and presented in table I showed the pH value ranging from 6.66 - 7.46, with an average value of 7.12 which is within the permissible limit of between 6.50- 8.50 WHO standards for drinking water(WHO,1999). The temperature ranged between 27.4˚C-27.6˚C for the samples which were higher compared with the WHO guideline of 25˚C. This could be as a result of the fact the temperature is dependent on the geographical and climatic factors and conditions of an area (Winger, 1981).

Also, the values obtained for electrical conductivity, and total dissolved solids were all in conformity with the WHO standards for drinking water. On the average, the values obtained for chemical parameters such as; Iron, Lead, Chromium, and copper were in conformity with the WHO standards for drinking water except for the concentration of zinc which ranged between 0.1ppm -0.6ppm which is far below the WHO permissible limits of 3ppm (WHO,

2004). The concentration of lead, chromium, copper, and iron vary from one sample to another, this could be attributed to geological distribution of minerals that vary from one location to another (Adefemi et al, 2007).

Furthermore, from the results obtained and presented on tables X and XI, showed that all the water samples were highly polluted as tables X coli form count ranged from 10 – 22 counts with nutrient agar while table XI showed coli form count per ml of samples which ranged from 14 – 36 counts per ml of samples which is far above the WHO permissible values of 0 – 10 counts per ml maximum limits. The high coli form counts present in the water samples may be due to the position of sewage tanks that are close to the borehole in the sampling sites as total coli form counts present in any water samples indicates the presence of faecal contamination (WHO, 2004). The diseases caused by the consumption water, and poor hygienic practices are the leading cause of death after respiratory diseases (WHO, 2003).

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

From the results obtained and presented on previous chapter, it can be deduced that the physico-chemical parameters varied from one sampling point to another and were within the limits of WHO guidelines for drinking water.

On the contrary, all the water samples from the five sampling points were highly polluted as they have coli form counts were far above the WHO permissible limits.

5.2 RECOMMENDATION

Due to the high degree of microbial contamination of all the water samples analyzed I therefore recommend the following points to tackle the current outcry of water quality within the Nigerian Defence Academy permanent site, Kaduna.

- The cadet brigade should provide a mini water treatment plant as this will ensure that treated water are distributed to various water collection points for consumption within the academy.
- The cadet brigade should also ensure that routine washing and disinfection of water storage tanks are carried out regularly to prevent the growth of algae as this area is completely neglected within the academy.
- Finally, water quality evaluation exercises should be carried out frequently and periodically by local, state, and federal water regulatory bodies.

3 REFERENCES

(1) Bishts S., Patra B.A. (2007). "*Assessment of Drinking Water Quality*" Delhi, India. Or http://www.pelagiaresearchlibrary.com

(2) Rajappa et al (2011). *"Advance in Applied Science Research*" India. Vol. 2 No5, pp 143-150.

(3) Chan et al, (2007). "*The Malaysian journal of Analytical sciences*", Malaysia, Vol.2, No2 pp 44-420

(4) Jafari A., Mirhossaini H. (2008). "*Physicochemical analysis of drinking water"*, Koldasht city, Iran. Asian journal of Applied Sciences,
Vol.1 pp87-92

(5) Popoola O.T., Lemo O.O (2007). "*Physicochemical changes and microbiological Deterioration of Potable Water during Long Term Storage",* Abeokuta, Nigeria. An international Journal of Agricultural Sciences, Sciences, And Technology. Vol.1 pp51-59

(6) Borne (1978). "*Encyclopedia of Science and Technology*", Vol.24, 3rd Edition, pp40-47

(7) WHO (2004).Guidelines for drinking water quality. 3rd Edition vol.1 pg 366

(8) Egbo A. (2002). "*Water publication water front*" A journal of Nigeria water and sanitation association. April-June 4-9, Lagos

(9) WHO (2007). *Cited by the New Nigerian Newspaper* Oct. 16th No 13642 pp40

(10) WHO (2010). *Guidelines for drinking water Quality*

(11) Adefemi O.S., Asaolu S.S. (2007). *Assessment of the physicochemical status of water samples from major Dams*, Ekiti, Nigeria. 6(6) pp 657-659

(12) Arunabh M., Vasishta B. (2008). "*Physicochemical and microbial analysis of underground water"*, Arrand district, India. Journal of chemistry

(13) Salem H.M., Farag A. (2000). "*Heavy metals in drinking water and their impact on Human Health"*, Cairo University, Egypt. Pp542-556

(14) Davey A.K. (1989). *Environmental Chemistry*. Second Edition, pp164-272
(15) WHO (2006*). "Guidelines for drinking water quality*" volume 1:3rd edition, WHO press, Switzerland.
(15) Oluduro A.O., Adewoye B .I. (2007). *Efficiency of moringa oleifera seed extract on the micro flora of surface and groundwater*. Journal Plant Science. 6: 453-438
(16) Howard P. (2011). "*Groundwater Quality*" united states.
Also found at http://ga.waterusgs.gov/edu/waterquality.html
(17) Encyclopediamedia.com (2007). "*Water pollution, causes and effects"*
(18) Michael H., (2010). "*Water pollution*" Washington, DC. Encyclopedia of Earth
(19) United Environmental Protection Agency (2005). "*Protecting water Quality from Agricultural runoff*" Fact sheet No EPA-841-F-05-001
(20) New Jersey Department of Environmental protection (2004). "*Storm water best management practices manual*". Trenton, New Jersey
(21) Newton, David (2008). "*Chemistry of the Environment*". Checkmark Books pp104
(22) Akoto O. (2007). "*Chemical analysis of drinking water from some communities"* Sunyani, Ghana. Int. J. Environ. Sci. Tech., 4 (2): 211-214