Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.8, 2015 www.iiste.org

Examination of Several physiochemical characteristics of underground water collected from various wells situated south Baghdad-IRAQ

Saba. R. K. Al-Taei
Department of Biology, College of Science University of Al-Mustansiriyha

Abstract

Underground water is subjected to contamination due to the wastewater of different agricultural and industrial activities .This work was designed to examine several physiochemical variables of well water situated in southern land of Baghdad that already used in such activities. Water samples were collected from different wells in January and July 2014.

It has found that mean pH value were varying from 7.1 ± 0.4 to 7.5 ± 0.7 and these values for EC were 1.24±0.09 to 2.5±0.19 while mean values of turbidity were ranged from 0.01±0.0 to 7.01±1.54 . Mean values of each of BOD, COD and DO have been found to range from 7.0±2.44 to 13.24, 13.3±3.33 to 68.0±11.7 and 3.1±2.6 to 7.5±3.22 respectively. However, water samples had mean value of PO_4 within a range of 0.30±0.01 to 0.66±0.12 and the mean of SO_4 was placed between 93±24.69 to 371±35.27. For each of Cl, Ca and Mg ions had given mean values in a range of 0.01±0.0 to 1.9±0.36, 70.0±21.51 to 98.0±28.72, and 80.1±13.51 to 100.5±25.62 respectively.

It seems clearly that there was no significant (<0.05) differences between the collecting periods for all examined variables except for water EC where mean values were significantly ($P \geq 0.05$) higher in July than that of January. However, similar insignificant differences were recorded between mean values of tested underground water samples in terms of all physiochemical variables.

The mean values of certain examined variables were well above than those of fresh water of both rivers and lakes such as EC, BOD and Mg ions while the mean values of pH and DO were found to be within the range of similar variables, but the remaining variables were much lower than those reported for raw water. Furthermore, turbidity in water sample of well 5 was extremely higher in July than those of the remaining wells either in January and July.

Key words: Water contamination, underground water, physiochemical variables, fresh water, water standards.

Introduction

Groundwater may form a sustain and alternative water resources for different man activities such as agriculture, industry, and other human needs particularly at alarm circumstances of water lack in coming days. However, such water resources are at a considerable quantity that can safe urgent life needs.

Ground water is believed to be comparatively much clean than the surface water. Over use of ground water for drinking, irrigation and domestic purposes has resulted in rapid depletion of water, pollution of ground water aquifers has made many of these wells unfit for consumption [1].

Groundwater is inevitably subjected to water contamination as consequence of different industrial and agricultural activities that discharge various liquid wastes which may easily reach groundwater at low but measurable quantities [2, 3, 4 , 5 and 6].

Several studies have examined physiochemical properties of groundwater [7, 8, 9, 10, 11 and 12] and reported that such water quality were different from those other fresh water of both rivers and lakes. Other works have clearly indicated to various contaminants in groundwater such as bacterial [13, 14 and 15], heavy metals [16, 17 and 18] and petroleum hydrocarbons [19 and 20].

The present work was designed to examine physiochemical properties of water samples of eight wells situated within agricultural and industrial area south of Baghdad. Water samples were collected from these wells during January and July 2014.

Material and Methods

Water samples from eight randomly selected from Al-Yousifia district south of Baghdad. Two liters of water were collected in plastic bottles from each well and placed in refrigerated containers to preserve the properties of the samples during January and July 2014.

Water samples were examined to determine PH, E.C., turbidity, BOD, COD, DO, Calcium, Magnesium, Phosphate, Sulphate and Chloride using standard methods recommended by APHA [21and 22].

All obtained data were subjected to biometrical analysis to test the differences between those examined wells and between times of sample collection and presented in forms of figures and tables.

Results and discussion

Regarding water pH, the highest mean value (7.5 ± 0.7) was found in water sample of well 3 during January and the lowest mean value (7.0±0.3) was recorded in water sample of well 5 in July Table 1. Increasing mean pH value during January may be linked to rainy days that enhance CO_2 solubility [23] while the decreasing means value in July may be due to saline water since chloride and sulfide ions would decrease water pH towards neutral value. However, these values seem to be relatively constant and in general such values are close to drinking water [24]. Such data are almost similar to those reported study [25] which examined several underground samples collected from various wells in Nigeria.

For water EC, the highest mean value was 2.5±0.19 mS/cm and recorded in water sample of Well 7 during July while the lowest mean value was 1.24±0.09 mS/cm in well 2 during January (Fig1).

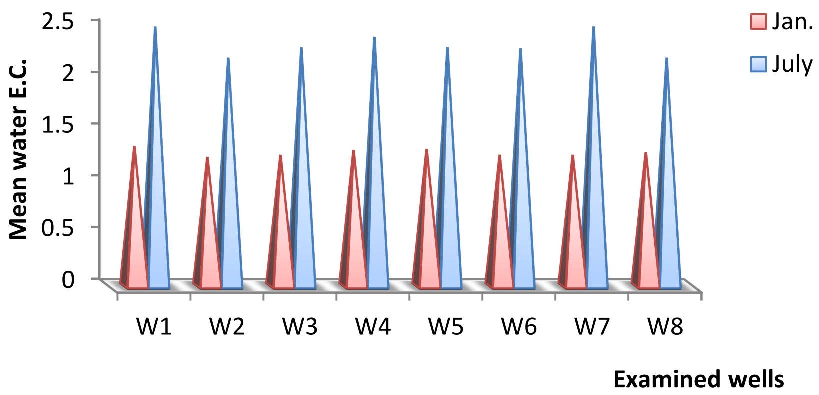

Fig.1. Mean EC in water samples of eight wells collected in January and July.

These results however, seem to be lower during cold season and higher in hot season and the reason for the increased value may be due to solvent salt ions as suggested by previous studies [6 and 26]. Such water EC mean values are exceeding standard levels recommended by USEPA and WHO but these levels seem to be suitable for agricultural activities being less than 15.0 mS/cm that suggested by FAO.

Regarding water turbidity, the highest mean value was found to be 7.01±1.54 NTU in water sample of well 5 during July while the lowest mean value was 0.01±0.0 NTU for water samples of the most examined wells during both collecting periods (Fig.3).

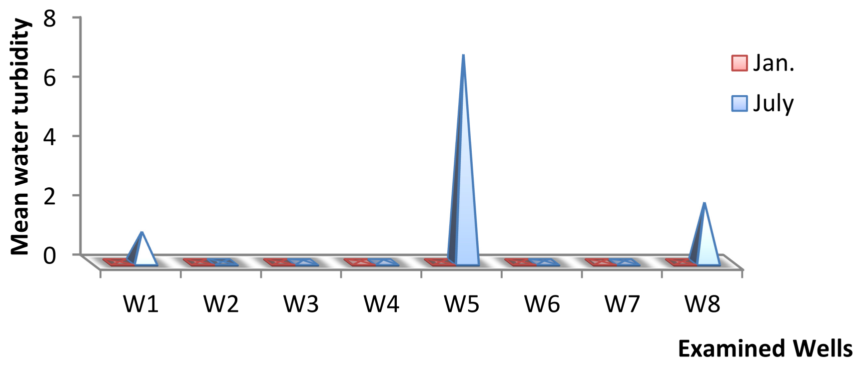

Fig.2. Mean Turbidity in water samples of eight wells collected in January and July.

The high water turbidity in well 5 may be linked to silt and mud and other solid material leached from rock beds as suggested by other studies [11, 27 and 28] while the low water turbidity level may attribute to the fact that most underground water is relatively steady as in case of marshes.

In case of water BOD, highest mean value (22.0±4.12 mg/l) was found in water sample of well 4 during January while the lowest mean value (6.2 ± 1.14 mg/l) in well 2 water sample during July (Fig.3). In general well 4 had the highest mean value in both January and July.

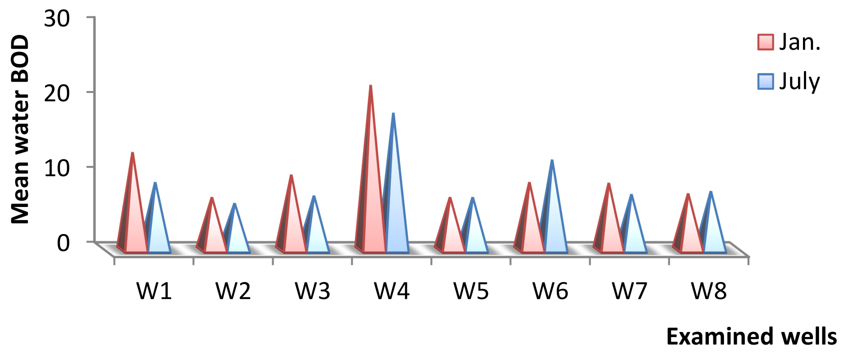

Fig.3. Mean BOD in water samples of eight wells collected in January and July.

It seems clearly that fresh water BOD is affected by oxygen concentration released via aerobic biodegradation of organic contaminant being available to be consumed by bacteria. However, in case of water ground, such aerobic process does not occur.

Similar studies [25 and 29] which examined physiochemical properties of water samples collected from different wells in Nigeria and India gave almost similar findings.

For COD water levels, the current study has found that the highest mean value (68.0±11.7 mg/l) and the lowest mean value (14.0 ± 3.5 mg/l) were detected in water samples of well 6 in January and July respectively (Fig.4).

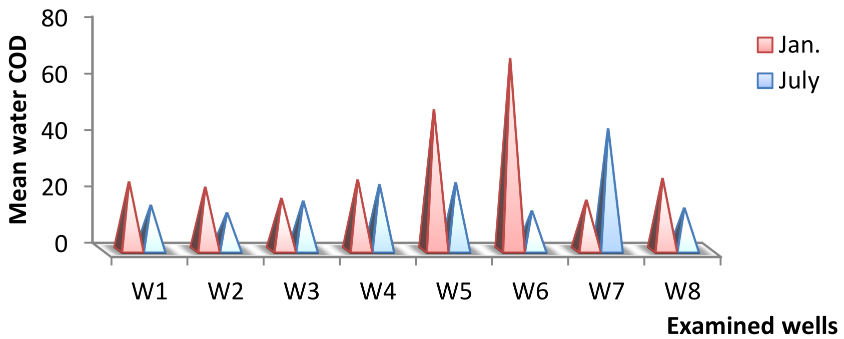

Fig.4. Mean COD in water samples of eight wells collected in January and July.

Obviously, high COD level reflects higher pollution concentrations and organic material and the lower level is linked to low contamination and trace organic compounds [30]. However, previous similar studies [25 and 29] carried out in Nigeria and India and examined physiochemical variables of water samples collected from different wells had reported similar results.

For groundwater DO, the highest mean level was 7.5±3.22 mg/l in water sample of well 8 during July and the lower value was 3.1 ± 2.6 mg/l in groundwater of well 2 in January (Fig.5).

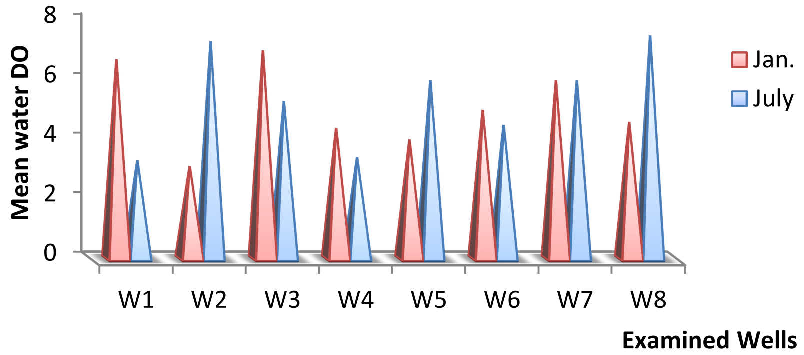

Fig.5. Mean D.O in water samples of eight wells collected in January and July.

The degree of oxygen dissolve is affected by water salinity and also water temperature and thus it is expected with saline underground water, the level of DO would be rather low [30]. In general, the examined underground had mean DO value either higher or lower than 6 mg/l which is recommended by WHO [31].

Regarding PO_4 ions, the highest mean value (0.66±0.12 µg/l) was recorded in water sample of well 1 in July and the lowest value (0.23±0.08 µg/l) was found in water sample of well 8 during January (Fig.6). It seems clearly that higher mean values were recorded during July and nevertheless such values are quite below WHO and Iraqi standards which are 0.4 µg /l particularly during January.

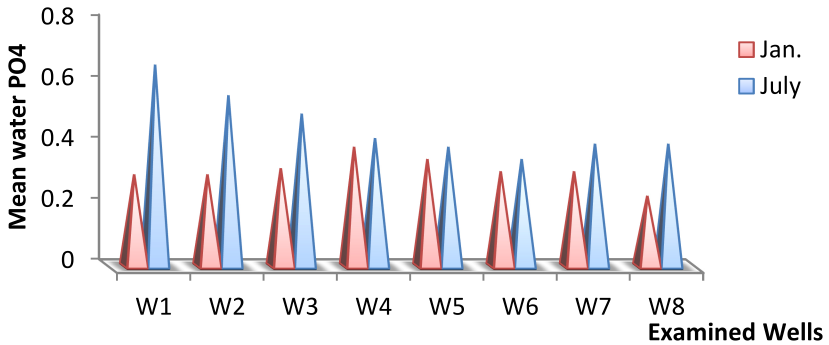

Fig.6. Mean PO4 ions in water samples of eight wells collected in January and July.

The PO_4 groundwater is affected significantly by sanitary and agricultural wastewater that may contain considerable phosphate concentrations as explained by [12] and also not adjacent to residential areas.

For SO_4 ions, the current work has detected highest mean value (390.0 ± 38.64 µg /l) was in water sample of well 2 in January and the lowest mean value (93.0 ± 24.69 µg /l) in sample of well 1 during July (Fig.7).

Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.8, 2015

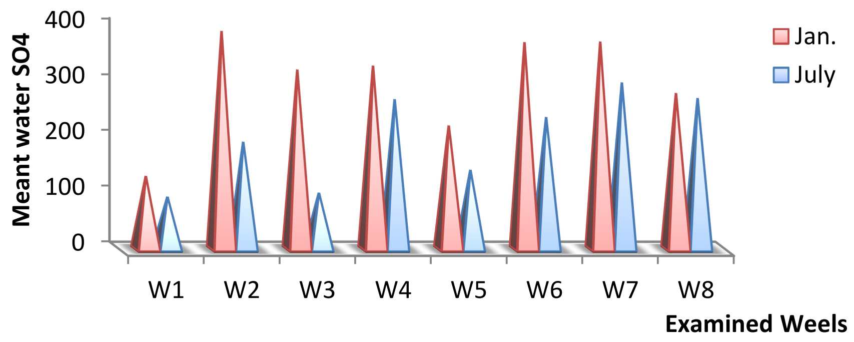

Fig.7. Mean SO4 ions in water samples of eight wells collected in January and July.

In general, higher mean values for water samples of all examined wells were in cold season and also samples of well 1 had the lowest mean values during both January and July than those of the remaining wells.

PO_4 ions seem to be the most abundant in than other sulfide compounds and occur at various concentrations [22] and readily to dissolve in water [32]. Lower levels of PO4 may be related to certain species of algae occurring in groundwater which act to decrease ions concentrations [33]. However, these data are below international and national standards which are not more than 400 µg /l.

In case of chloride ions, the results obtained in this study show that the highest mean value (1.9±0.36 µg /l) was in water sample of well 7 during July and the lowest mean value (0.01 ± 0.0 µg /l) in the sample of well 4 in January (Fig.8).

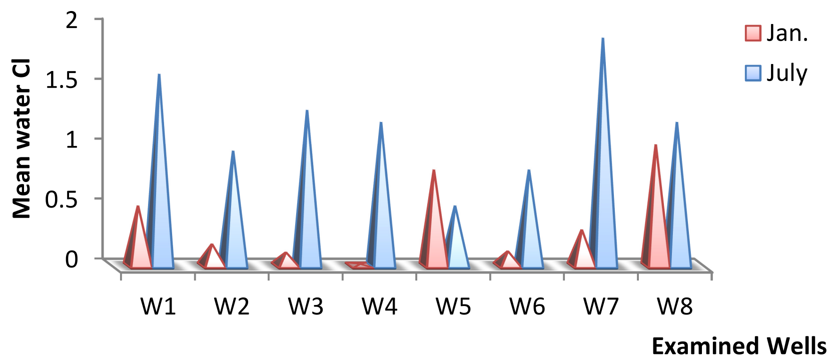

Fig.8. Mean Cl ions in water samples of eight wells collected in January and July.

It seems obviously that Cl ions mean values in water samples of all examined wells were in general higher in hot season than those of cold season. Such variations however may be due to the quantities of groundwater that consumed during summer and resulting in elevating Cl concentrations in wells as explained by [11].

Furthermore, such data were within accepted levels of water used for both drinking and agricultural irrigation as recommended by WHO.

Regarding groundwater calcium ions, this study has found that highest mean value (98.0±28.74 µg /l) was found in water sample of well 3 and the lowest mean value (70.0 ± 21.51 µg /l) was recorded in a sample of well 1 and the both were in January (Fig.9). In general, no clear differences between most of these data of January and July except for that of wells 1, 3, and 8.

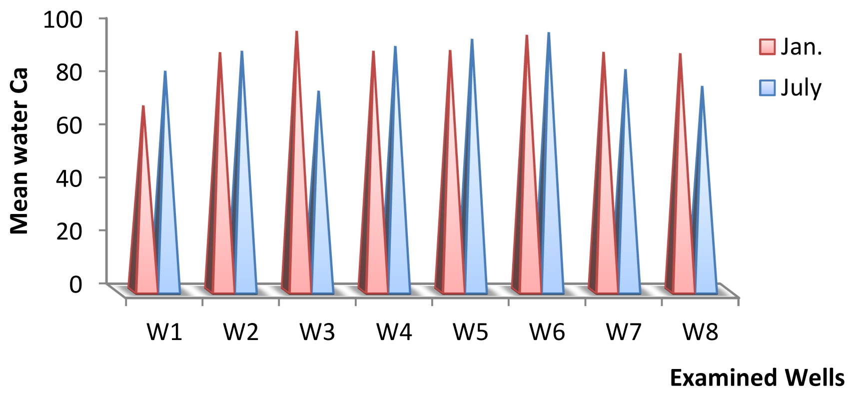

Fig.9. Mean Ca ions in water samples of eight wells collected in January and July.

In similar study [25] which examined eight well in Nigeria and reported much lower water Ca content than those found in current work which did not exceed 9.25±0.10 µg /l. Another study [28] again carried out in Nigeria and detected much Ca water content found in this study**.** Such higher levels found in the current work may related to geological features of Iraq soil that rich in calcium.

Finally, groundwater magnesium content was found at highest mean concentration (100.0±15.42 µg /l) in well 1 during January and at lowest mean concentration (80.7 ±17.66 µg /l) in well 8 during July (Fig.10). However, no significant differences were found between mean values of both most examined wells and collecting time except for those of well 4 and 8.

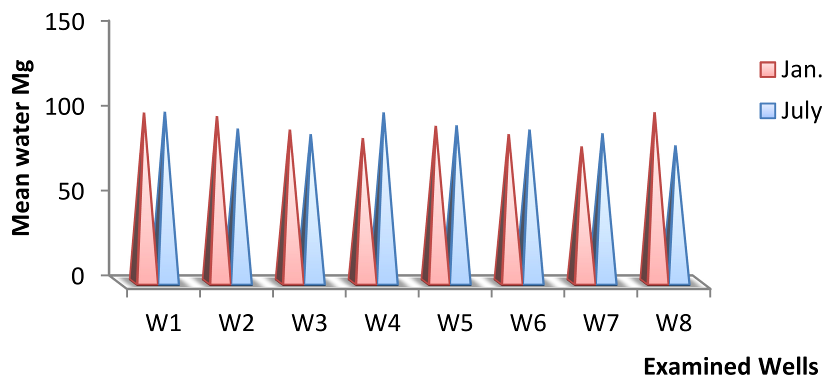

Fig.10. Mean Mg ions in water samples of eight wells collected in January and July.

In general both calcium and magnesium ions were found at high concentration in this study while other similar studies carried in Nigeria and India [25, 28 and 29] and this may be due to Iraqi geological structure particularly granitic terrain which contains considerable concentrations of these both metals.

References

1. Chutia, J and S. Sarma, (2009). Seasonal Variation of Drinking water quality with respect to fluoride in Dhakuakhana sub – division of Lakhimpar District of Assam, Int. J. Chem. Sci, 7(3): 1821, 1830.
2. Bouwer, Herman (1978) "Ground Water Hydrology" McGraw – Hill Book Company: 480P.
3. yenika M.E; Uma, K.O; Obiefuna, G.I (2003) The impact of human activities on ground – water quality: a case study of shallow aquifers in Jimeta – yola Metropolis, North east Nigeria water Resources Journal of NAH 14(2): 84 – 91.
4. Joarder, M.A; Raihan, F; Aalm, J.B; Hasanuzz-mqn, S. (2008). Regression analysis of around water quality data of sunamajang District, Bangladesh International Jour. Enviton Research 2(3); 291 – 296.
5. Prasad, B.G. and T.S Narayana, 2004, Water pollution Major issue in Urban areas. Nat Env. Doll. Tech., 3:47-50.
6. Bahaa, E.W (2005). The Migration of inorganic contaminates from landfill sites into the soil and groundwater system, Mse, Thesis; University of Kebangsaan - Malaysia.

7. M.A Maniyar, (1990) Evaluation of ground water Quality of the Bore wells off Gulbarga city maintained by K.U.W.S and D. and Board M.E. Dissertation submitted to Gulbarga University Gulbarga, 16 – 29.
8. Aremu, M.O olaofe, O. Ikokoh, P.P yakubu, M.M. (2011) physicochemical characteristics of strem, well and borehole water source in Eggon, Nasarawa state, Nigeria Journal chemical society Nigeria, 36(1), 131 – 136.
9. Azeez P.A. Nadarajan N.R and Mital D.D., The impact of monsoonal wetland on ground water chemistry, poll. Res., 19(2), 249 – 255. (2000).
10. Dahiya, S. and Kaur, A (1999) Assessment of physic – chemical characteristic of underground water in rural areas. J. Environ poll, 6(4), 281 – 288.
11. Zakaria, R. 2012 physico. Chemical parameters of Ground – Water. Afri. J. Basic Appli. Sci 4(2): 28 – 29.
12. Mahanad, M. R.; Mohanty, B.P and Behera, N.R (2010), physico – chemical analysis of sure and ground water of Baghdad district, Oriss, India, Ijrras, 2(3): 284 – 295.
13. S; Khurana, S.C., Manish, K; Yadar, N. adar, R (2012). Seasonal Variation of coliforms witrate in Ground water Quality in Kanpur metro-inte. J.Chem. Environ. 2(2): 207-209.
14. Valenzuela1, M.; Bernardo, L.; Marcelino, C.; María A; Claudio, P. and Oscar P. (2009). Fecal contamination of groundwater in a small rural dryland watershed in central Chile. CHILEAN JOURNAL OF AGRICULTURAL RESEARCH 69(2):235-243
15. HOWARD G, PEDLEY S, BARRETT M, NALUNBENGA M and JOHAL K (2003) Risk factors contributing to microbiological contamination of shallow groundwater in Kampala, Uganda. *Water Res.* **37** 3421-3429.
16. Oyeku1, O. T. and Eludoyin, A. O. (2010). Heavy metal contamination of groundwater resources in a Nigerian urban settlement. African Journal of Environmental Science and Technology Vol. 4(4), pp. 201-214.
17. Momodu, M.A. and Anyakora, C.A. (2010) Heavy Metal Contamination of Ground Water: The Surulere Case Study. Research Journal Environmental and Earth Sciences 2(1): 39-43.
18. Iqbal, M.A. and Gupta, S.G. (2009). Studies on Heavy Metal Ion Pollution of Ground Water Sources as an Effect of Municipal Solid Waste Dumping. African Journal of Basic & Applied Sciences 1 (5-6): 117-122.
19. Zheng, J. (1988). Petroleum hydrocarbon contamination of groundwater in Tiverton, Rhoda Island. USA. Chin.J. Oceanol. Limnol, V6;No.4; 367-372.
20. František, K. ; Zbyněk, B; Pavel, M.; Miloslava, K. and Irena, S. (2003). Contamination of soils and groundwater by petroleum hydrocarbons and volatile organic compounds – Case study: ELSLAV BRNO. Bulletin of Geosciences, Vol. 78, No. 3, 225–239.
21. APHA (1995) standard Methods for Examination of water and Waste water, 19th ed n., American public Health Association, Washington. D.C.
22. American public Health Association (APLLA) (1999) standard Methods for the examination of water and waste water. 21th Ed. A.P.H.A 1015 fifteenth street, NW, Washington, DC, USA.
23. Goldman, C.R. and Horn, A.J. (1983) Limnology McGrow – Hill, Int. Co. New york. Inc. USA. 464.pp.
24. WHO (World Health Organization) (1993) Guideline for Drinking Water Quality, 2nd Ed. Vol. z. Geneva
25. Agbalagba O. E., Agbalagba O. H. , Ononugbo C. P. and Alao A. A(2011). Investigation into the physico-chemical properties and hydrochemical processes of groundwater from commercial boreholes In Yenagoa, Bayelsa State, Nigeria. African Journal of Environmental Science and Technology Vol. 5(7), pp. 473-481.
26. Melad, S.F (2009). Determination of the concentration of some heavy metals in fish (Tilapia zilli and gastropodamelanoidesTuberculata) MSc thesis college of sciences. Sebha University. Lgbia.
27. Rani, A.L and Babu, D.S (2008) A statistical evaluation of ground water. Chemistry from the west coast of Tamil Nada, india, Indian J. of marin sciences Vol 37(2): 186 – 192.
28. Emmanuel, B. and Nurudeen, A. (2012). Physicochemical Analysis of Groundwater Samples of Bichi Local Government Area of Kano State of Nigeria. World Environment, 2(6): 116-119.
29. Janardhana, R. D. ; Hari , B. ; Swami, A.V.V. and Sumithra, S. (2013). Physico-Chemical Characteristics of Ground Water of Vuyyuru, Part of East Coast of India.
30. Dueance, J. L (1986), United States Geological survey (USGS) water Science for school retrieved 9. April, 2009 pp 1-8.
31. WHO (2003). Guideline for drinking water quality, preface, chapter L DRAFT.
32. Pomeranz, A Dalfin, T and Korzats, Z(2002) increased sodium concentration in drinking water, increase blood pressure in neonates. J. Hypertense, 20: 203 – 207.
33. Al – Salmain, I. M.A (1985) study in effect of So4, Ions in phytosynthetic characteristic of green phytoplankton M.S.C. thesis Department of ecology and hydrobiology college of biology Moscow state University. SSSR.

Table 1: Mean value ± standard deviation of several physiochemical variables of different well water samples.

Collection date	Water sample	Mean ± Standard deviation										
		pH	EC	Turbidity	BOD	COD	DO	PO4	SO4	Cl	Ca	Mg
January	W1	7.1±0.4	1.35±0.72	0.01±0.00	13.0±2.4	24.3±4.58	6.7±2.2	0.30±0.02	130±17.62	0.5±0.024	70.0±21.51	100.0±15.42
	W2	7.5±0.6	1.24±0.09	0.01±0.00	7.0±2.62	22.4±5.26	3.1±2.6	0.30±0.01	390±38.64	0.18±0.011	90.0±30.62	97.9±11.26
	W3	7.5±0.7	1.26±0.18	0.01±0.00	10.0±4.3	18.4±4.32	7.0±0.9	0.32±0.03	321±28.56	0.11±0.032	98.0±28.74	90.0±14.74
	W4	7.3±0.3	1.31±0.42	0.03±0.006	22.0±4.12	25.0±5.0	4.4±0.8	0.39±0.03	328±33.0	0.01±0.0	90.5±26.49	85. 0±14.0
	W5	7.4±0.4	1.32±0.08	0.01±0.004	7.0±2.44	50.0±8.84	4.0±1.6	0.35±0.06	221±20.62	0.8±0.12	90.8±30.22	92. 2±16.21
	W6	7.2±0.6	1.26±0.16	0.01±0.005	9.0±2.74	68.0±11.7	5.0±0.0	0.31±0.08	370±29.88	0.12±0.05	96.5±35.0	87.3±12.62
	W7	7.4±0.0	1.26±0.09	0.02±0.006	8.9±2.68	17.8±3.81	6.0±2.1	0.31±0.05	371±35.27	0.3±0.062	90.1±29.88	80.1±13.51
	W8	7.4±0.5	1.29±0.12	0.01±0.0	7.5±2.19	25.5±6.2	4.6±1.8	0.23±0.08	279±28.77	1.01±0.0	89.6±25.42	100.2±22.24
July	W1	7.1±0.6	2.5±0.07	1.03±0.094	9.0±3.08	16.0±4.4	3.3±1.7	0.66±0.12	93±24.69	1.6±0.084	83. 0±19.74	100.5±25.62
	W2	7.2±0.4	2.2±0.07	0.01±0.0	6.2±1.14	13.3±3.33	7.3±1.5	0.56±0.11	191±18.66	0.95±0.027	90.5±26.44	90.6±18.68
	W3	7.1±0.3	2.3±0.24	0.06±0.005	7.2±1.09	17.5±5.27	5.3±0.8	0.50±0.18	100±22.32	1.3±0.033	75.5±18.68	87. 3±24.12
	W4	7.2±0.4	2.4±0.14	0.08±0.007	18.3±4.3	23.3±6.72	3.4±1.1	0.42±0.09	268±36.84	1.2±0.061	92. 3±31.42	100.1±30.16
	W5	7.0±0.3	2.3±0.23	7.01±1.54	7.0±1.11	24.0±7.0	6.0±2.2	0.39±0.16	141±26.39	0.5±0.0	95.0±27.86	92.5±27.42
	W6	7.2±0.2	2.29±0.07	0.04±.006	12.0±2.84	14.0±3.5	4.5±0.82	0.35±0.08	236±28.71	0.8±0.044	97.5±23.94	90. 0±28.84
	W7	7.1±0.3	2.5±0.19	0.04±0.004	7.4±2.31	43.3±10.4	6.0±0.16	0.40±0.13	298±37.14	1.9±0.36	83.6±18.82	87.8±19.86
	W8	7.2±0.4	2.2±0.08	2.02±0.96	7.8±1.92	15.0±3.28	7.5±3.22	0.40±0.22	270±32.28	1.2±0.065	77.3±19.46	80.7±17.66