Diyala Journal of Engineering Sciences

ISSN 1999-8716

Printed in Iraq

Vol. 05, No. 01, pp.138-146, June 2012

STUDY SOME PHYSICAL AND CHEMICAL PROPERTIES OF DRINKING AND RAW WATER FOR BALADRUZE CITY

Professor Amir.F. Dawood AL-Niaimi*, Assistant lecturer Abdal Hak.K. Hussien** & Assistant lecturer Mohammed.H. Msaed***

Dep. of Chemistry,College of Science,University of Diyala

E-mail:Niaimi@yahoo.com *، Hac.cor_57@yahoo.com** ،moh.petro_78@yahoo.com***

(Received:14/3/2011 ; Accepted:11/12/2011)

ABSTRACT:- Some physical and chemical properties of drinking and raw water for Baladruze city in Diyala Governorate they were studied. Where the samples are collected as one sample monthly from new water clarifying station as a source for drinking water and from surface of Baladruze river, one major branches for Diyala river, starting from April to December 2010. The results were shown the acidity (pH) for two kinds of water at the weak base because to present the composites bicarbonates of calcium, magnesium and sodium premium another hydroxides. The water samples studied were containing total dissolved salts concentrations within the concentrations allowance (< 1500 mg/l) of two types water for most months in year and the total dissolved salts concentrations in drinking water less than raw water. The total hardness of water were within the acceptable ranges (< 500 mg/l) and the total hardness in drinking water less than raw water. The studied were shown the concentrations of calcium and magnesium are within allowable concentrations while the concentrations of calcium more than magnesium and concentrations for the both in drinking water less than raw water. The studied were shown the two kinds of water were containing to bounty concentrations from dissolved oxygen, and the water turbidity was conformable for each months studied within allowance ranges of quality water for drinking water and non conformable for raw water.

Keywords: Physical, chemical, range, calcium, magnesium.

INTRODUCTION

The water pollution is making consume or souring in quality of water, which lead to defectiveness happing in its composition system in direct or another that will decrease from natural act performance in uses by human, or losses the much of its economic values. The water pollution include more than parameter, attrition of large quantities from oxygen dissolved in water, increasing in concentration of dissolved salts, chemical materials and disadvantageous some element in human that which make the uses of water in grave. The sources of water pollution are much and multifarious, more of its came from non environmentalism human ethologic. Preamble of these sources is the petroleum and its applications, leavings from factories and sanitary flumes, acidic raining, uses of insect's exterminatories and chemical fertilizers. The water environmental studies beginning in some countries at last century [(1)]. Started the importing in studied for the physical, chemical and biological properties of meres, where the researchers studies the water meres in Sweden, Holland and U.K, and scatters the searches about the quarterly changes for more the environmental parameters and changes that happened inside the environment system. The water environmental studies about the inside water (flow and stood) has shares in change and offering the solution for the present-day problems such as the danger of organic or industry

pollution with highly technology advance. The leavings of factories and cities flumes these will direct or indirect inside to water flats and effect on a live of beings and dulcet of water [2]. Some of researchers [3,4]study the physical and chemical properties for (Shutt- Al Arab) water and primary studying for Docane mere and Tigris river. Also [5] they are studying the water sources in Iraq and shows that the environmental studied for water flats in Iraq are fewer. The importing in study the Iraqi water flats increasing before the end the last century where cover the north, medium and south of Iraq [6]. Study the physical and chemical properties and algae that adherent and rambling in Diyala river [7].

The aim of this search is study the physical and chemical properties for drinking and raw water for Baladruze city, the samples are took from Baladrooz river surfaces and water clarifying station. The properties including the acidity of water (pH) and its effect on water quality, concentration of total dissolved salts (T.D.S), electrical conductivity (E.C), oxygen dissolved in water (D.O) and its effect on tastes of water, total hardness of water (T.H) through the concentration of calcium (Ca) and magnesium (Mg) elements and study the turbidity (T) of water because. The studying include both physical and chemical tests carried out in the laboratories of Diyala environmental office.

EXPERIMENTAL WORK

- **Samples Collected**

Water drinking samples have been collected from Baladruze drinking water clarifying station about one sample per each week and take average the results of four tests per each month through (April to December) for 2010 , and the raw water samples are collected from the Baladrooz river per each week and make average the results of four tests per each mouth, and these samples are collected from different points at deeps (30 cm) from the surface of river at the center of Baladrooz city . The both of water types are taken to special water laboratories of Diyala environmental office. The examination procedures were performed by using the standard methods for the examination of water and waste water [8] and include: Turbidity, Acidity, Total Dissolved Salts, Electrical Conductivity, Total Hardness, Calcium and Magnesium concentration, Dissolved Oxygen and Turbidity.

- **Apparatus**

The acidity (pH) of water has been registered by using pH- meter 3320 type Jenway (Romania origin). The total dissolved salts and electrical conductivity for water samples has been determined at the temperature of laboratory by Conductivity T.D.S. ^{O}C. meter type Cyberscan 10con. (French origin) with T.D.S in mg/l and E.C in ms/cm units. The calcium concentration has been calculated from titration [7] method by the calibration with standard solution (EDTA-Na) (Ethylene Diamine Tetra Acetic acid-Na) with Miroxide indicator in base medium with ppm units. The magnesium concentration has been calculated from titration [7] method by the calibration with standard solution (EDTA-Na) with Isocrom black-T indicator in buffer solution (pH=10) with ppm units. The total hardness for water evaluated from calcium and magnesium concentrations by the following equation (in ppm units):

$W_{T.H} - W_{Ca} = W_{Mg}$

Where: $W_{T.H}$ = concentration of water total hardness, W_{Ca} = concentration of calcium, W_{Mg} = concentration of magnesium, while the total dissolved oxygen in water measured by DO_2 meter 9071 type Jenway (Romania origin). The water turbidity has been gauged by Lamott 2020 code 1979-EPA with NTU units (Nephelometric Turbidity Units).

RESULTS AND DISCUSSION

- **Acidity (pH)**

The results for acidity of water shown Fig.(1) at range (7.2 – 7.7) and these values refers to the water as a weak base properties [8]. The weak base properties for water because a finding composites of calcium , magnesium and sodium bicarbonates accession to the another hydroxides[9]. Which are come from natural calcareous of soil for Diyala river and its branches are passing it[3] specially heights monotane. These ratios for acidity are within accepted range for drinking water validity [9] and these at range [8.5 <pH>6.5] according to Environmental Protection of Association (EPA).

The decreasing of hydrogen ion (H^+) concentration (or increasing of pH) is important in water treatment and clarifying processes, when the decreasing of hydrogen ion concentration will help on hypochlorous acid (HOCl) and (NCl_3) forming and that very important in a water purification processes, as below equations show the hydrogen ion(H^+) production, where the decreasing its in water will making the irreversible reaction, by another meaning, will increase composites of (HOCl) and (NCl_3) forming which that use in water clarifying.

$$Cl_2 + HOH \longrightarrow HOCl + H^+ + Cl^- \quad \text{……..(1)}$$

$$NHCl_2 + Cl_2 \rightleftharpoons NCl_3 + H^+ + Cl^- \quad \text{… …(2)}$$

Can be notice the decreasing in (pH) value in drinking aseptic water by chlorine or chloroamine from raw water because increasing in hydrogen ion (H^+) concentraton which is production from above equations[10]. So the water with high (pH) is perfected and it with highly efficient in clarifying by uses the chlorine or chloramines composites that gives pH value within the allowance range.

- **Total Dissolved Salts (T.D.S)**

The analysis of total dissolved salts results in Fig.(2) shown the water is containing a quantities from dissolved salts and minerals materials, where the concentrations of total dissolved salts in drinking water less than raw water because of a good treatment processes in water clarifying station. These concentrations of drinking and raw water are within the permitting range for drinking water (T.D.S < 500 mg/l) according to Environmental Protection of Agency (EPA)[11].

The most of dissolved salts in Baladrooz river , which is a branch from Diyala river, is come from inorganic materials[10] such as the rocks which containing the bicarbonates of calcium, magnesium and sulfurs because the natural calcareous for Diyala river gully and it passing from heights monotane [8]. The most of the these dissolved materials as a salts [10].

The results of salts analysis shown also the concentrations were varied in simple values during the month of year because of effect of raining and levels water difference in river which that will effect on dissolved salts quantity. The Baladrooz river are passed in city media and the sanitary flumes leavings putted in it that's will effect also on concentration of dissolved salts in water.

- **Electrical Conductivity (E.C)**

The electrical conductivity measuring results shown in Fig.(3), the electrical conductivity increase with increase the concentration of total dissolved in water with values approx double of total dissolved salts [12,13] according to the following equation [10]:

$$T.D.S\ (ppm) = 0.67 * EC \quad (\text{in micro ohm. } Cm^{-1}) \qquad \ldots\ldots\ldots (3)$$

The values of electrical conductivity shown also the values within the allowance range for electrical conductivity (E.C < 2000 ms/cm) according to Environmental Protection of Agency (EPA)[11].

The pure water is sloppy for electrical conductivity and the electrical conductivity increasing with increasing the concentration of dissolved salts [14] which are carbonates, bicarbonates, chlorides and sulphates and all as a anions or cations such as calcium, magnesium, sodium and potassium.

- **Total Hardness (T.H)**

The results in Fig.(4) shown the concentrations which the total hardness for drinking and raw water for each months that are studied within the allowance range (T.H < 500 ppm) [15], the results shown also the values of total hardness of drinking water less than the total hardness of raw water because the treatment water in water clarifying station.

The present of calcium ions (Ca^{+2}), Magnesium (Mg^{+2}) and another ions are caused the total hardness of water [16,17]. The degree of water hardness increase with increasing the concentration of calcium and magnesium ions in water [14] and it is can be classify within the general hardness which is scaled in part per million (ppm) for concentration of calcium carbonates ($CaCO_3$).

The hardness water also effect on foam of soap and on the cleaning efficiency. So must be a good treated the water by in water clarifying unit to decreasing the hardness by added the lime (CaO) to the water during the treatment to precipitating the hardness salts as a calcium carbonates in clarifying baths.

- **Calcium and Magnesium**

The results in Fig.(5) shown the calcium and magnesium concentration are within the allowance range for drinking water (Ca < 150 ppm, Mg < 50 ppm) according to Environmental Protection of Agency (EPA)[11], also shown the calcium concentration more than magnesium concentration in water and their concentration in drinking water less than raw water because the good water treatment in water clarifying unit. These elements are present in water as an ions (Ca^{+2}, Mg^{+2}) and caused to water hardness [15]. The concentrations shown for calcium and magnesium in water result from dissolving and degradation for alumina silicates of calcium and magnesium, also from degradation for lime rocks [14] and some salts which found in heights monotone for Diyala river (Baladruze river is branched from Diyala river) during flow it.

- **Dissolve Oxygen (D.O)**

The results in Fig.(6) shown the dissolved oxygen concentration for drinking and raw water are within the acceptable range (D.O < 10 ppm) and the dissolved oxygen concentration for drinking water more than raw water. The increasing in dissolved oxygen concentrations for algae and mosses which are effect on dissolved oxygen concentrations through the photosynthesis process as shown in below equation [14,15,16,17]:

$$(\text{algae} + \text{mosses}) + CO_2 \xrightarrow[\text{Chlorophyll}]{\text{Sun rays}} \text{Cellulose} + O_2\,(\text{dissolved}) \quad \ldots(4)$$

Withal the much water plants living in baths water in units for water treatment and clarifying which have a large surface areas to increasing the dissolved oxygen concentration in water so that the dissolved oxygen concentration in drinking water more than raw water. Also the dissolved oxygen concentration can be increasing by coming down the oxygen atmosphere through the raining [18].

The water with highly dissolved oxygen concentration refers to slightly pollution by organic materials because the Aerobic Bacteria (AB) which are eating the organic materials will respiration the oxygen caused to decrease the dissolved oxygen concentrations shown below [14,15,16,19]:

$$AB + C,H\ (\text{organic leavings}) + O_2(\text{dissolved}) \xrightarrow[\text{Respiration}]{\text{Digesting and oxidation process}} CO_2 + H_2O + \text{Energy} \quad \ldots(5)$$

The results in Fig. (6) also shown the dissolved oxygen concentration are high for April, October, November and December months and low for June, July and August months because of effect the temperatures on oxygen dissolved in water where the low temperatures make much dissolvent, so that the dissolved oxygen concentration in summer are fewer.

- **Turbidity**

The results in Fig.(7) shown the turbidity for drinking water within the acceptable range (Turbidity < 5 NTU) according to communiqués of world health organization (WHO) [11]. The results shown too the large variation in turbidity between the drinking and raw water because of high efficient in turbidity removing process by water treatment in clarifying stations through use the sedimenting, stagnating, filtrating and adding the alum [$Al_2(SO_4)_3$] to water.

Solid materials suspension in water caused to water turbidity such as sand, clay, organic materials and different beings microscope which are gleaned by water during passing in river. The turbidity of water is effect on light permeability through the water because of present the above bodies. The measured of water turbidity is advantageous in select the method and type of required treatment parable sedimentation and filtration with kind of suitable in clarifying process [18].

CONCLUSIONS

According to the results obtained from this study, the following conclusion is deduced:

1- Acidity (pH) of two types water at allowable ranges according to Environmental Protection of Association (EPA) deals with a weak base media.
2- Total dissolved salts and electrical conductivity at acceptable ranges, the electrical conductivity increasing with increasing the total dissolved salts.
3- Total hardness concentration depended on calcium and magnesium concentrations, the concentration of calcium more than magnesium and the all at allowance ranges.
4- Turbidity of drinking water less than raw water because of the a good treatment in a clarifying station.
5- Dissolved oxygen (D.O) of drinking water more than raw water .

REFERENCES

1- Kalaf. J.W, Hoagland K.D., 1982, "Ecology of fresh water algae": philology society of America, New Yourk, 3 (4) : 139-144.

٢- السعدي. حسين علي وآخرون (١٩٨٦)، علم البيئة المائية، جامعة البصرة، العراق، ص ٥٧-٦٥.

3- Al-Mukhtar B.A., Khalaf A.N. and Khuda T.A., 1985 ," Variations of some physicochemical
factors of rivers Tigris and Diyala", J. Biol. Sci.res. 16 (2) : 99-105.

4- Al-Hamed M. I., 1966," Limnological Studies on the Inland Waters of Iraq", Bull. Iraq. Nat.
Hismus, Baghdad. 3(5):112-122.

٥- الصحاف مهدي (١٩٧٦)، الموارد المائية في العراق وحمايتها من التلوث، الجمهورية العراقية، وزارة الاعلام، ص.٣٠٧

٦- عبد الله، داود سلمان محمد (١٩٨٩)، الإنتاجية الأولية للهائمات النباتية والعوامل البيئية المؤثرة عليها في قناة شط العرب، رسالة ماجستير، جامعة البصرة، العراق، ص ٧٥-٨٢.

7- Smith J.W., 1988," National Drinking Water Mission", Department of Rural Development, Government of India, 53-59.

8- Lind. O. T., 1979, " Hand book of commen methods in Limnology" 3rd ed. New Yourk,71-99.

9- Bill Argo, J.M., 2003, " Treatment of pollution water", International Phalaenapsis Alliance,
,Washington, 45-62.

10 - Anderson J. H., Estabrooks T. L. and Mcdonell J. F., March 2000, "Duluth Metropolitan Area Streams Shown melts Runoff Study", Duluth Regional, Francesco, 89-109.

11- Chris M., Elaine A. 1983, " Interpreting water test results", Chem. Scien. Ser., New Yourk,21-38.

12- Golmen C.R., Horne. A.J.and Hill .B.C, 1983, " The Chemistry of Environmental Pollution,
London, 166-191

13- Cole. G.A. Mosbyeo. C.V., 1983, " Textbook of limnology ", 3td ed., Sheffield, 22-35.

14- Moore .M.L., 1989, " Nalms management Guide for Lakes and Reservoirs", North America
lake Management society, , p.o. Box 5443, Madison, WI, 5405-5443.

15- Robert.H.M., 1995. "Contaminats in the Mississippi River", Geological survey Circular, Reston, Virginia, 72-98.

16- Hutchinson. G.E., 1957 " Atrcatise on Limnology ", Wiley, 1015pp.

17- Michaud , J.P. 1991 " Gude to understanding and monitoring Laka and Streams " , Washington Stat Dept. of Ecology, Publications Office, Olympia, WA, USA ,4 (360):407-
472.

18- Mark. W. L., Evans T.M. and Ramon. J. S., July 1981 " Biological treatment of water pollution ", J. Applied and Environmental of Microbiology, 4(3): 121-135.

١٩- لطيف حميد علي (١٩٩٠)، أسس وتطبيقات في الكيمياء الصناعية، جامعة الموصل، العراق.

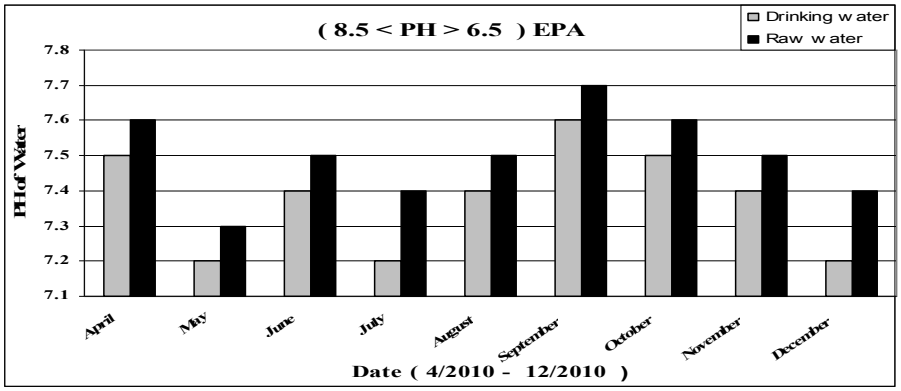

Figure (1) PH of Drinking and Raw Water

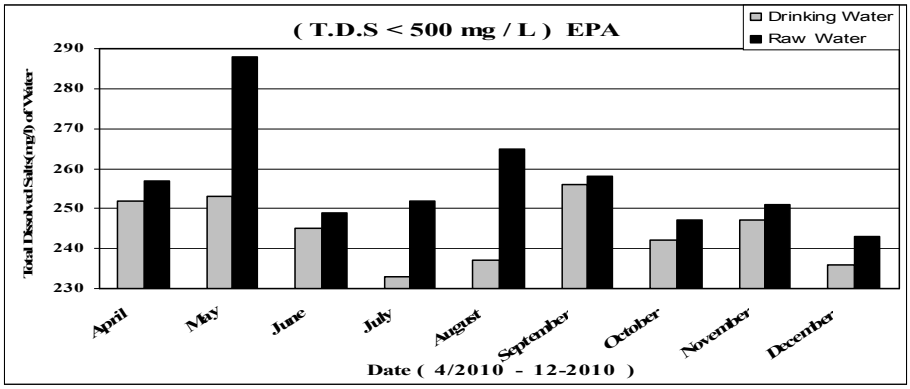

Figure (2) Total Dissolved Salts of Drinking and Raw Water

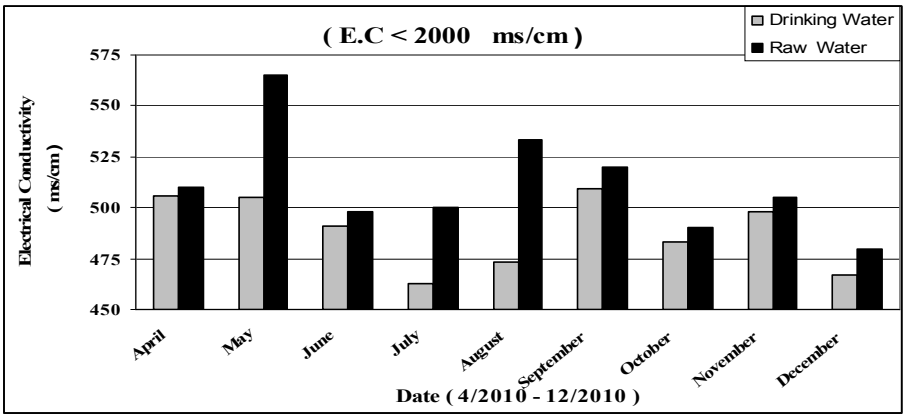

Figure (3) Electrical Conductivity of Drinking and Raw Water

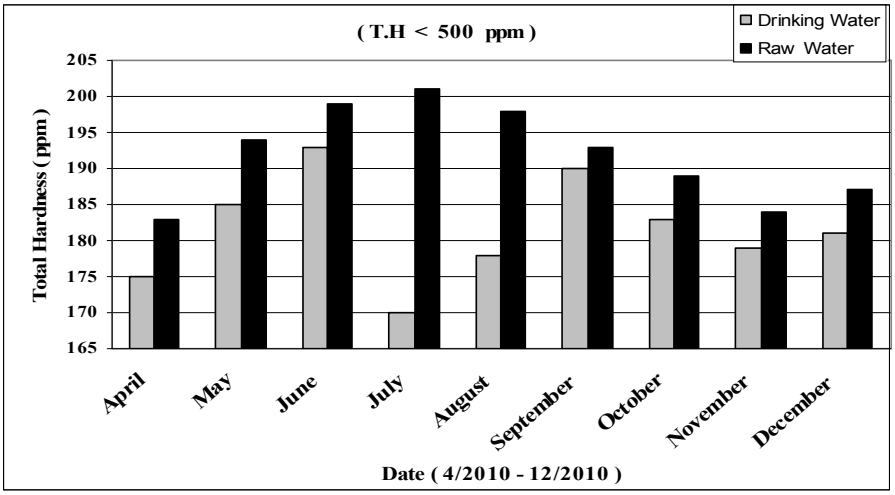

Figure (4) Total Hardness of Drinking and Raw Wate

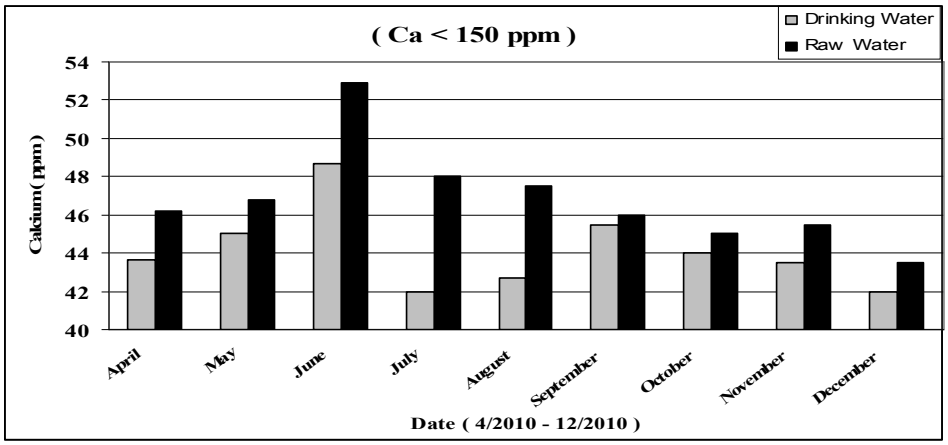

Figure (5-1) Calcium of Drinking and Raw Water

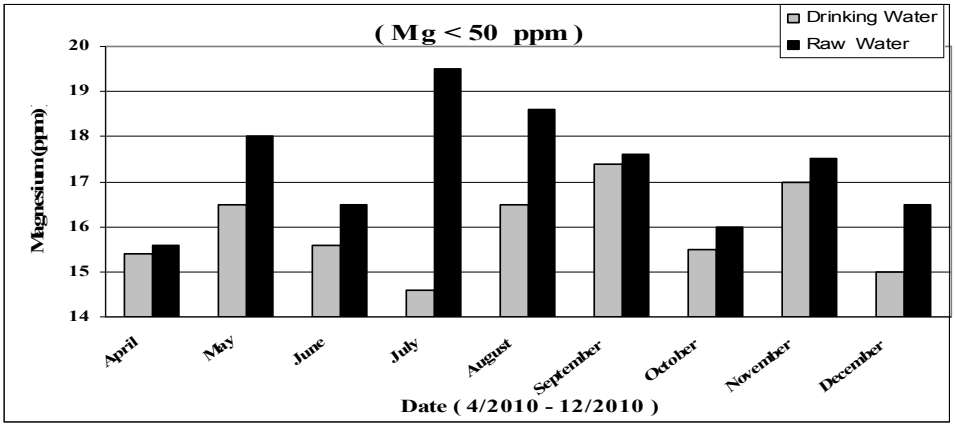

Figure (5-2) Magnesium of Drinking and Raw Water

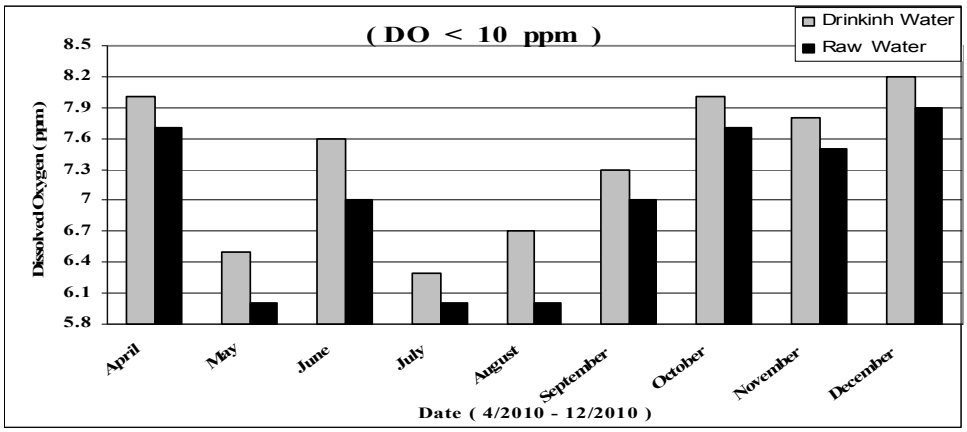

Figure (6) Dissolved Oxygen of Drinking and Raw Water

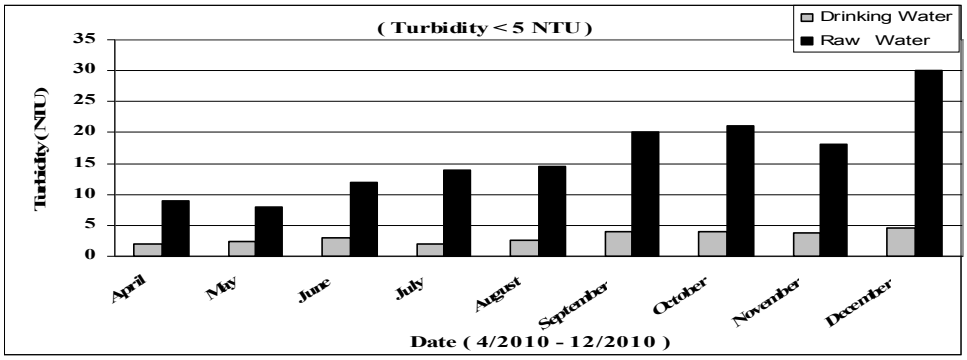

Figure (7) Turbidity of Drinking and Raw Water

دراسة بعض الخواص الفيزيائية والكيميائية لمياه الشرب والخام لمدينة بلدروز

أ.د.عامر فاضل داود، م.م.عبد الحق خلف حسين، م.م.محمد حمزة مساعد

قسم الكيمياء، كلية العلوم، جامعة ديالى

الخلاصة

تمت دراسة بعض الخواص الفيزيائية والكيميائية لماء الشرب (النظيف) والخام لمدينة بلدروز في محافظة ديالى، حيث جمعت العينات بواقع عينة واحدة شهرياً من محطة تصفية المياه الجديدة في المدينة كمصدر لماء الشرب ومن سطح نهر بلدروز احد الفروع الرئيسة لنهر ديالى ابتداءاً من شهر نيسان ولغاية كانون الأول ٢٠١٠ ، وأوضحت النتائج أن تراكيز الأس الهيدروجيني (pH) تقع ضمن الجانب القاعدي لنوعي الماء ويعود ذلك إلى وجود مركبات بيكاربونات الكالسيوم، المغنيسيوم والصوديوم فضلاً عن الهايدروكسيدات الأخرى. وبينت النتائج أن عينات الماء المدروسة أنها تحتوي على تراكيز الأملاح الذائبة الكلية ضمن التراكيز المسموح بها لنوعي الماء لأغلب الأشهر غير أن تراكيز الأملاح الذائبة الكلية في ماء الشرب اقل من الماء الخام. وأوضحت قياسات التوصيلية الكهربائية بأنها تزداد بزيادة كمية الأملاح المذابة الكلية في الماء. كما أن العسرة الكلية لعينات الماء المدروسة تبينت أنها ضمن الحدود المسموح بها وان ماء الشرب اقل عسرةٍ من الماء الخام وسبب ذلك المعالجة الجيدة للماء في محطة تصفية المياه، وأوضحت الدراسة أيضا أن تراكيز الكالسيوم والمغنيسيوم مقبولة غير أن تركيز الكالسيوم أكثر من تركيز المغنيسيوم وان تراكيز هما في ماء الشرب اقل من تركيزهما في الماء الخام.وكما أظهرت الدراسة أيضا أن نوعي الماء كانت تحتوي على تراكيز وفيرة من الأوكسجين المذاب وان عكورة الماء فكانت مطابقة في جميع الشهور للنسب المسموح بها لجودة المياه كماء للشرب وغير مطابقة للماء الخام.