

Analysis of Water Quality using -Chemical –Physical- Biological Parameters of the Kinds of Water used for Drinking in the Baghdad Province- Al Adhamiya City

Jassam Gzar Lafta
Institute of Technology Baghdad, Iraq

Abstract

The current study was carried out to analyze and evaluate the drink water samples collected from residential areas of Baghdad Province al-adhamiya City. The level of TDS, alkalinity, Ca, Mg, Hardness, Electrical Conductivity, pH, and selected heavy metals (Fe, Cr, Cd & Zn) were determined. The results showed that all water samples have alkaline pH. All these water samples have very low concentration of Fe and Zn. The concentration of Cr and Cd was observed higher than the prescribed limit of WHO and ISI. In the light of this analysis we can conclude that all these water samples require some treatment before their use for drinking purpose. The field study was conducted for the three sites of water in the province of Baghdad province, al- adhamiya city (river water and piped water and water tank) where the samples were collected during the month of September 2014. The result establishes that drinks water sample in three site, is useful for irrigation and household purpose, and suitable for drinking. A correlation study has been carried out amongst all possible pairs of the physical and chemical parameters to assess drink water quality. Correlation study indicates that different parameters are strongly interrelated. The correlation and regression provides an excellent tool for the prediction of parameter values within reasonable degree of accuracy. Were studied and compared with National Drinking Water Quality Standard (NDWQS) of Iraq and WHO water quality guidelines. The results revealed that most of the parameters were in normal range and indicated suitability for drinking purposes.

Keywords: Water, Chemical, Physical, Biological, Baghdad, Al-Adhamiya.

1. Introduction

Water is the very important for life and abounds on earth, but this vast natural resource has been depleted and turned into scarce commodity with increased usage catering to the needs of ever-expanding population. There is almost a global shortage of water and the world's most urgent and front rank problem today is supply and maintenance of clean drinking water. The climate change and spells of droughts have even stressed regional water tables (APHA, 1998). There are strides to fight the grim battle of acute shortages of water. The problems relating to water attract the attention to the urgency for investigating causes and suggest remedies in a bid to prepare future plan of action for maintenance of potable waters and related development issues. The maintenance of a healthy aquatic ecosystem is dependent on the physico-chemical properties of water and the biological diversity. A large number of streams and rivers in India have been impounded to store the water for multipurpose beneficial uses like irrigation, fisheries, power generation and drinking water supply. Now-a-days, the ecology of reservoirs is under stressed condition due to fast pace of development, deforestation, cultural practices and agriculture (Ashok K. Agarwal and Govind S. Rajwar, 2010). These activities trigger the rate of sedimentation of the reservoir bed characterized by silt and organic suspended material which initiates the process of eutrophication at a very early stage and show a deterioration of habitat quality. Environmental pollution is the global concern of the day. The growth of industrial area is rapid and very fast thus related anthropogenic activities have also been increased like waste discharge from industries, transportation and domestic activities. The domestic waste generated is directly enters into the different sites of water bodies without any treatment. Also the continuous flow from agricultural waste water contaminates the water source of surrounding area. This entire problem affects the water resources and ultimately human health. Water is one of the three major components of the environment; therefore, there exists a close linkage between the quality of water and the environment which bears an almost importance for ecosystem. Natural bodies of water are not absolutely pure as various organic compounds and inorganic elements remain in dissolved form. Many kinds of macroscopic flora and fauna grow in different types of aquatic habitats. The physical and chemical quality of water vary according to the basin shape and size, depth, light penetration, precipitation, location, temperature, chemical nature of surrounding soil and dissolved minerals, pH, etc, and the biological components of the habitats depend upon them. If all the physical, chemical and biological parameters are in optimum condition the balance between these is maintained (Pratiksha Tambekar, 2012). The main purpose of analyzing physical, chemical and microbiological characteristics of water is to determine its nutrient status. Since, the water contains dissolved and suspended materials in various proportions, its physical and chemical characteristics differ along with its biological characteristics (Kiran G. Chaudhari, 2014). The water quality is also affected by pollutants which act on elements existing in water such as dissolved oxygen or produce substances such as ammonia, nitrates etc. It is not possible to understand biological phenomena fully without the knowledge

of water chemistry as the limn biological and limn chemical components of the ecosystem. If we can find some correlations among these numerous parameters, however, the task of periodic monitoring of water quality may be facilitated to a good extent (WHO, 1998). The physico-chemical means are useful in detecting effects of pollution on the water quality but changes in the trophic conditions of water are reflected in the biotic community-structure including species pattern, distribution and diversity (R. MATHUR and S. SHARMA, 2010). Some ponds of India have been extensively studied by various workers (A.K. Suthar, 2012). The present study has provided detailed information on physico-chemical and microbiological parameters of the pali district's water at ten different sites with an objective to indicate changes in the quality of waters at the different sites. The study will be helpful in estimating the impact of water bodies various physicochemical and biological parameters of the water. According to the Australian drinking water guidelines: drinking water must not contain chemicals, inorganic substances or organisms that may be harmful to human health. Drinking water should also be at reasonable temperature and be free of unappealing odours, taste and colour .The guideline defines drinking water as water which is safe to drink over a life time that is, it constitutes no significant risk to health. Investigations of the quality of drinking water have been continuously performed by researchers (Maria R. Agostino S. Marcella Giovanni C, 2009, Jos P, 2009) around the world with rapid urbanization; the chemical aspects of water quality have become a cause of increasing concern as toxic chemicals in industrial effluents pose a high risk to human health. Two surveys of consumer satisfaction with drinking water quality conducted in Tiwan (Y, 2007) , in both surveys, the main reasons that respondents did not drink tap water was "water sources are inappropriate" and "unpleasant mouth feel". A study conducted on the level of inorganic elements and heavy metals (Na, Mg, Fe, Ni, Co, Cu, Cd, Pb and Zn) in Kallar Kahar lake (Furhan I Nadeem R Muhammad A Muhammad A, 2005), indicated that the concentration of the studied elements were not within the safe limit at the sampling sites throughout the studied period and the Kallar Kahar lake is not suitable for drinking, farming and agriculture. The study the physical and chemical properties for drinking and raw water for Baghdad Province al- Karada area, the samples are taken from Tigris 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.To communicate information on the quality of water to the concerned citizens and policy makers, analysis of water is utmost important. It thus, becomes an important factor for the assessment and management of ground water. Thus, in this research work an attempt has been made to assess the physical and chemical parameters of ground water like pH, electrical conductivity, Total hardness, Total dissolved solids, dissolved oxygen, Alkalinity, Biological Oxygen Demand, Chemical Oxygen Demand, Phosphate, Sulphate, nitrate, Chloride and Heavy metals (Cd, Mn, Ni, Zn, Cu, Fe and Pd). The analyzed data were compared with standard values recommended by WHO.

2. Materials and method

2.1 Study area

The study area is located in Baghdad Province- al adhamiya city, within the alluvial plain sector, which represents the western part of the unstable shelf, between latitudes (33°25'-33°44') and longitudes (44°16'- 44°29'). Tigris River runs through the city of Baghdad in the mature stage forming river meandering and a number of islands due to the decrease of river velocity and increase in sedimentation. Tigris River divides Baghdad into two parts (Karkh and Rusafa). Diyala River with a (300) km length meets the Tigris River south of east of Baghdad. Also, the military channel receives water from the Tigris River in the northern part of the study area and flow in the southern part of the Diyala River. On the other hand, the city of Baghdad consists of nine units, five of them belong to Municipality of Rusafa and the other four to the Karkh district, and each unit contains a number of small municipal districts, and linked to all units of the municipal network of highways. The area of the Municipality of Baghdad is about (869.031) km²

2.2 Samples Collected

In this study samples are collected from Baghdad Province- al adhamiya city drinking water clarifying station about one sample per each week and take average the results of four tests per each month through (September) for 2014, and the raw water samples are collected from the Tigris river per each week and make average the results of four tests per each week, and these samples are collected from different points at deeps (30 cm) from the surface of river at the center of al adhamiya area. The both of water types are taken to special water laboratories of al adhamiya area environmental office. The examination procedures were performed by using the standard methods for the tests of water and waste water and include: Turbidity, Acidity, Total Dissolved Salts, Electrical Conductivity, Total Hardness, Calcium and Magnesium concentration, Dissolved Oxygen and Turbidity.

Table 1. The results of the analysis of the chemical and physical factors in selected waters in the Al Adhamiya city

Site	PH	TDS Mg/ Liter	T.s.s Mg/ Liter	Tmc ^{0c}	Conductivity ms/ cm
River water	7.8	540	135	29	880
Piped water	8	876	30.0	27.7	665
Tank water	8.3	893	29.6	29.5	652

Table 2. The results of the analysis of ions and total of brackish in some selected areas in the Al Adhamiya city

Site	so ₄ ⁻² mg/ liter	cl ⁻ mg/liter	co ₃ ⁻² mg/ liter	No ₃ ⁻¹ mg/ liter	Na ⁺¹ mg/ liter	ca ⁺² mg/ liter	mg ⁺² mg/ liter	Total brackish mg/ liter
River water	185	79.4	19.7	8,8	50.2	73.1	22.0	199.3
Piped water	382	146	197	0.22	185	25.0	8.8	192.7
Tank water	342	140	194	0.20	183	21.0	8.0	199.3

Table 3. The results of the analysis of elements in selected waters in the Al Adhamiya city

Site	pb mg/ liter	Zn mg/liter	Cu mg/ liter	Fe mg/ liter
River water	0.0014	0.0016	0.033	0.173
Piped water	0.0075	0.0016	0.014	0.176
Tank water	0.0069	0.0016	0.013	0.167

Table 4. The preparation of bacterial colonies located in obtained samples of Al Adhamiya city

Site	TB 100mg	Tc 100mg	F.c 100mg	F.s 100mg
River water	149	54	12	30
Piped water	17	8.7	3.4	1.8
Tank water	20	14.9	3.1	1.2

Table 5. Global standards and Iraqi for drinking water

Property	Standard specifications according to the World Health Organization		Iraqi standards for drinking water
	Lower Concentration Permitted mg/liter	Highest Concentration Permitted mg/liter	Highest Concentration Permitted mg/liter
Total solids	500	1500	1500
Color	Colorless	Colorless	Colorless
Taste	Palatable	Palatable	Palatable
Smell	Palatable	Palatable	Palatable
Turbidity	5	25	25
Chlorides	200	600	600
Iron	0.1	1	0.3
Manganese	0.05	0.5	0.1
Copper	0.005	1.5	0.005
Zinc	5	15	15
Calcium	75	200	200
Magnesium	30	150	150
Sulphates	200	400	400
Total brackish	100	500	500
Nitrates	45	-	50
Phenol	0.001	0.002	0.002
Detergents	0.02	1	1
Fluorides	0.6	-	-
PH	7.8	Min 6.5	Min 6.5
Vital requirement for oxygen	0.25	1	1
Arsenic	-	0.01	0.01
Cadmium	-	0.003	0.003
Chrome	-	0.05	0.05
Cyanide	-	0.05	0.02
Mercury	0.001	0.001	0.001
Celeom	0.01	0.01	0.01
Hydrocarbons	0.002	0.002	0.002

3. Discussion

The physico-chemical and biological parameters of the drinking water supply in Baghdad Province- al adhamiya city is given in table 1, 2, 3 and 4 .The results are then compared with National Drinking Water Quality Standard (NDWQS) of Iraq and WHO guideline value for drinking water in table 5. Results revealed that the all property in the drinking water of the sampling sites was suitable for drinking water when comparing within the guideline of National Drinking Water Quality Standard (NDWQS) of Iraq.

4. Conclusion

From the following study of drink water of Baghdad Province- al adhamiya city, it can be observed that the pH of water is within the permissible limit while most of the parameters like TDS, Alkalinity, Ca hardness, Mg hardness, Chloride, Fluoride, and Nitrate have the values more than the permissible limit. So it is concluded that groundwater of Baghdad Province- al adhamiya city region is highly contaminated and thus a regular and periodical monitoring of water is suggested.

References

- A.K. SUTHAR, R. S. R. M. A. S. S. 2012. Physico-chemical and microbiological studies of drinking water of Pali district, Rajasthan *Journal of Chemical, Biological and Physical Sciences* Feb-Apr.2012, Vol.2.No.2, 1061-1066
- APHA 1998. Standard methods for the examination of water and waste water, . 2nd ed. American Public Health Association, Washington, D.C. .
- ASHOK K. AGARWAL AND GOVIND S. RAJWAR 2010. Physico-Chemical and Microbiological Study of Tehri Dam Reservoir, Garhwal Himalaya, India. *Journal of American Science*, 6(6).
- FURHAN I NADEEM R MUHAMMAD A MUHAMMAD A 2005. Contamination of Kallarkahar Lake by inorganic elements and heavy metals and their temporal variations, . *Journal of Applied Science*.
- JOS P 2009. The origin of speciation: Trace metal kinetics over natural water/sediment interface and the consequences for bioaccumulation, *Environmental Pollution* 157: 519-527.
- KIRAN G. CHAUDHARI 2014. Physico-chemical Studies of Ground water samples. *Journal of Chemical, Biological and Physical Sciences*, JCBPS; Section D; Nov . 2014 – Jan. 2015, Vol. 5, No. 1; 901-905. .
- MARIA R. AGOSTINO S. MARCELLA GIOVANNI C 2009. Cadmium adsorption on Vermiculite, Zeolite and Pumice, . *Journal of Environmental Management* 90: 364-374.
- PRATIKSHA TAMBEKAR, P. M., R. J. BATRA AND R. G. WEGINWAR , 2012. Quality assessment of drinking water: A case study of Chandrapur District (M.S.) *Journal of Chemical and Pharmaceutical Research*, 4(5):2564-2570
- R. MATHUR, A. K. S., R. SHARMA, A. SHARMA & AND S. SHARMA 2010. ASSESSMENT OF GROUND WATER QUALITY OF RAJASTHAN WITH SPECIAL REFERENCE TO JODHPUR AND BARMER REGION *Int. J. Chem. Sci.*: 8(3), 2010,.
- WHO 1998. 2nd Edition, I. Recommendation, World Health Organization . Y, C. L. L. L. H. 2007. Influence of alkalinity, hardness and dissolved solids on drinking water test: A case study of consumer satisfaction, . *Journal of environmental Management* 82: 1-12.



Assistant Professor: Jassam Gzar Lafta

Received his B.Sc. in College of Agriculture, Department of Soil/ Baghdad University, Iraq, 1975 , received the M.Sc. degree in Soil Chemistry / salinity and reclamation / University of Anbar, Iraq, 2004 , currently he is lecturer, researcher and training supervisor, Dep. of Electronic in Institute of Technology Baghdad