

**Salahaddin University**

**Collage of science**

 **Environmental health and science department**

**Monthly and spatial variation of some Physical-Chemical variables in Greater Zab River-Kurdistan region of Iraq.**

 Research project

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by:

Mahdi Haydar Mohammed

Merna zaher abdulraheem

 Supervised by:

 Assistant lecturers: Rezan S. Ahmed

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**ABSTRACT**

The Great Zab River catchment is a major left-bank tributary of the River Tigris and drains a substantial part of the Kurdistan Region.This research was conducted to find out the monthly changes that occur in the Great Zab River, which include **(Temperature \ Turbidity \ PH \ EC \ T.D.S \ CL- \ Total hardness \ Alkalinity \ Ca++ \ Na+ \ K+ \ Mg++ \ NO3- \ SO4--).**  Three samples were taken over three consecutive months, from mid-October to mid-December. The result indicated that level of TDS was from 210 to 223 mg/L and was all lower than the acceptable level (500 mg/L). Turbidity of water samples in all three studied months were recorded higher level in December which was (9.4 NTU). And lower level was recorded in November which was (2.6 NTU). Concentration of Ca+2, Mg+2, Na+, K+ and Cl¯ in water samples for water samples from Greater-Zab river are all lower than permissible level that been recommended.

**INTRODUCTION**

It is well known that clean water is absolutely essential for several purposes for healthy living. According to WHO organization, about 80% of all the diseases in human beings are caused by water (Mishra, 2009).

Water resources are under relentless pressure due to population growth, rapid urbanization, industrialization and Environmental concern. Human and ecological use of instream water requires that both the quantity and the quality of water be considered (Chang, 2008; Masamba and Mazvimavi, 2008).

Both factors, contribute to pollution from municipal waste, mining and industry, and agricultural runoff, all of which further degrade water quality and thus the amount of quality water sources, further exacerbating the quantity of usable waters (Ali, 2010; Aziz, 2006; Toma, 2013). All of these factors clearly indicate that water is a highly valuable resource for human beings, but also recognise that good management is crucial for its preservation in quantity and quality.

Major nutrient sources for the water body include municipal and industrial sewage discharges, runoff from fertilizers and manure applied to agricultural land from diffuse sources in catchment areas (Howarth et al., 2000).

Human influences (industrial and agricultural activities, increased consumption of water resources) as well as natural processes (changes in precipitation inputs, erosion, and weathering) degrade surface water and impair its use for drinking, industry, agriculture, and recreation. or other purposes (Shekha, Y.A. 2008).

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Rivers are large natural stream of water emptying into an ocean, lake, or other bodies of water and usually fed along its course by converging tributaries. Although they contain only about 0.0001% of the total amount of water in the world at any given time, rivers are vital carriers of water and nutrients to areas all around the earth (Wetzel, 2001).

Rivers are the most important natural resource for human development but it is being polluted by indiscriminate disposal of sewage, industrial waste and plethora of human activities, which affects its physicochemical and microbiological quality. Increasing problem of deterioration of river water quality, it is necessary to monitoring of water quality to evaluate the production capacity ((Mishra, 2009).

 The physio-chemical study could also help in understanding of the structure and function of a particular water body in relation its habitants. The proper balance of physical, chemical and biological properties of water in river is an essential ingredient for successful production of aquatic resources (Hutchison, 1957).

The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such as color, temperature, acidity, hardness, pH, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality. Some physical test should be performed for testing of its physical appearance such as temperature, color, odour, pH, turbidity, while chemical tests should be performing for its BOD, COD, dissolved oxygen, alkalinity, hardness and other characters (Patil, 2012).

The aim of this study was to evaluate the levels of physical and chemical variables in order to determine the source of pollutants and water quality in the Great Zab River.

**Description of the study area:**

Greater Zab River is a large river (392 km) in Iraq. The river is one of the main tributaries of the Tigris. It originated mainly from the mountainous areas of Iran and Turkey. It is situated between 36◦ -37 north latitudes and 43◦-44◦ east longitude. The Greater-Zab River (Bahdinan River) is the only source of surface water in Erbil city for drinking and other purposes (Shuokr, 2009).

The Greater Zab originates in Turkish Kurdistan and is partly regulated by the Bekhma dam. Its length is 392 Km from the source to Almakhlut village in south of Mosul (Shareef, 2008)

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**Material and method:**

Water samples were collected from the Greater Zab Rive, in three consecutive months which are mid-October mid-November and mid-December. Analysed following methods outlined in the Standard Method for Examination of Water and Wastewater (APHA, 2005). The following water quality parameters were determined which were chosen as the major indicators namely temperature, turbidity, pH, electrical conductivity, total dissolved solids, alkalinity, total hardness, calcium, magnesium, sodium, potassium, chloride, nitrate and sulfate.

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| **Table (1): Physio-chemical parameters of three different sampling time.** |
| **Parameters** | **Unit** | **Water Quality Standard** | **Sampling (1)****October** | **Sampling (2)****November** | **Sampling (3)****December** |
| **temperature** | **Co** |  | **29.9** | **11** | **12** |
| **Turbidity** | **NTU** | **5** | **6.3** | **2.6** | **9.4** |
| **PH** |  | **6.5-8.5** | **7.7** | **7.1** | **7.5** |
| **EC** | **us/cm** | **1000** | **434** | **446** | **420** |
| **TDS** | **mg/L** | **500** | **217** | **223** | **210** |
| **Chloride** | **mg/L** | **250** | **12** | **12**  | **10** |
| **T. hardness** | **mgCaCO3/L** | **200** | **253** | **280** | **278** |
| **Alkalinity** | **mgCaCO3/L** | **200** | **200** | **215** | **200** |
| **Calcium** | **mg/L** | **100** | **63** | **70/** | **69** |
| **Sodium** | **mg/L** | **200** | **9** | **13** | **12** |
| **Potassium** | **mg/L** | **10** | **1.8** | **1.3** | **1.1** |
| **Magnesium** | **mg/L** | **30** | **24** | **26** | **26** |
| **Nitrate** | **mg/L** | **50** | **4** | **5** | **6** |
| **Sulfate** | **mg/L** | **250** | **79** | **66** | **76** |

**Results and Discussion:**

The average of the main physical and chemical properties (turbidity, pH, electrical conductivity, total dissolved solids; alkalinity, total hardness, calcium, magnesium, sodium, potassium, chloride, nitrate and sulfate) of water samples from Greater-Zab river and the taken data shown in table above.

Turbidity of water samples in all three studied months were recorded higher level in December which was (9.4 NTU). And lower level was recorded in November which was (2.6 NTU). This may relate to the higher flow rate of river water and discharge of materials into the water body.

Higher temperature recorded in October which was (29.9℃) and temperature is a factor which effects on the almost all other parameters in the water. Temperature effects the seasonal and diurnal variation. It controls the rate of all biochemical and biological reactions including growth, multiplication, decay, mineralization, production etc (Kanchan, 2000).

The greater amount of electrical conductivity (EC) was recorded in November which was (446 μS cm -1). Values of EC of water samples from selected months were (420-446 μs/cm) lower than the acceptable level recommended by (WHO,2004). Electrical conductivity is measured with the help of EC meter. The permissible limit for electrical conductivity (EC) is 300 μS cm -1. The instrument is standardized with known values of conductance observed with standard KCl solution It gives an idea of soluble salts present in the water samples (Patil, 2012).

The level of TDS was from 210 to 223 mg/L and was all lower than the acceptable level (500 mg/L). TDS is a measure of all the chemical constituents dissolved in water, it is mostly influenced by the concentration of major ions; calcium, bicarbonate, magnesium, sulfate and chloride and it is closely linked to the EC (Shareef, 2009). Total Dissolved Solids measures the amount of different inorganic salts dissolved in water. High levels of dissolved solids content indicate poor water quality and vice versa (Shekha, Y.A. 2008).

The results obtained by water surveys conducted in this investigation showed that total hardness values were often higher than the minimal permissible level recommended by the WHO for drinking water. The observed values of alkalinity were slightly within the permissible level recommended by the WHO for drinking water. Alkalinity, pH and hardness affect the toxicity of many substances in the water. It is determined by simple dil HCl titration in presence of phenolphthalein and methyl orange indicators (Patil, 2012).

Concentration of Ca+2, Mg+2, Na+, K+ and Cl¯ in water samples for water samples from Greater-Zab river are all lower than permissible level that been recommended. The concentrations of sulfate of this survey varied from (66-79mg/L) were within the acceptable level for drinking purposes according to WHO standards.

The nitrate concentration in surface water is normally low (4-6mg/L), but can reach high level as a result of agriculture run-off, contamination with human and animal wastes. The concentrations often fluctuate with the season and may increase when the river is fed by nitrate-rich aquifers (WHO,2003).

Sulphate is one of the important indicators of the presence of a state of contamination of the water source water is that it comes from multiple sources, including sewage water, industrial water, and soil solutions, especially gypsum consisting of the watery compound CaSO4 that characterizes soils. Its effect on a person who is accustomed to fresh water is characterized by an increase in the incidence of diarrhoea in If sulphites exceed 250 mg/L. (Ali, 2009).

Generally, pH values were in alkaline side, the range of pH in Erbil province fell in accordance with the known values of Kurdistan waters and also other part of Iraq. pH usually has no direct impact on water consumer; it is one of the most important parameters, careful attention to pH control is necessary to all stages of water treatment. The optimum pH value for drinking water purpose is (6.5-8.5) (Toma,2000).

**Conclusion and Recommendations:**

The effects of water pollution are not only devastating to people but also to animals, fish, and birds also destroys aquatic life and reduces its reproductive ability. Polluted water is unsuitable for drinking, recreation, agriculture, and industry. It diminishes the aesthetic quality of lakes and rivers. Eventually, it is a hazard to human health.

To minimize the pollution in drinking water we can use modern technologies such as reverse osmosis and ozonation in large scale, which are effective in the treatment of water but their feasibility in a rural setting needs to be worked out.

The present review paper undertaken to account to bring an acute awareness among the people about the quality of water. The individual and the community can help minimize water pollution by simple housekeeping and management practices the amount of waste generated can be minimized.

Reducing the use of chemical fertilizers and pesticides that can decrease the water quality when back irrigation water discharges to the rivers. Improve pollution control planning. Water pollution control planning in river basins should be improved, with the introduction of more realistic and tangible targets. Pollution control should not be regarded as the final target, but the way to achieve a clean and healthy water environment. This requires a long-term, integrated, but progressively targeted strategy for the protection of water quality.

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