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Study of Water Quality of Tigris River Upstream Al-Kut Barrage

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Abstract. The study was conducted on the water quality of Tigris River in upstream of AL-Kut Barrage during the period of August 2018 to June 2019. Six vertical sections have been selected upstream of Al-Kut Barrage. The distance between one section to another was 100 m, the first section begins at 350 m from the origin of Barrage. The result showed that the values of cadmium ion were 0.0346 ug/L to 0.0707 ug/L. The Lead values of the Tigris River water samples were 4.29 ug /L to 8.33 ug /L. The values of nickel ion have been ranged between 7.59 ug/L to 9.75 ug/L. Zinc ions have been recorded 53.5 ug /L to 72.1 ug /L. The concentration of above ions was situated within Iraqi and world Health organization (WHO) criterions that relating with propriety of water of Tigris River for drinking and irrigation.

Keywords. Water quality, Tigris river, Al-Kut Barrage.

I. INTRODUCTION

Water quality is indicator of the suitability of water using by humans, animals and plants [1]. The purpose of evaluating irrigation water depend on the risks that this water poses to the soil and the growth of crops and animals, as well as the people who consume these crops [2]. The most important indicators that affect water quality is chemical (salts and other chemical compounds), physical (heat and radiation), and (taste, color, and smell) [3]. Hilgard (1906) [4], was the first researcher that mentioned the importance of irrigation water quality based on the chemical composition and total concentration of dissolved salts, followed by many researchers in this field like [1,5]. The water quality in Iraq has been affected by different forms of pollutants as a result of human activities, including, waste water and waste from cities, and factories that flow into riverbeds without treatments. Agricultural is one of the factors contributing to the deterioration of water quality [6]. Juttner [7], have been explained that the most important bio-chemical indicators that effect on water quality come from wastewater by humans, and these indicators are temperature, turbidity, oxygen dissolved, nutrients and factories.

The used water that used in different activity contains a lot of dissolved salts in different concentration and ionic composition. This is coming with negative results on chemical and physical properties of the soil and productivity of plants. According to International Food and Agriculture Organization (FAO), the water quality depends on the total concentration of salts as the main quality factor for the use of irrigation water [8].

Heavy metals in the environments indicate that it is exposure to contamination [9], indicated that the concentration of these elements in the river depends on the temperature, salinity, pH, organic and mineral materials. Heavy elements are present in a dissolved state, in suspended loads, sediments, or within the crystalline composition of the minerals. The sediment particles with a volume of less than (2μ) contain high concentrations of heavy elements due to their high content of clay minerals that have a high adsorption capacity for these elements .

The aims of this study:

1- Study of the elements in Tigris River and their effect on water quality.
2- Determine the heavy elements in the Tigris River.
3- Study the water quality and its suitability for agriculture.

II. MATERIALS AND METHODS

This research has been conducted on the Tigris River (in front of Al-Kut dam). The study period was (11 months), six sites sections has been selected, in advance of the Kut dam. One hundred meters was the distance between one site and another.

- **Water samples**

Water samples were taken from each section of the river for three sites. The first site is located on the right side, the second site is,in the middle of river and the third site is on the left side of the river. Two water samples were taken from each location, the first at a depth of 0.2from the, and the second at a depth of 0.8 from the river's water level. Samples of water were collected one time/month from different sites, starting on August 2018 till June 2019. The time for collecting the sampleas was morning time for all period of study. Samples were taken using model-taking equipment. this samples has been used for conducting physical and chemical analysis. The samples analysis using 1 ml of (manganese sulfate solution and 1 ml alkyl iodide azide solution). This is for maintain the oxygen level until laboratory work. Also, 2.250 L of polyethylene has been used after washed well with river water.

- **Evaluate heavy elements**

Heavy elements has been determined using Atomic Absorption spectrometer (AAS) equipment. This equipment has been used for estimate lead, cadmium, copper, zinc, and manganese. According to [10], each element has its own wavelength.

- **Statistical analysis**

The data has been analysis by using Genstat program for found least significant differences L.S.D (0.05) between samples.

III. RESULTS AND DISCUSSION

- **Heavy elements**

Figure (1) shows the cadmium values in the water samples of the Tigris River sections during the months of the study. The time 14/6/2019 has been recorded 0.0346 ug/ L for the first section S1 and 0.0707 ug/ L for the sixth section S6. From these results, the cadmium values in the Tigris River water samples and for all sections were within the permissible limits, according to the Iraqi, the World Health Organization WHO and Canadian standards, the results have been recorded 0.003, 0.0051, 0.0002 ppm respectively (Fig. 1), whether for drinking, irrigation or aquatic biology purposes. Therefore, there are significant differences between the cadmium values of the sample's models taken on 12/8/2018, 12/15/2018, 2/8/2019, 27/4/2019 and 14/6/2019, while the differences were not significant between the cadmium values of the samples which were taken on November 2018 and May 2019.

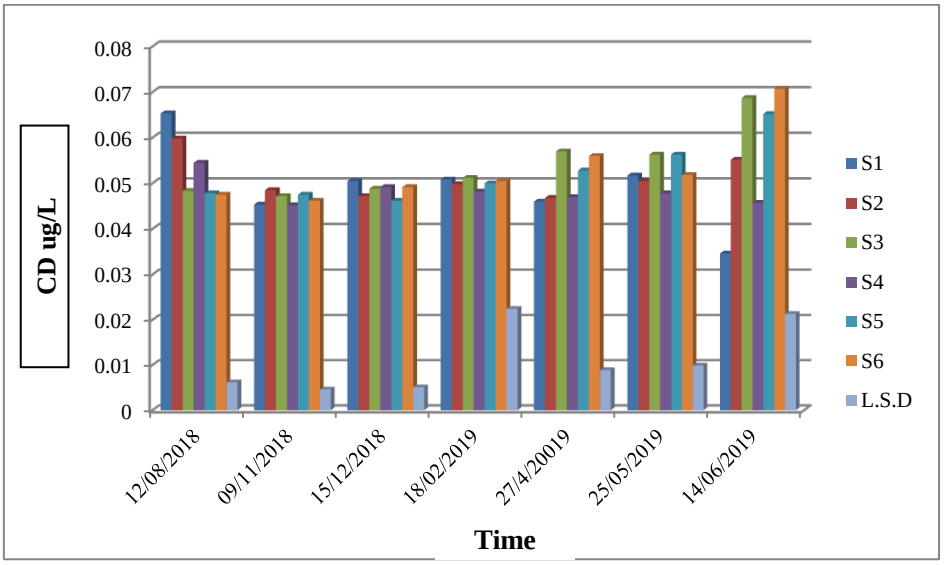

FIGURE 1. Cadmium values in the sections of the Tigris River.

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Figure (2) show the values of lead in the water samples of the Tigris River. The results have been indicated that 4.29 ug/ L (0.0043 mg/ L) for the sixth section S6, and 8.33 ug/ L (0.0083mg/ L) for the third section S3. These results were collected on 14/6/2019 and 27\4\2019 respectively.

The results showed that the lead values in the Tigris River water samples and for all sections were within the permissible limits. according to the Iraqi and the World Health Organization WHO and Canadian standards, samples were recorded 0.01, 0.2, 0.007 ppm respectivety, except the sections S1, S3, and S6, whose water samples were brought on 27/4/2019 and were outside the permissible limits (Fig. 2).

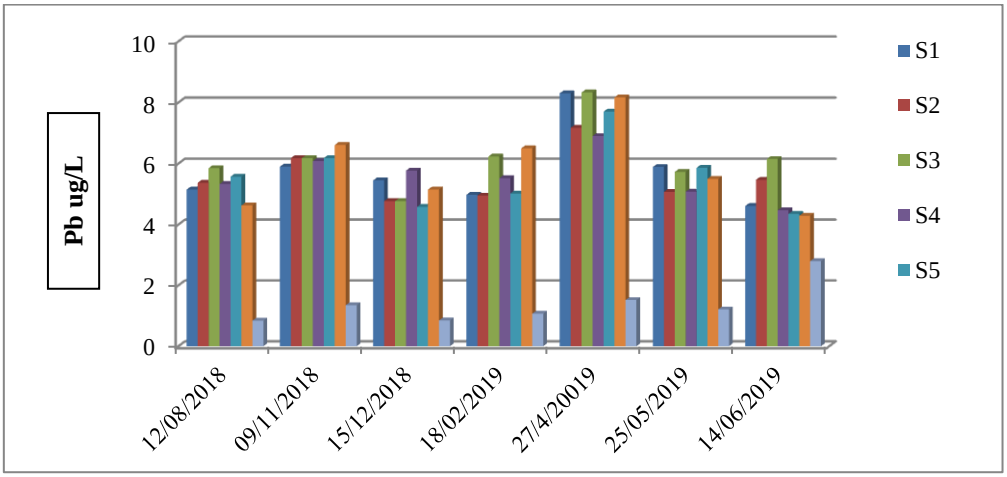

FIGURE 2. Lead values in the sections of the Tigris River.

Figure (3) indicate the values of nickel in the water samples of the Tigris River. The results has been recorded 7.59 ug/ L (0.0076 mg/ L) for section S1 which taken 14/6/2019 and 9.75ug/ L (0.0098 mg/ L) for section S1 which taken 12/8/2018.

The results in Figure (3) showed that the nickel values in the Tigris River water samples for all sections were within the permissible limits and according to the Iraqi and WHO and Canadian standards, which were 0.02, 0.2, 0.15 ppm Respectively. The differences between the nickel values samples were mostly not significant, while the samples were significant differences between the samples for the time 15/12/2018 (Fig. 3).

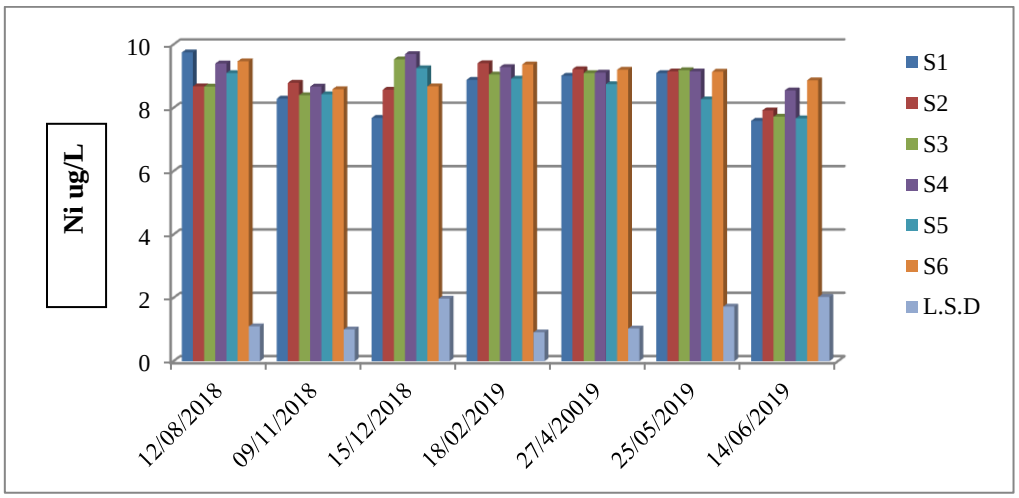

FIGURE 3. Nickel values in the sections of the Tigris River.

Figure (4) shows the values of zinc in the sections of Tigris River for all months of the study. The values ranged between 53.5 ug/ L (0.054 mg/ L) for the fourth section S4, from which water samples were brought on 14/6/2019, while 72.1 ug/ L (0.072 mg/ L) for the sixth section S6, which the water samples were taken on 18/2/2019.

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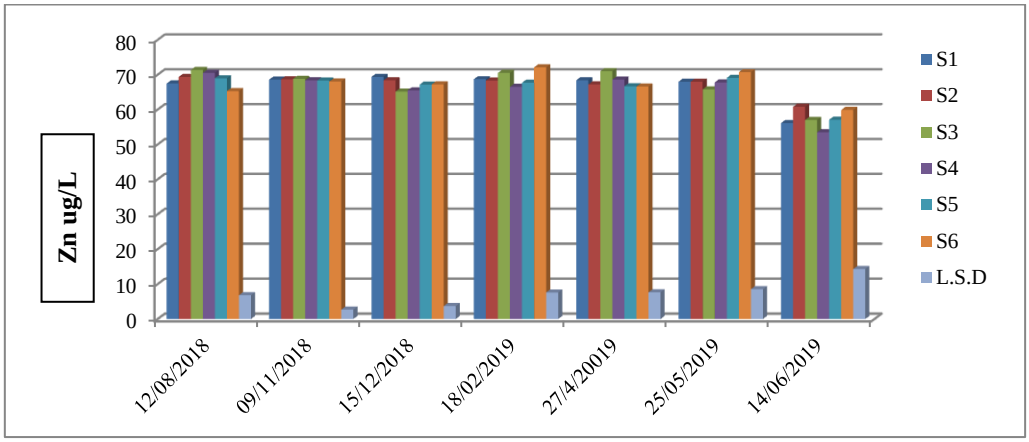

FIGURE 4. Zinc values in the sections of the Tigris River.

The results in Fig. (4) showed that the zinc values in the Tigris River samples and for all sections were within the permissible limits and according to Iraqi and Canadian standards, which were 3, 1, ppm, respectively, while the zinc values for all the studied sections exceeded the permissible limits of the WHO and amounted to 0.03 ppm, regarding the validity of water for irrigation purposes. The results showed that the differences between the zinc values of the samples were mostly not significant, except for the zinc values for the sections, from which the water samples were taken on December 15, 2018 were significant. This is because to the wastewater, agricultural wastewater, and wastewater from factories discharged in the river surrounding study area.

IV. CONCLUSION

This research concluded that the wastewater, drainage and industrial waste water have been increased the concentrations of heavy elements. The cadmium has been recorded 0.0346_0.0707ug/ L, 4.29_8.33 ug/ L lead, and 7.59_9.75 ug/ L nickel, while the zinc record 53.5_72.1 ug/ L. the heavy elements have been increased for all sections during the period of study. The reason for this increase was the wastewater and industrial wastes discharged into the Tigris River.

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