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The Effect of Purification Units for Drinking Water Spread in Al-Alam and Al-Bu Ajil on Heavy Metals

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ABSTRACT

The current study was carried out on the treatment and treatment units located in the district of Al-Alam and the village of Al-Bu Ajil, which are located near the Tigris River, with two stations for each region for the period from September 2020 to February 2021, as two samples were collected for each treatment unit by a sample before treatment and a sample after treatment. Iron values ranged between (0-0.9) mg / liter before and after treatment, and they ranged between (0-0.05) mg / liter, and zinc values were recorded values ranging between (0-0.9) mg / liter. Before treatment and after treatment, it ranged between (0-0.05) mg / liter, while the aluminum values were relatively few, as values ranged between (0.03_0) mg / liter. As for the values after treatment, they were (0) mg / liter. Cadmium values were between (0,1_0) mg / liter. In the samples after treatment also, all values were (0) mg / liter in all stations, and the nickel values ranged between (0,9_0) mg / liter in the samples before treatment and after treatment. The values were all (0) mg / liter in both stations, and the copper values were very low in the mentioned areas, as values ranged between (0.1_0) mg / liter before treatment and after treatment, the values were (0) mg / liter. In both stations, the purification plants proved their high efficiency in filtering water from heavy elements, and the samples after treatment were in conformity with the Iraqi standards for drinking water. It is worth noting that the purification plants in the areas of Al-Alam and Al-Bu Ajil need a constant monthly maintenance and a replacement process for the filters as they draw their water from wells.

***Keywords*-** Water, Zinc, Cadmium, Nickel, Aluminum, Iron, Heavy Metals.

I. INTRODUCTION

Water is the pillar of life and the basis of existence and one of the most important components on the surface of the globe, as water covers the entirety (71%) of the entire surface of the globe. As for fresh water, it is a small percentage that does not exceed (2%) of the total water (Abdul-Jabbar et al., 2006). A great importance imposed by the human need for it as a source of drinking, as this water must be free of various pollutants such as chemicals, suspended matter, pathogenic organisms and everything that affects its qualities and characteristics (Abu Saada, 2000) and Fertum (2018) showed that more than (16%) Of the world's population still suffer from polluted and unhealthy water.

The quality of the water of the Tigris River has deteriorated from what it was twenty years ago for many reasons, including the neighboring riparian countries on the river, water storage in dams and lakes, or the increased consumption of water for domestic, industrial and commercial uses, which leads to an increase in the discharge of polluted water into the river, and the difficult conditions that have passed In Iraq, which led to a decrease in the rates of processing of safe drinking water, as well as a deterioration in the quality of drinking water (Al-Mashhadani, 2012). The development taking place in the population societies, the progress of agriculture and industry, and the increase in the population has led to the accumulation of various forms of waste and pollutants that would pollute surface water in different degrees and types (Al-Saadi, 2002). The sources of water pollution are different and numerous, and the most important of these sources are industrial and human waste. of various types, which may cause death to various living organisms (Al-Sarraf, 2006).

The toxic effect of many heavy metals is the most dangerous because of their high stability, which makes them move long distances and easily. Heavy metals also have the ability to destroy life cycles and cellular structures, and they can resist the cracking process by microorganisms (Forsther & Wittman, 1981). Heavy metals also have bioaccumulation (Bioaccumulation) their concentrations accumulate when they are transferred, which are transmitted from one organism to another (Martin et al, 2015).

II. MATERIALS & METHODS

***Description of the study sites*:**

The purification unit on the outskirts of the city of Tikrit: This unit is located on the outskirts of the city of Tikrit, Al-Alam district, which is adjacent to Tikrit from the west. This unit was chosen because it treats well water and transforms it into potable water, and the residents turn to it.

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The purification unit in the outskirts of Tikrit: This unit is located on the outskirts of Tikrit, specifically in the AlbuAjeel area, where the existing purification unit filters and treats wells water to provide residents with drinking water. It is an area of a rural nature and uses well water for various uses.

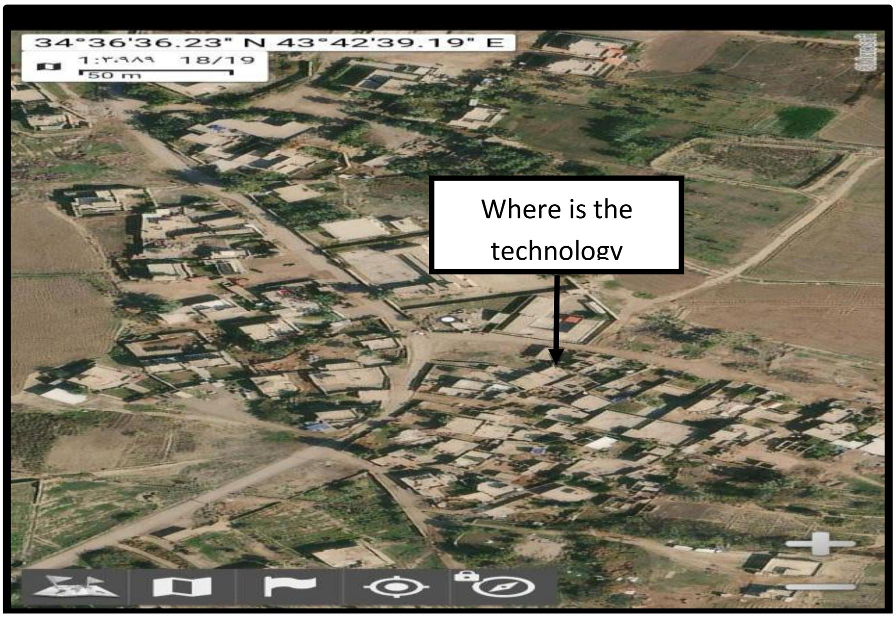
III. COLLECTIONS OF MODELS

Samples were collected monthly for a period of six months from September 2020 to February 2021, with two purification and treatment units, the first is located within the Al-Alam district, adjacent to Tikrit, and the second is located within the village of AlbuAjil, which is located on the outskirts of the city of Tikrit. The sites were selected based on the availability of samples and on the population density. According to the people's turnout for these units, as these sites are where water wells are used for various uses (drinking). Tests were conducted per month at the rate of two samples per unit to purify a sample before treatment and a sample after treatment using 250 ml glass bottles, as the samples were transported to the laboratory by means of Iced cork to preserve water properties Tests were conducted to detect heavy metals present in the samples before and after treatment.

It symbolizes the purification unit in the district of Al-Alam (first station (pr1)

It symbolizes the purification unit in the village of AlbuAjil (Pr2).

The geographical location of the treatment unit in the district of Al-Alam



The geographical location of the treatment unit in the village of AlbuAjil.

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IV. ESTIMATION OF HEAVY METALS CONCENTRATION

According to the method described in APHA (2005), a PerkinElmer A Analyst 200 Spectrometer Atomic Absorption of Singapore origin is used to measure the concentration of heavy metals (cadmium, copper, lead, zinc) in mg/L; As the samples are filtered with filter paper and 100 ml of sample water is taken in a glass beaker, 5 ml of concentrated nitric acid is added to it, then placed on the hot plate with an hour bottle on it, then left to boil until its quantity reaches 10 ml, then the watch bottle is washed and the volume is completed to 100 ml Distilled water, then a lamp is installed for each element in the atomic spectrometer, as well as the appropriate wavelength. The device is turned on and then measured**.**

Atomic Absorption spectrometer

V. RESULTS AND DISCUSSION

Copper (Cu)

Copper is one of the heavy metals that is found in little in the earth's crust, as it is present in proportions that do not exceed (0.1). They are called heavy elements based on the division of elements depending on the density, as their density is more than 5 mg / liter (Tucker et al, 2003). The copper element also has the ability to move in acid-oxidizing environments (Salmonos, 1995), it reaches the environment through mining (Gautam et al, 2010) and causes water pollution due to its wrong additions to canning containers (Onundi et al, 2010) and it has severe damage to the environment. Human health, as it affects the kidneys and liver (Lemos et al, 2009). The copper values in the stations ranged between (0_0.1) mg / liter in the water samples before treatment. The highest percentage (0.1) mg / liter was recorded in September in the first station and the lowest value was (0) mg/L for the same station in October, December, January and February. As for the samples after treatment, there were no copper concentrations, as the purification units proved their efficiency in isolating copper from the water prepared for drinking. Between (47_62) mg / liter and close to the results recorded (Al-Sarraj et al., 2019).

Table 1: Shows the values and concentrations of copper during the study period

Monthly changes of copper values (mg/L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	**Pr1**
0.0	0.0	0.0	0.0	0.00	0.001	0.0	0.0	0.0	0.0	0.0	0.0	**Pr2**

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Zinc (Zn)

Zinc concentrations are somewhat low due to the dominance of heavy metals that are less soluble in natural waters (Boyd, 2000). One of the main sources of zinc in water is mining and coal burning (Guatam et al, 2014). Anemia, low protein, cholesterol, and pancreatic damage (AL-Rawi, 2019). The zinc values in the two stations ranged between (0.1_0.9) mg/L, and the highest value of zinc was recorded in the second station, which amounted to (0.9) mg/L. liter during the month of September and the lowest value was (0.1) mg / liter. The values of zinc for samples after treatment ranged between (0_0.02) mg / liter, as the used purification units proved their high efficiency in controlling the concentrations of zinc and reducing its concentrations to the values of They are imperceptible in the water prepared for drinking from these units, as these results were much lower than what was recorded (Al-Mashhadani, 2019) during his studies on the Khosr River and the Tigris in Mosul.

Table 2: Shows the values and concentrations of zinc during the study period

Monthly changes of zinc values (mg / L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0	0.3	0	0.0	0.001	0.9	0	0.05	0.0	0.5	0.0	0.4	**Pr1**
0.00	0.9	0.0	0.02	0.01	0.10	0	0	0.01	0.5	0	0.3	**Pr2**

Cadmium (CD)

A toxic element that spreads quickly and is considered one of the polluting elements, as its concentrations in the table are imperceptible, and the reason for this is that the rains and floods led to the dilution of its concentrations (Langston et al, 1999). Cadmium values ranged between (0.1) mg / liter as the highest value For the first station in September, the lowest value was (0) mg / liter in the same station. In the second station, which is the village of Al-Bu Ajil, cadmium concentrations were relatively non-existent, as the average concentrations reached (0) mg / liter in the station for all months. The results were close to those recorded by Al-Mashhadani (2012) in his study of the quality of the Karkh water project in Tarmiyah. The water supplied in this unit conformed to the standard specifications of Iraqi drinking water.

Table 3: Shows the values and concentrations of cadmium during the study period

Monthly changes of cadmium values (mg / L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0	0.001	0	0.1	0	0	0.0	0.1	0.001	0.21	0	0.01	**Pr1**
0	0	0	0	0	0	0	0	0	0	0	0	**Pr2**

Nickel (Ni)

Nickel rates ranged between (0.001_0.9) mg/L in the first and second stations, where the highest value was recorded, which reached (0.9) mg/L in the first station during February, and the lowest value was (0) mg/L in the second station for each of In January and February, these values and concentrations in the second station are imperceptible, as the results were higher than those recorded by (AL-Wahab, 2012) in his study of assessing heavy metals in drinking water at Baquba water purification plant, as the results were between (0.0-0, 20) mg / liter and higher than the results of (Abdul-Jabbar and his group, 2013) in the study of the presence of some heavy metals in the waters of the Tigris River north of Tikrit within Salah al-Din Governorate. The water prepared for drinking from these units conforms to the Iraqi standard specifications for drinking water.

Table 4: Shows the values and concentrations of nickel during the study period.

Monthly changes of nickel values (mg/L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0.0	0.9	0.001	0.1	0.0	0.08	0.0	0.1	0.0	0.01	0.001	0.20	**Pr1**
0.0	0.0	0.001	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**Pr2**

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Aluminum (AL)

The aluminum values in the studied stations ranged between (0_0.03) mg/L, as it reached the highest value of aluminum during the month of December, which amounted to (0.03) mg/L in the table that shows the values and concentrations of aluminum that the samples in the first station before treatment were The aluminum concentration is (0) mg/l. After treatment, the values increased, and this may indicate a defect in the purification system and the failure to replace filters or maintain the system during the month of December. As for the rest of the values, they were much lower than the results reached by (Ghawi, 2017), in the study of the concentration of heavy metals in drinking water in Al-Diwaniyah Governorate, which amounted to (0.7_4.2) mg / liter. The prepared samples were drinkable and in compliance with the Iraqi drinking water standard specifications.

Table 5: Shows the aluminum values and concentrations during the study period

Monthly changes of aluminum values (mg/L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0	0	0	0	0.01	0	0	0	0	0	0	0	**Pr1**
0	0.02	0	0	0.03	0	0	0	0	0	0	0	**Pr2**

Iron (Fe)

The values of iron in the water samples of the studied stations ranged between (0.22_0.9) mg/L, with the highest value reaching (0.9) in the second station during the month of September, while the value was (0.10) mg/L in the first station during the month of October. The second. As for the samples after treatment, iron concentrations ranged between (0_0.40) mg/L. These results were close to the results obtained by (AL-Sulaimaen, 2009) in assessing the quality of drinking water in Al-Diwaniyah Governorate. The prepared drinking water from these units was in conformity with the Iraqi drinking water standard specifications**.**

Table 6: Shows the iron values and concentrations during the study period

Monthly changes of iron values (mg / L) during the study period 2020-2021												
February		January		December		November		October		September		**Months/Stations**
After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	
0	0.40	0.001	0.1	0.02	0.4	0.0	0.1	0.001	0.8	0.001	0.10	**Pr1**
0	0.10	0.0	0.9	0.0	0.10	0.0	0.22	0.001	0.10	0.0	0.9	**Pr2**

Iraqi and international determinants of drinking water

EPA	**Iraqi 2009**	**European**		**WHO 2004**		**determinants adjectives**
the highest rate	**allow to**	**the highest rate**	**allow to**	**the highest rate**	**allow to**	
	5	**—**	**—**	**5**	**—**	**turbidity**
8.5	**6.5-8.5**	**—**	**—**	**9.2**	**6.5**	**Acidic function Ph**
—	**1400**	**—**	**—**	**1400**	**—**	**electrical conductivity (micro Siemens/cm)**
—	**1500**	**—**	**—**	**—**	**1000**	**Total dissolved solids (mg. L-1)**
5<	**5<**	**—**	**5**	**—**	**5.0**	**dissolved oxygen (mg. L-1)**
5>	**5>**	**—**	**5>**	**—**	**5>**	**vital oxygen requirement (mg. L-1)**
200	**170**	**—**	**—**	**150**	**—**	**total basal (mg. L-1)**
250	**500**	**—**	**—**	**500**	**100**	**total hardship (mg. L-1)**
—	**200**	**—**	**—**	**200**	**75**	**Calcium (mg. L-1)**

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—	**150**	**50**	**30**	**150**	**30**	**magnesium (mg. L-1)**
200	**200**	**—**	**250**	**250**	**—**	**chloride (mg. L-1)**
—	**10**	**—**	**—**	**0.0**	**—**	**chloride (mg. L-1)**
—	**0.0**	**—**	**—**	**0.0**	**—**	**.F. coll (cell. 100ml-1)**

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