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Environmental Study of Water Quality, Some Heavy Metals and Bacterial Pollution in Euphrates River in the City of Nasiriya

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Abstract: This study was aimed to detect possible environmental effects on the Euphrates River in Nasiriya city. Two sites were selected along the study area which is carried out during the November 2016-April 2017. Physical and chemical properties are measured (air and water temperature, pH, salinity as well as the average of some heavy metals: Pb, Ni and Cd. The present study was diagnosis some of bacteria in the water. The result revealed a clear balance between the temperature of water and air in the stations studied. the lowest rate of air temperature was (23°) in the first station and the lowest value was (20°). While the water was above the value of 22° in the second station and the maximum rate of air temperature was (24°) in the second station. Furthermore, the pH was values tended to base. It is reached the highest value (8.10) in the second station and the lowest value (7.95) in the first station. Also, there was change in the value of salty for station in the study. The concentrations of heavy metals in water for the second station were higher than in the first station, for, Pb and Ni and Cd concentrations were 1.98, 1.03, 0.24, respectively. The present study was isolate types of bacteria such as *Escherichia coli, pseudomonas* sp. and *Aeromonus* sp.

Key words: Heavy metals, bacteria, environmental effects, temperature, Euphrates River, chemical properties

INTRODUCTION

Rivers are one of the most important sources of fresh water used by humans. Their accessibility increases their use and makes them highly susceptible to pollution (EPA., 1999). Many communities rely on river water for various purposes such as drinking, agriculture, transportation and industrial uses. They also provide environmental systems that provide habitats for various species of animals and plants, as well as sites for recreation and swimming (Murck, 2005). The exposure of rivers to different types of pollutants negatively affects their composition and balance, exposing different communities to hazards, especially, the human communities on which they rely as a major source of water for civil, agricultural and industrial purposes (Hassan *et al*., 2001). Water pollution is defined as a change in the chemical, physical or biological properties to a grade that makes water harmful to humans, animals or properties (Hassan *et al*., 2001). The most environmental pollutants are fecal pollution, especially in rural areas Fecal waste. As this is most evident in the developing countries (WHO., 1997; Feachem, 1975). One of the most prominent materials for surface water is dissolved organic matter which can be oxidized by some microscopic organisms that need oxygen (Hynes, 1960). These organic substances encourage the growth and reproduction of certain microorganisms (Mason, 1981). There is also a group of pathological organisms such as the intestinal family Enterobacteriaceae as *Salmonella* spp., *E. coli, Shigella* spp. bacteria (McFeters *et al*., 1974). Waste of water in factories accounts about 60% of the total pollutants of the sea, lakes and rivers (WHO., 2003). Sewage was described as one of the most serious public health problems in most countries of the third world (WHO., 2002) indicated that sewage is responsible for the transmission of various pathogens, so that, people are susceptible to bilharziasis, yellow fever, typhoid, etc. The physical and chemical properties of water have a role in influencing waters. Heat plays a role in the chemical reactions of the aquatic environment through its effect on the metabolism of water and its ability to compete with each other (Weiner, 2000). Salinity is one of the most important water quality specifications for all uses and has a direct role in determining the quality and abundance of aquatic characteristics (Wetzel, 2001). It also has a direct effect on the uptake of some elements by benthic and algae (Munda, 1984; Popoff, 1984). pH is also a factor in aquatic life because most metabolic events depend on the pH (Wang *et al*., 2002). The solubility of the elements in the water depends on the pH as most of the elements remain dissolved in the low pH and in the case of increasing the

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Table 1: The environmental characteristics of the Euphrates River

Factors	Station 1 (°C)	Station 2 (°C)
Team A	23	24
Team W	20	22
pH	7.95	8.10
NaCl	4.1	2.5
Pb	1.98	1.63
Ni	1.03	0.91
Cd	0.24	0.31

pH of carbonate and then oxides and hydroxides are those elements that can settle in the bottom as insoluble sediments (Agarwel, 2009). Trace elements are present in the aquatic environment in nature but with a few concentrations. Increasing rates of these elements leads to physiological damage and the destruction of different characteristics (Taobi *et al*., 2000).

The aim of study: The study aims at measuring some environmental characteristics (temperature, acidity and salinity, measuring some of heavy elements (Cd, Pb, Ni) and estimating the bacterial pollution of the Euphrates River in Nasiriya city (Table 1).

MATERIALS AND METHODS

Area of study: The first station: the entry of water to the city of Nasiriya. The second station: the center of the city of Nasiriya, near the bridge of Al-Zaytoon.

Sampling collection: Water samples were collected from two stations from the center of the river and at a depth of approximately 30 cm below the surface. The samples were collected using plastic bottles (polyethylene) of 5 L per sample, randomly at each station for physical and chemical analysis. Adding a few drops of concentrated nitric acid equivalent to 2 mL per liter of the sample as a stabilizing agent for keeping trace elements in water. The samples were examined for all measurements in the Graduate Laboratory at the Department of Biology, College of Science, University of Thi-Qar.

Water samples were collected for germination tests in 500 mL clean glass bottles with sterilizing plugs. The bottles were closed and half-coated with aluminum foil. They were sterilized at 121°C and 15 pounds/ang^2 was pressed for 15 min. After collecting the samples, sterile and leave an aerobic vacuum inside the bottle and then stored in a flint container on the crushed ice until it is transferred to the laboratory within 2-3 h for the necessary tests.

Physical and chemical measurements

Temperature: The temperature of the air and water was measured directly in the sample sites using the normal temperature range from 0-100 m , if the temperature of the air is measured first in the shade, then measured water temperature after immersed in the water for 5 min, then measurements are taken for several times for checking.

pH: The pH of the water was measured on-site using pH-meter (HI8424), manufactured by HAA, after calibration with pH buffer solutions (4, 7 and 9) prior to research (APHA, 2003).

Salinity: Salinity was measured on-site by salinity meter.

Extract trace elements

Extract trace elements in water: Riley and Taylor (1968) method was used as water samples 5 L were filtered using a glass filtration unit and a vacuum pump with a diameter of 0.45 microns balanced and dried at 60°C after being soaked with nitric acid (0.5) (Ion exchange column 50*2.5 cm) containing a Chelex-100 resin in the form of sodium (Sodium Form) size (50-100 mm) at a flow velocity not exceeding 5 mm/min. Then rinsing the resin with 50 mL of nitric acid (2) caliber and add 10 mL of ions free of water to the column and then collect the solution passing through the column and a broom at 70°C. (1-2 mL) of concentrated nitric acid and 5-10 mL of ion free water for the purpose of complete dissolving and then complete the final volume to 25 mL with ions free water. Clean and sealed plastic bottles have the size mentioned until the measurement of atomic absorption spectrometer at the Environmental Research Center, University of Technology, Baghdad, Iraq.

Measurement of trace element ions: The trace ion elements were measured in the studied samples using the flame atomic absorption spectrophotometer. Cadmium, nickel and lead elements were measured. The special bulbs were used for each Hollow Cathod Lamp. Standard solutions were also prepared for the elements are examined from stock solutions.

Bacteriological examination (filtration method): The specific steps for examining the samples of water received into the laboratory can be summarized using this method by the following steps: 100 mL of the water model was passed onto the filtration unit. After filtering the water, the forceps of the filtration membrane are turned into a liquid medium to develop and isolate the bacteria on the membrane surface. After the filtration process, the filtration membrane is removed by sterile forceps to isolate the bacteria on the surface of the membrane.

Table 2: The types of bacteria that were diagnosed during the study

Stations	Bacteria diagnosed at the station
Station 1	*Escherichia coli, Pseudomonas*
Station 2	*Escherichia coli, Pseudomonas, Aeromonas*

Insulation and diagnosis: Samples were planted on the blood agar medium and MacConkey agar and after incubation period (24 h at 37°C), the following bacteria were diagnosed (Table 2).

Diagnosis of isolated bacteria: It was diagnosed with *Pseudomonas* spp. Depending on the fact that colonies pale blood analysis of the type of beta on the center of blood agars were green in color to black and lactose sugar fermentation on the center of agar MacConkey and green color for the production of dyes (pyocyanin) and smell similar to the smell of grape fermented as well as positive for the examination of catalysts and oxides (Riley and Taylor, 1968). *Escherichia coli* appeared on the middle of the MacConkey and rosy (because of its fermentation of lactose sugar), small, dry and with regular ends (Brooks *et al*., 2004). For *Aeromonas* bacteria are Gram negative non-productive spores are organic and anaerobic often living in the aquatic environment are positive for oxidase testing (Atlas *et al*., 1995).

RESULTS AND DISCUSSION

Table 1 showed environmental characteristics such as temperature of water and air with the lowest air temperature (23°C) at station 1 and the highest (24°C) in station 2 while the lowest water temperature was (20°C) at station 1 and highest (22°C) at station 2. The lowest pH (7.95) was recorded in station No. 1 and the highest was (8.10) in station 2. The research recorded the lowest level of salinity (2.5) per thousand, the highest level (4.1) and the lowest (1.36) in station No. 2. While nickel scored the highest rate of 0.91 in station No. 2 and the lowest level of 1.03 in station No. 1. Cadmium reached the highest level of 0.31 in station No. 2 and the lowest level of 0.24 in station No. 1.

The results were observed to have seasonal changes in air and water temperature rates. The difference between the brightness of the sun and the length of the daily lighting may be due to the difference in the time of collecting the samples and the speed of the flow which researches on the good mixing of the water which leads to smoothing the temperature from the bottom to the surface, the highest temperature levels were recorded at station 2 as the surface water temperature tends to follow changes in air temperature more often due to shallow water and increased surface area of water relative to size (Leclerc *et al*., 2002). For pH, it is the result of many chemical and biochemical reactions that occur in water. The value of pH plays a large role in the aquatic environment and depends on the activity of microorganisms and algae in particular. Algae consumes carbon dioxide for photosynthesis, pH value in the day and the microorganisms analyzed and the rest of the lives consume oxygen and release the second carbon dioxide respiration, decreasing the value of pH. It was noted through the results of this study that all water samples are of a basic nature and are a general feature of Iraqi water (Leclerc *et al*., 2001; Talling, 1980). The water base is indicative of the abundance of primary productivity. Carbon oxide water conversion to basal formation (Abdullah and Abboud, 1994). Salinity is a major contaminant in inland rivers (Hawakes, 1982). Iraqi waters are generally oligohaline between 0.5 and 5 parts per thousand, high salinity was observed at station 1 due to low water levels while a slight decrease in value at station 2 was due to the rise of river levels during this station increased salinity plays a role in reducing the toxicity of trace elements towards aquatic organisms because they form complexes with chlorine ions that make the element not dynamically available to use the organism and it researches to precipitation and increase the concentration of these elements in the sediment. The entry of trace elements into the aquatic environment changes over time, the main factor influencing this change is the untreated domestic, agricultural and industrial waste water and the use of fertilizers and pesticides containing heavy elements in agriculture (Reza and Singh, 2010), unlike organic pollutants entering water, biodegradation cannot remove heavy elements from the aquatic environment (Vukovic *et al*., 2002), so, it causes many toxic effects at different levels of organisms in the food chain to reach the human at the end of the chain (Blo *et al*., 2002). The highest concentrations of lead and nickel was in the first station while the lowest was in station 2, this may be due to differences in water levels as their height causes dehydration and dispersion of elements and the change in water level has an effect on the concentration of trace elements. The increase in water levels reduces the concentrations of trace elements dissolved in water, their decrease leads to increased concentrations of these elements (Azhar and Abd, 1985). Concentration of some trace elements may be affected by various factors such as pH and salinity (El Abidine, 1985), the pH plays a clear role in the transfer of elements between the two phases, as the drop increases the solubility in water which causes an increase in the spread and readiness of living characteristics in water. The results show that the lowest recorded concentrations are for cadmium, the highest concentration of elements (nickel, lead) is due to the high

concentration of lead resulting from high traffic near the study area which can add pollutants rich in trace elements, the studied areas are located near one of the public roads. As a result, these pollutants are distributed to the basic components of the environment by falling to the ground by gravity or by falling water dust or by wind mixed with river water which is loaded with various pollutants and sometimes transported to distances to receive it in a place that may be far from sources of pollution (Rajendran *et al*., 2005), the cadmium component recorded the highest rate at station 2 which can be attributed to the passage of the Euphrates River near the agricultural land that raises a number of compounds such as fertilizers and pesticides containing concentrations of some trace elements directly into the river, leading to increased concentration of these elements in water as well as their accumulation in the food chain (Otchere, 2003).

It is clear from the results that the main cause of the emergence of colon bacteria in the water models of the selected stations is due to the pollution of the Euphrates water with sewage where it was observed that the sewage is not properly treated before being returned to the river, in addition, these are agricultural areas where it is common to throw dead animals in the riverbed and become one of the main sources of pollution of the river water,these results are consistent with (Leclerc *et al*., 2001; Al-Lami *et al*., 2001) who considered that the presence of these bacteria is a higher indicator of water pollution, making it unsuitable for consumption. The occurrence of *Pseudomonas* sp. bacteria in some stations is a pathogenic bacteria that causes urinary and ear infections and other diseases. This result is consistent with the findings of Talling (1980) who isolated these bacteria from water and considered them to be pathogenic and pathogenic bacteria in infants and children.

CONCLUSION

Aeromonus bacteria have been isolated and are present in river and sewage water. Since, 1962, Leclerc has reported that these bacteria are responsible for some cases of diarrhea that occur when dealing with contaminated water and cause contamination of wounds when they are touched and also cause blood contamination (Leclerc *et al*., 2001). The emergence of these types of bacteria which have been isolated and diagnosed, gives the greatest evidence of the lack of safety of this water for use, perhaps due to lack of interest in sterilization of water.

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