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Research Article

## Study of the bacterial and algal content of school tanks water in Salah Al-Din Governorate

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### Abstract

The current study included determining some characteristics of water reservoirs in Salah al-Din Governorate from December 2020 until the end of July 2021, and comparing the results with Iraqi and international drinking water standards. Samples were collected every month from each station for eight months during the study period. The study included the following chemical properties (dissolved oxygen, biological oxygen requirement), and biological properties (calculating the total number of bacteria, and diagnosing algae). The results showed that the dissolved oxygen values ranged between (5.0-11.9) mg/L, while the biological requirements values ranged from (1.1-7.5) mg/L. Examination of the total number of bacteria showed high levels in the winter. 23 species of algae belonging to 3 phyla were isolated and identified.

**Keywords** Biological properties, Water characteristics, Bacteria, Algae

### Introduction

Water is the main element for sustaining life, in addition to being one of the limited natural resources on the face of the earth, and it is possible to face a shortage in its presence one day in the future if it is consumed in an unplanned manner.

The importance of the presence of water in human life is not limited to its use for drinking only, but many other aspects are indispensable in it, as it is used in cooking and food preparation, personal hygiene and bathing, daily use for cleaning pots and dishes, and irrigation of plants and crops, cleaning homes and manufacturing some products.

Drinking water is considered one of the dangerous sources that may infect humans with various diseases if its water is polluted (Bresha and Sharif, 2018).

The biological pollutants of water, such as pollution by pathogenic and non-pathogenic microorganisms, are among the most important forms and forms of water pollution, and even the most dangerous. Diseases and epidemics transmitted through biologically polluted water are one of the most

common causes of human death, and water-related diseases are one of the most prominent health problems in the world (Al-Sarawi, 2015).

The research aims to: Study the chemical and biological properties of tank water and compare them with the Iraqi and international standards allowed for drinking water. And the detection of the bacterial content by calculating the total number of bacteria. And the investigation of the algal content in the water tanks.

### Materials and methods

The samples were collected from four different regions within Salah al-Din Governorate, and these areas Tikrit, Samarra, Al-Dur, and Baiji for 8 months (from December 2020 until the end of July 2021), and sterilized glass bottles (250 ml capacity) were used to collect the samples

### Chemical checks

#### *Measurement of dissolved oxygen*

Using the method of modification of bids (Winkler method) shown by the US health organization, after fixing the sample field.

### Biological oxygen demand

The Winkler method was used after storing the sample in the incubator for five days at a temperature of 25 ° C. Then the biological requirement was determined according to the following formula:

$$\text{Bod}_5 = \text{DO}_0 - \text{DO}_5$$

### Biological study

#### Counting the total bacteria

The method for calculating the total number of bacteria in water samples included preparing a series of decimal serial dilutions with sterile tools and conditions, using distilled water and distributed in test tubes of 9 cm 3 for each tube. The tubes were placed after closing them in the medical cotton in the receptacle for sterilization below 121 degrees and a pressure of 1 bar for 15 minutes was prepared. A series of the scare was prepared up to 10<sup>-4</sup>. After preparing the scare chain for the models, 0.1 cm 3 of the scrapings were withdrawn (4 x 10<sup>-1</sup>, 4 x 10<sup>-2</sup>, 4 x 10<sup>-3</sup>, 4 x 10<sup>-4</sup>) Inoculation of each dilution in a Petri dish to pour then in the fed agricultural medium Nutrient agar. The latter was prepared by following the manufacturer's instructions (HIMEDIA) and sterilizing with Autoclave at 121 ° C. and pressing 1 bar for 15 minutes, then cooled the medium after sterilizing it to a temperature of 45 ° C. Then poured the feed media into the dishes with no less than (15-10) cm 3 for each plate. The plates moved quietly three times towards the hour hand and three times against the clockwise direction and the dishes were left after a period to cool and solidify The food medium inside, taking into consideration - that the casting process took place - near the flame for accuracy and avoiding contamination of the medium. The dishes were incubated in the incubator at 37 ° C for 24-48 hours upside down. Then calculate the growing colonies in the medium for each dilution and multiply the numbers by the reciprocal of 10 ×, and then the total average number of bacteria for each (1) ml of the model (APHA, 2005); WHO, 2008).

### Algae diagnosis

Samples were collected from the drinking water tanks for schools every month, and they were transported to the laboratory and kept in a place at a low temperature until they were examined under the microscope and diagnosed in the laboratory. Diatoms were identified using the following sources: (Prescott, 1962; Benson & Rushforth, 1975; Hassan, et al, 2012; Edward and David, 2010).

As for the non-diatomaceous species, they were identified using the following sources: (Prescott, 1962; Benson & Rushforth, 1975; Smith 1950).

### Results and discussion.

#### Dissolved oxygen

Dissolved oxygen is one of the most important environmental factors that affect the physical, chemical, and biological processes prevailing in life. The presence of dissolved oxygen is essential to get the type of organisms in the water as they are needed in the breathing process to release the energy needed for their growth and life (Allo, 2006). One of the primary sources of dissolved oxygen in water is the atmosphere, which is in contact with the surface of the water, and the good growth of phytoplankton plays a positive role in increasing oxygen through photosynthesis (Ismail and Saad Allah, 2016).

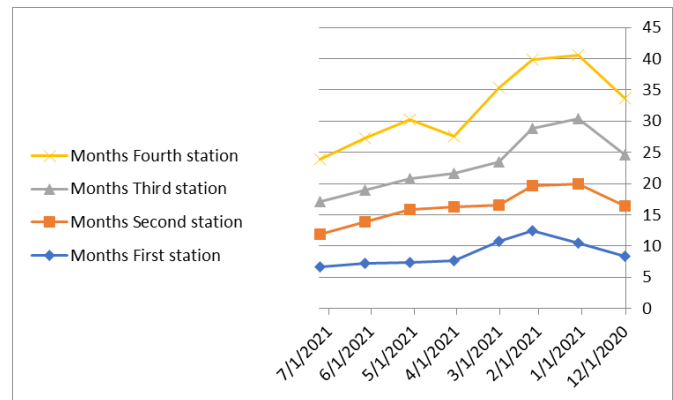
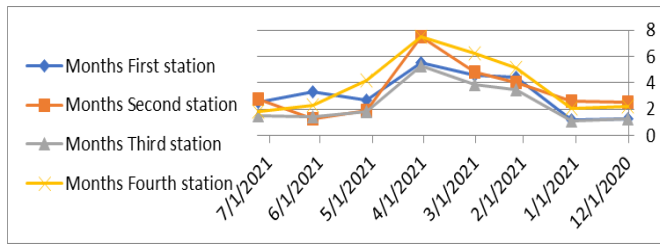


Fig. 1. Monthly and local changes of dissolved oxygen during the study period (mg/l)

Oxygen values ranged between (5 - 11.9) m / liter. It recorded the highest value of winter, which is (11.9 mg/liter), in the fourth plant on 3/2021, and the lowest value of summer (5 mg/liter) on 5/2021 at the third station. The higher oxygen values in winter are due to the lower temperature, which increases the solubility of oxygen in water (Al-Dabbagh and Al-Saadi, 2004). As for the decrease in dissolved oxygen during the summer, it is due to the high water temperature, which leads to the reduction of oxygen, because the relationship is inverse between them. Also, increasing the water temperature increases the activity of the disintegrating bacteria of the organic materials, which increases the consumption of dissolved oxygen (Al-Ghanem, 2005). All values for all stations within the international and Iraqi specifications were from (5-8) mg/l.

#### Biological oxygen

The degree of polluted water can be determined from an organic point of view by the counting of oxygen consumed by microorganisms (Hassan et al., 2008).



**Fig. 2 monthly and local changes to the biological requirement for oxygen during the study period (mg/l)**

In the studied areas and throughout the study period, reservoir water was recorded with the highest value for the biological requirement in the second and fourth stations on 4/2021 is (7.5) mg/liter, while the lowest value recorded is (1.1) in the third station on 1/2021. The reason for the increased biological requirement for oxygen may be due to the growth of bacteria or the presence of dead algae in the tanks or as a result of the fall of bird droppings as a result of not covering the tank tightly. On this basis, the samples fall within the category of clean water as a class that lacks cleanliness according to the classification used for water pollution. The global health and Iraqi standards that occurred for the biological requirement did not match (0).

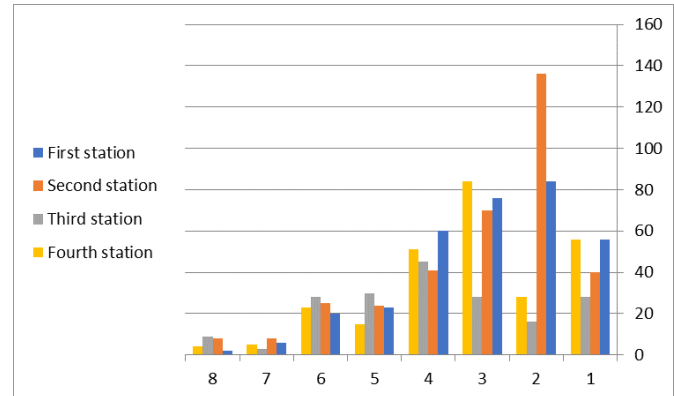
Water is a good medium for bacterial life and growth and an important source of transport for latent intestinal diseases (Aubaid, 1998). Therefore, most natural waters contain different types of bacterial organisms that can be sourced from soils washed into water bodies, or from sewage water. (Tartera and Japer, 1987). These bacteria are found either stuck in a water column or repellent in clay and fed into the water either by oxidizing the organic materials or using inorganic compounds containing iron or sulfur (EPA, 2004). If you don't block the tank covers correctly, it may give way to dust particles entering with air currents and their contents from microorganisms to reservoir water (Safawi et al., 2008).

### Calculation of the total number of aerobic bacteria

The total number of bacteria is one of the important indicators for identifying the extent of water contamination with bacteria, and it guarantees the total of optional and non-self-fed aerobic and anaerobic bacteria present in the water. This examination was used to evaluate the bacterial content in a general evaluation in water and the number is often roughly, as it is not possible to provide an adequate food medium for all types of bacteria, and the impossibility of providing the appropriate conditions for all the existing types, which leads to the disappearance of some of them and the emergence of those that can grow and produce clear colonies in the medium used Under the included examination conditions (time, mean temperature) (APHA, 2005; WHO, 2006).

After estimating the total number of aerobic bacteria as a general measure of the water quality and the suitability of water and its suitability for drinking and food making and an

important indication of changes that can occur in water quality during the storage and distribution stages by detecting the loss of the purifying effect of chlorine, the medium used in feeding nests to detect aerobic microbial species being a public media For bacterial growth, especially when growth is at 37 ° C and in aerial conditions that are suitable for most bacteria in their growth.



**Fig. 3. the total number of bacteria on the feed media (cell/ ml)**

It is noted from Figure (3) that the number of bacteria was high during winter. Then the values began to decrease gradually until the end of the study, as the total number of air bacterial bacteria growing on the medium of feeding acids ranged at 37 ° C for (24) hours between (2 x - 136), as the highest value was recorded during 1/2021 (136) For the station (the beginning of the month sample for the Second station) and the lowest value (2) during 7/2021 for the station (the end month sample for the first station) The reason for the high numbers of bacteria is due to the presence of high levels of organic materials and particles deposited at the bottom of the tanks that help the growth of bacteria The largest is the decrease in numbers in the summer, due to the increase in summer temperatures, which in turn leads to an increase in the activity of the primary species that feed on bacteria (Al-Nafea and Salman, 2011). This corresponds to studies that indicated the increase in the number of bacteria in the winter such as (Hammadi, 2005; Al-Fatlawi, 2007; Badri, 2012).

### Study of algae

Algae play an important role in aquatic systems, as they work to provide oxygen, recycle nutrients, and absorb carbon dioxide and heavy metals, but on the other hand, algae have great damage as they work to block water intake stations, and some species produce algal toxins dangerous to public health (Al Husseini, 2017).

Individuals in this study (23 species) of algae in the four studied stations belong to three phyla, as shown in Table (1). *Bacillus* algae were dominant in the studied stations. As for the different types of them among the studied sites, it is due to the different environments and conditions to which they

are exposed, or as a result of the availability of pollutants and nutrients.

**Table 1. Distribution of the diagnosed algae in the studied stations**

Diagnosed algae	The first station	The second station	The third station	The fourth station
Division : Cyanophyta <i>Chroococcus Sp</i>		#		#
<i>Nostoc Sp</i>		#		#
<i>Oscillatoria limosa</i>			#	#
<i>Oscillatoria subbrevis</i>				
Division: Chlorophyta <i>Pandorina Sp</i>	#	#	#	#
<i>Eudorina Sp</i>	#		#	
<i>Scenedesmus Sp</i>		#		
<i>Ulothrix varibilis</i>	#	#		#
<i>Spirogyra neglectata</i>	#			
Division: Chrysophyta <i>Diatoma Sp</i>	#	#	#	#
<i>Diatoma vulgare</i>	#			
<i>Synedra ulna</i>				#
<i>Synedra capitata</i>			#	
<i>Cyclotella Sp</i>	#	#		
<i>Cymbella affinis</i>	#	#	#	#
<i>Cymbella Sp</i>	#			#
<i>Cymbella cistula</i>	#			
<i>Navicula radiosa</i>		#	#	
<i>Navicula Sp</i>		#		
<i>Navicula cuspidate</i>			#	
<i>Nitzstha sigma</i>		#	#	#
<i>Nitzstha palea</i>		#		

**Conclusions**

The water of the studied stations tanks is contaminated with bacteria and algae and cannot be used without treatment. Because of neglecting to clean and care for tanks, algae and bacteria find a fertile environment for growth.

**Recommendations**

1. Attention to cleaning the tanks from the inside and outside using sterile materials such as chlorine.
2. Water should be stored in sealed tanks made of healthy materials so as not to affect the composition of the water.
3. Spreading awareness through visual and electronic media of the danger of using drinking water without treatment.

**Conflict of Interest**

The author hereby declares no conflict of interest.

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