Assessment of water quality in Al-Musharh River in Maysan Province

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Abstract

The present study was conducted to assessment of water quality in Al-Musharh River in Maysan province. Water samples were collected from three sites during the period from July 2022 to January 2023. Ten physical and chemical parameters were analyzed. Results of the present study was revealed that the values of these factors ranged between (13.5 -30 C˚), (7.1-8.8), (1108 -1415 mg/l), (23- 62 NTU), (360 -550 mg/l), (5.4-18.67 mg/l), (0.024 -0.518mg/l), (332-422 mg/l), (3.5- 6.41mg/l), (6-11 mg/l) for temperature, pH, total dissolved solid, turbidity, total hardness, nitrate, phosphate, sulfate, dissolved oxygen and biological oxygen demand respectively. Our results showed that some of these parameters were within the permissible limit of WHO and Iraqi standards for drinking water such as pH, turbidity, total hardness, nitrate, phosphate and dissolved oxygen, whereas turbidity, total dissolved solid, sulfate and BOD were above the permissible limits according to WHO and Iraqi standards. The water quality of Al-Musharh River is affected by geological nature, agricultural activities, industrial wastes and untreated sewage water.

Keywords: Al-Musharh River, Maysan Province, water quality

Introduction

Water is essential for life and very important natural resource, because provides habitat for different aquatic life in surface water such as rivers, lakes and marshes, therefore, must protect water from pollution risks and manage it uses [1,2]. Environmental pollution is defined asany change in the basic components of the environment, either naturally, or as a result of human activities [3,4]. These pollutants can cause a change in biological, chemical and physical properties, which makes it unfit for humans and other living organisms [5].Aquatic ecosystem exposed too many types of pollutants such as petroleum hydrocarbons, pesticides, heavy metals, detergents, medical wastes in addition to other materials which may be lead to negative effects on human health and biodiversity [6]. This pollution is due to the continued increase in population growth, geological changes, industrial and cultural activities [7]. Water pollution has become one of the important issues nowadays as a result of its impact on all living organisms and various activities [8]. The waters of Tigris river and it branches in Amarh city are exposed to many pollutants due to the increase in population density and discharge ofvarious types of waste containing many chemicals that lead to the deterioration of water quality in this rivers [9]. The physical and chemical properties of water can be used to fully understand and identify the elements that affect water quality as well as to give reliable information in assessing the water quality of rivers [10]. In addition to that provide a good basis for examining and knowing the water sources, water suitability for drinking, industrial and irrigation [11].
The purpose of this study to determine some physical and chemical properties from Al- Musharh River in Maysan province to assess their suitability for human consumption.

Methods

Description of the study area

Al-Musharh River is one of the short rivers in Iraq that branches from the northwestern side of the Tigris River in Amarh city, where the Tigris River splits in this location into two branches (Al-Kahlaa and Al-Musharh). Al-Musharh River is 55 km long from its source at its branching point near Al-Nazim to its mouth in the Al-Hawizah marshes [12]. The present study included taking three sites along the Al-Musharh River, Figure (1). These sites were identified by GPS. First site E: 705114 N: 3526471. In the beginning of the River, which branches from the Tigris River near the Al-Majidiyah area in the southeastern part of Amarh city. The second site is E: 730779 N: 3523392. It is located 14 km from the first site in Al-Shabisha area (Bani Hashim village). The area is characterized by agricultural activities. Third site E: 718324 N: 3526844.It is located in the center of Al-Musharh district, this site receive untreated domestic from the city center of Al-Musharh district, it is noted that the river water level is low in third site compared to the first and second sites, and it is noted that there is a large amount of solid waste in this site that is thrown from nearby homes and local markets.

Samples collection

Water samples were collected monthly for the period from July 2022 to January 2023 and expressed during the summer season (July, August), autumn (October, November) and winter (December, January) from three sites distributed along Al-Musharh River in prewashed polyethylene bottles 1 liter capacity from a depth of approximately 10-30 cm for measurement some physical and chemical factors.

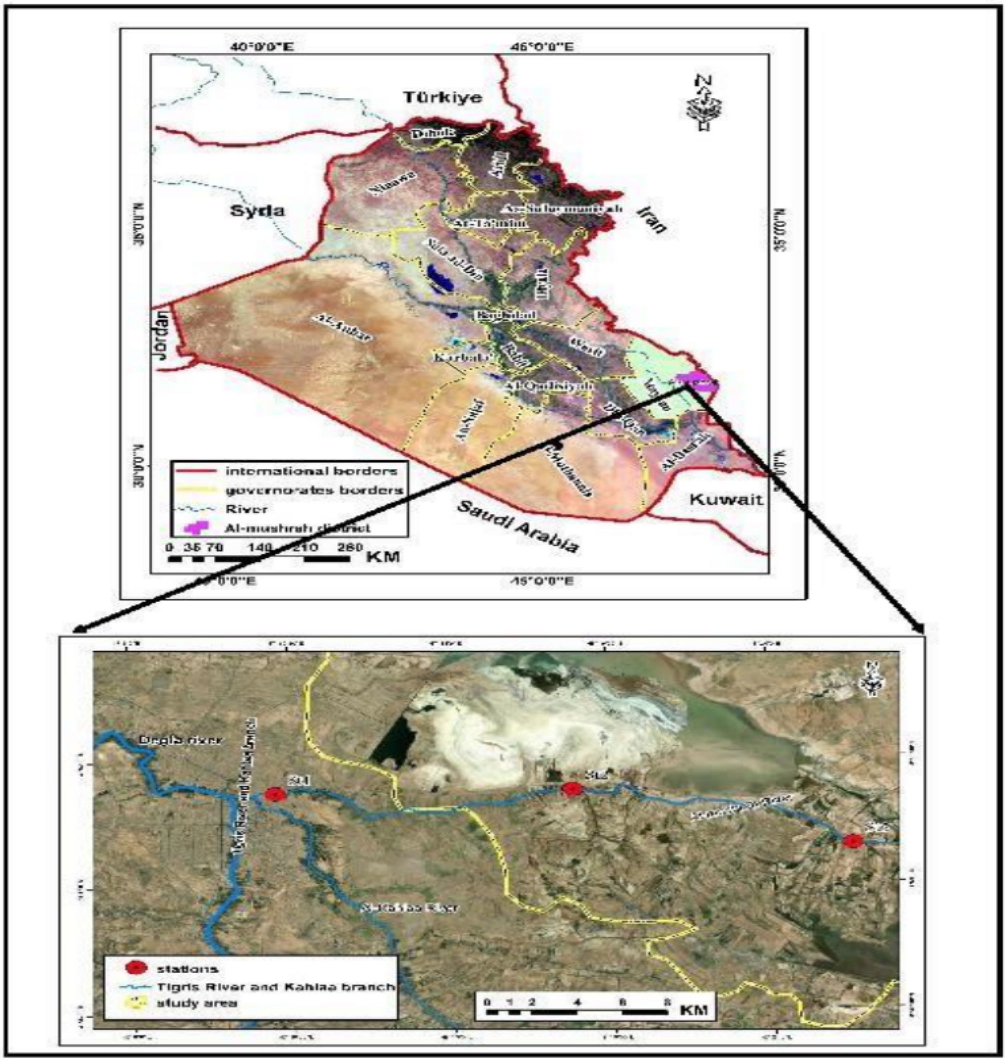

Figure (1): The study sites by GIS

Physical and chemical analysis

The conducted analyses included physical factors which are temperature, turbidity and total dissolved solids TDS, whereas chemical properties are pH, total hardness, nitrate, phosphate, sulfate, dissolved oxygen DO and biological oxygen demand BOD5.

The temperature was measured in the field with graduated mercury thermometer (0 -100 C°) at the depth 25 cm, the pH was measured in the field by using pH meter and turbidity was measured by using turbidity meter whereas the concentrations of other parameters such as

TDS, total hardness, nitrate, phosphate were determined according to APHA [13], whereas levels of DO in water samples was determined depending on Azid Modification Winkler method [14], whereas BOD5, the water samples put in the dark bottles then incubated in the dark place at 20 C° for 5 days, the dissolved oxygen was fixed and measured depending on Azid Modification Winkler method by using following equation: BOD5 mg/l = DO before incubation — DO after incubation.

Results and discussion

The results of the study in figure (2) revealed that there were seasonal variations in the water temperature, which ranged from 13. 8 to 30 C° during winter and summer respectively, this variation attributed to the nature of Iraq's climate [15]. The highest of pH value was 8.8 in the site two whereas the lowest 7.1 in the site three during summer (figure 3), this spatial variations may be due to amount organic materials which discharge in the river, in addition to other factors such as water temperature and role of bacteria in biodegradation of organic matter [3,16]. These values were within the permissible limits (6.5-8.5) of WHO and local standards during the period study except in site 2 during summer (table 1).

Concentrations of TDS was varied from 1108 to 1415 mg/l in the site 3 and 2 during winter and summer respectively (figure 4), seasonal variations attributed to changes in water temperature which lead to the evaporation process which reflected on TDS levels [4,17,18]. Results of the current study showed that TDS values were more than the permissible limits (1000 mg/l, table 1). The turbidity is a measure of light emitting properties of water and it is mainly caused by solid particles present in the suspended phase [3,19]. Turbidity values were ranged from 23 to 62 NTU in site 2 during winter and autumn respectively (figure 5). Resultsof the current study were more than the local and international standards of the permissible limits (5 NTU, table 1). This may be due to soil erosion, water levels in the river and microorganisms (bacteria and plankton), the higher turbidity values may be cause gastrointestinal disease for human and also have negative effects on consumer acceptability of water [20,21]. The highest values of total hardness (TH) was 550 mg/L in the site 3 during summer, whereas the 401. 5 mg/L in the site 1durng winter (figure 6), the seasonal and spatial variations may be attributed to the geological nature of the river and soil erosion spatially during winter season, in addition discharge untreated sewage and industrial water into the rivers [22]. The hardness values were within the permissible limits of Iraqi standard and WHO except in the site 3 during summer and winter (table 1). Elevated of hardness values of drinking water is connected with many health problems such as growth retardation, cardiovascular disease and reproductive failure, in addition to that high levels of hardness in water caused a laxative effect [23]. Nitrate levels were ranged between 5. 4 and 18. 67 in site1 and site 3during summer and winter respectively (figure 7), this concentrations were lower than the permissible limits of international and local standard limits for drinking water (table 1). Agricultural runoff and untreated sewage might be the major source of nitrate levels in the river. Nitrate pollution may cause various types of health risks such as blue baby disease [16,18,20]. Phosphate levels were ranged between 0.024 to 0.518 mg/l in site 1 and 3 during autumn and summer respectively. Phosphorus is play a vital role in living organisms, however, excessive phosphorus in aquatic ecosystem are harmful to most aquatic biota which cause a decrease in the dissolved oxygen concentration of water [24]. PO4 values in all the samples were within the permissible limits of WHO and Iraqi standards (except site 3 during summer) (figure 8 and table 1). This may be attributed to the domestic sewage which discharged into the river and decreased amount of water during summer [25]. The values of SO_4^{-2} were ranged between 332 and 422 mg/l (figure 9), concentrations of SO_4^{-2} for all samples were more than the permissible limits of international and local standards (table, 1). SO_4^{-2} is generally harmless, except its effect on taste. The major physiological impacts resulting from high levels of SO_4^{-2} are gastrointestinal irritation, dehydration and catharsis [3,19,26]. Dissolved oxygen levels at the present study are shown in Figure 10. The lowest value was 3.5 mg/l in summer recorded at site 3, whereas the highest value was 6.41 mg/l in winter2013 recorded at site 1. This seasonal and spatial variations may be attributed to the consumption of oxygen in the oxidation of organic compounds in the domestic waste discharged into the river specially in the site 3, also, levels of DO may be attributed to many factors such as temperature, photosynthesis, aquatic organisms respiration, good mixing and role of bacteria in degradation of organic matter [25,27]. Values of DO in most samples were below the permissible standard value as prescribed by WHO and Iraqi standard limits (table 1). Levels of BOD5 were varied from 6 to 11 mg/l in site 1 and 3 during autumn and summer respectively (figure 11). The increase in BOD5 value in site 3 during the present study may be return to excess the effluent of un treatment domestic wastes into the river [28,29]. BOD5 concentrations for all samples were more than the permissible limits of WHO [18] and Iraqi drinking water standard [30] (table 1).

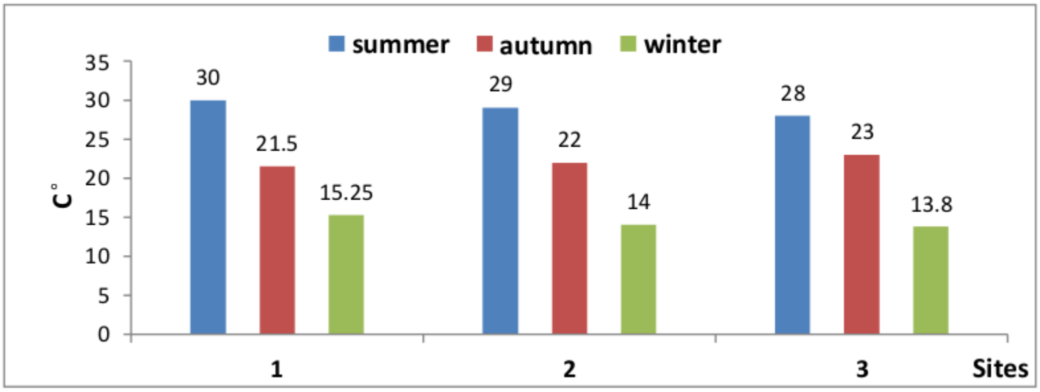

Figure (2): Seasonal and spatial variations in temperature.

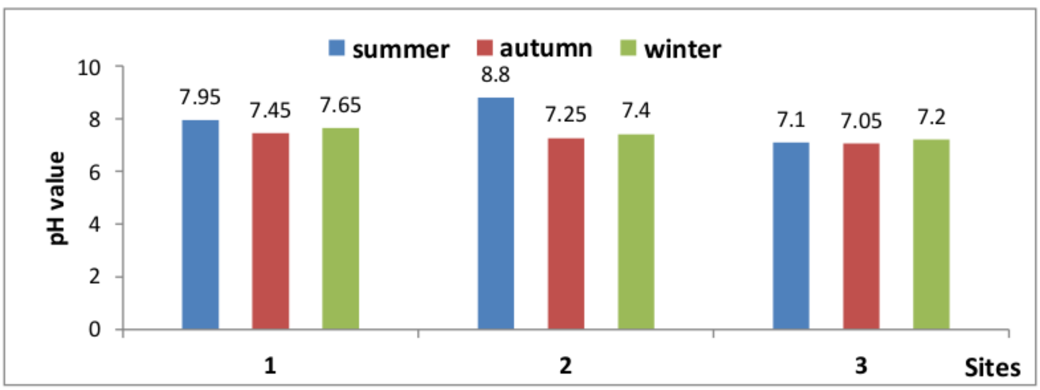

Figure (3): Seasonal and spatial variations in pH values.

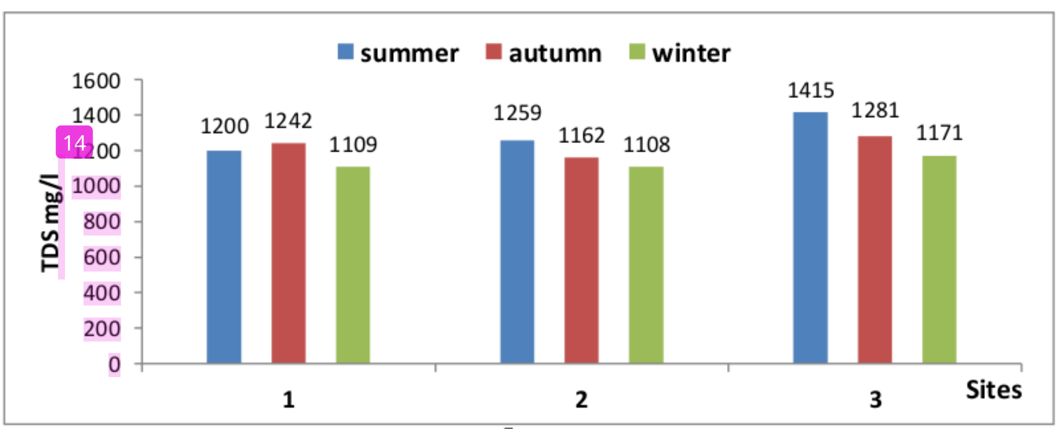

Figure (4): Seasonal and spatial variations in TDS values

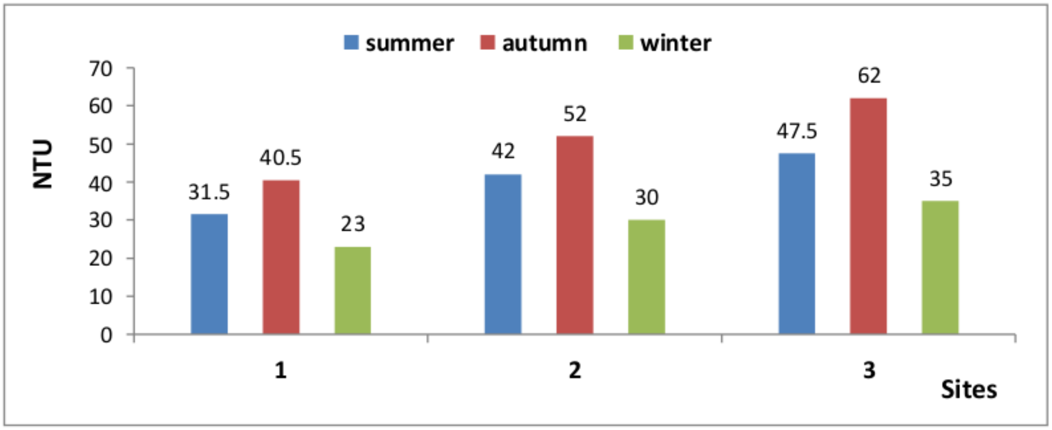

Figure (5): Seasonal and spatial variations in turbidity values.

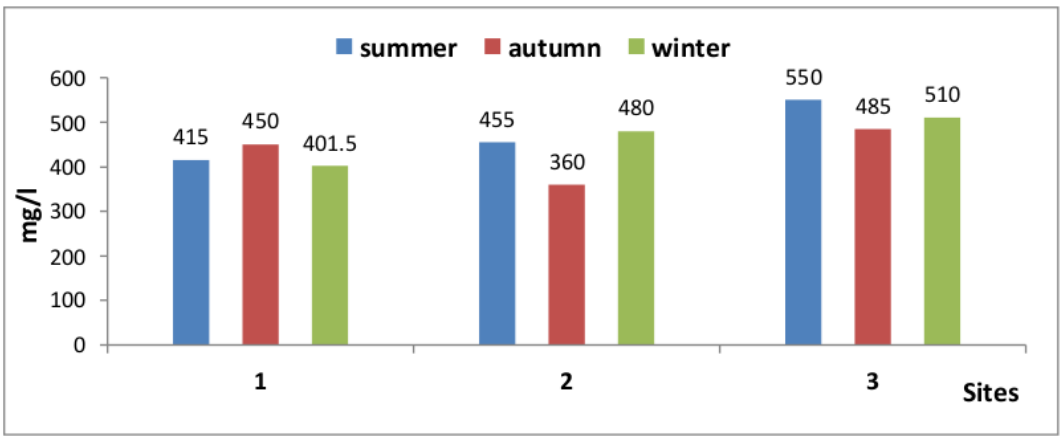

Figure (6): Seasonal and spatial variations in total hardness values.

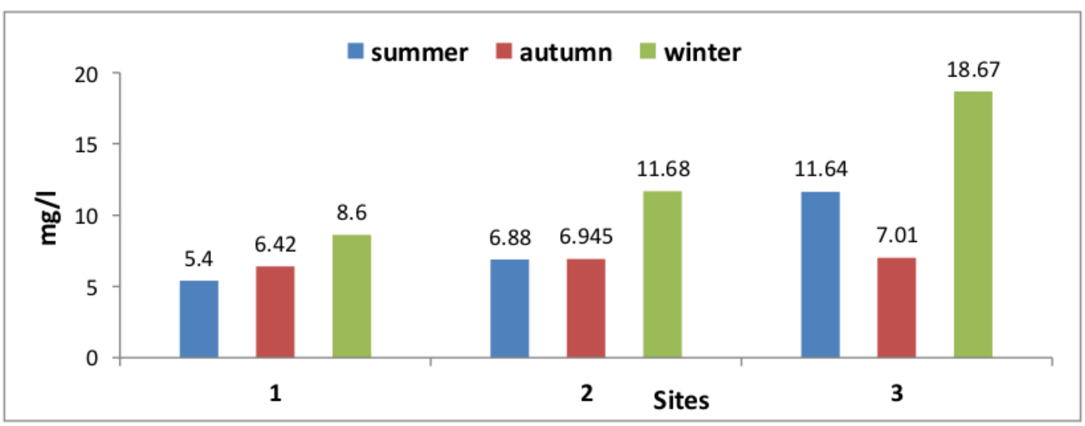

Figure (7): Seasonal and spatial variations in nitrate values.

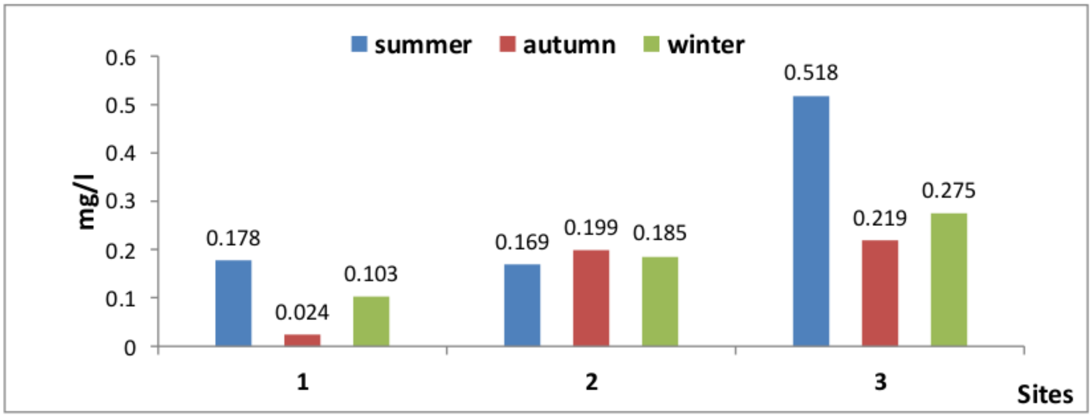

Figure (8): Seasonal and spatial variations in phosphate values.

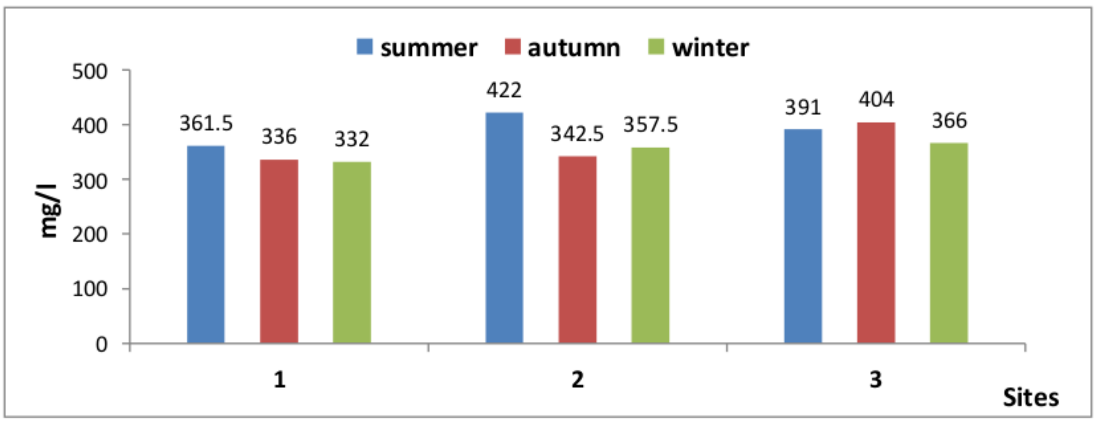

Figure (9): Seasonal and spatial variations in sulfate values.

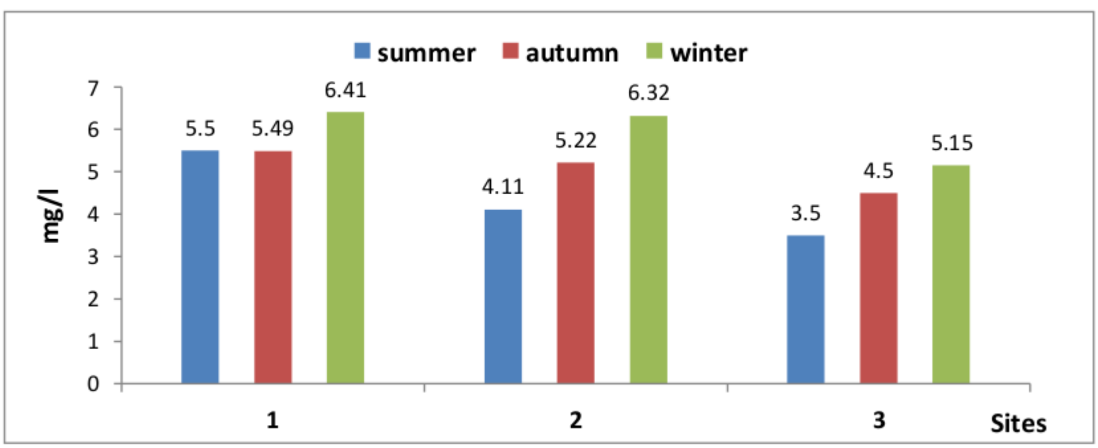

Figure (10): Seasonal and spatial variations in dissolved oxygen levels.

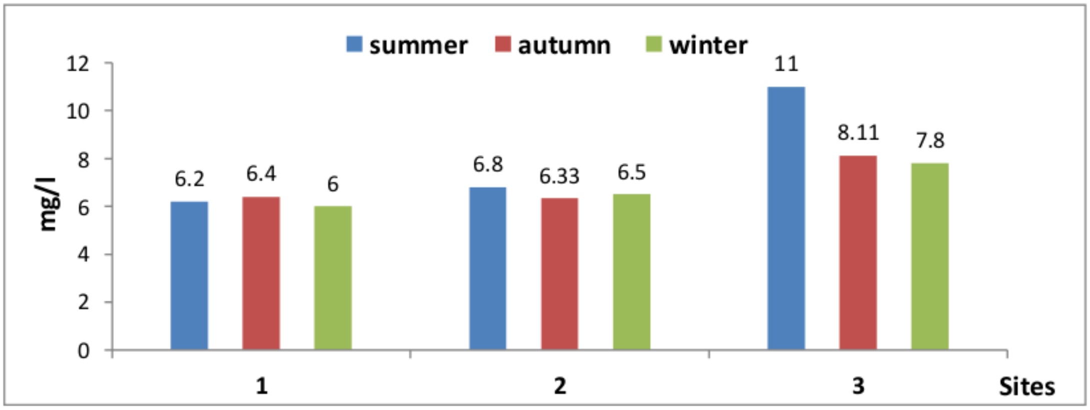

Figure (11): Seasonal and spatial variations in BOD levels

Table (1). Permissible limits of physical chemical factors depending on WHO and Iraqistandards

Parameters	WHO (2017)	Iraqi drinking water standard (2001)
pH	6.5- 8.5	6.5- 8.5
DO mg/l	> 5	> 5
BOD5 mg/l	> 5	> 5
TUR NTU	5	10
TDS mg/	1000	1000
TH mg/l	500	500
PO_4 mg/l	0.5	0.10
NO_3 mg/l	50	50
SO_4 mg/l	250	250

Conclusions

The results revealed that some of these parameters were within the permissible limit of WHO and Iraqi standards for drinking water such as pH, turbidity, total hardness, nitrate, phosphate and dissolved oxygen, whereas turbidity, total dissolved solid, sulfate and BOD were above the permissible limits depending on WHO and Iraqi standards. The water quality of Al- Musharh River is affected by geological nature, agricultural activities, industrial wastes and untreated sewage water.

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