Monthly variations of some physical and chemical properties for Al- Dujaila river of Al-Kut city

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التغايرات الشهرية لبعض الصفات الفيزيائية والكيميائية لمياه نهر الدجيلة في مدينة الكوت

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بـغـداد - الـعـراق

المستخلص

درست التغايرات الشهرية في الخصائص الفيزيائية والكيميائية للمياه لتقييم نوعية مياه نهرالدجيلة بيئياً للمدة من تشرين الاول 2013 إلى نيسان2014 .حيث يقع نهر الدجيلة في الجزء الجنوبي الشرقي من العراق و تحيط فيه مساحات شاسعة وخصبة من الأراضي الزراعية. تم اختيار ثلاث محطات للدراسة ، تقع المحطة الأولى في بداية نهر الدجيلة بعد تفرعه من نهر دجلة لتكون محطة السيطرة. وتقع المحطة الثانية على بعد 2 كم من المحطة الأولى حيث تمثل منطقة الدراسة .أما المحطة الثالثة فتقع على بعد 4 كم من المحطة الثانية بعد اجتياز النهر الأحياء السكنية الواقعة على جانبيه في مدينة الكوت. تم أخذ العينات شهرياً وبواقع نموذجين لكل شهر.الغرض قياس قيم و تراكيز مؤشرات الماء وتراوحت التراكيز الشهرية كالاتي:درجة حرارة الهواء (17 الى36)م^{0}و الماء (10 الى 24) م^0 و الاس الهيدروجيني (7.02 الى 8.2)والاوكسجين الذائب7.05(DO) (الى11.65) ملغم/ لتر والمتطلب البايولوجي للاوكسجين (BOD) (1.2 الى7.05) ملغم/ لترو عكورةالمياه (21الى65) وحدةعكورة والمواد الصلبة الذائبة (743الى 918) ملغم/ لتر والمواد الصلبة العالقة (32 الى95) ملغم/ لتر والتوصيلية الكهربائية (1115الى 1378) مايكروسيمنز والملوحة (0.71الى) 0.90جزء بالألف والعسرة الكلية (320 الى 500) ملغم/ لتر والكلورايد (104 الى 178) ملغم/ لتر والنترات(6الى 14.53) ملغم/ لتر والفوسفات (0.16الى 0.60) ملغم/ لتر .

Abstract

Monthly variations in physio-chemical parameters of Al-Dujaila, one of the main tributaries of the Tigris River were investigated from October 2013 to April 2014. The study location situated in the south-eastern sector of Iraq, and it was surrounded by wide and fertile agricultural lands. Three stations were selected for that. The first station is located at the beginning AL-Dujaila River after branching the Tigris river as control. The second is situated at distance 2 km away from the former represented study area.The latter station is located at 4 km apart from the second one. Samples collectingmonthly, two samples were taken each month.

In the present study fourteen physical and chemical parameters were analyzed based on the importance of these parameters. These fourteen parameters are arranged as following: air temperature (17 to 36) ºC, water temperature (10 to 24) ºC, pH (7.02to 8.2), E.C. (1115 to1378) µS/cm, salinity (0.71 to 0.90) ppt, DO (7.05 to 11.65) mg/L , BOD (1.2 to 7.05) mg/L ,turbidity (21.0 to 65) NTU, TDS (743 to 918) mg/L , TSS (32 to 95) mg/L , T.H

(320 to 500) mg/L , Cl^- (104 to 178) mg/L, NO_3 (6 to 14.53) mg/L and PO_4 (0.16 to 0.60) mg/L.

Introduction

Rivers have always been the most important fresh water resources, and most developmental activities are still dependent upon them. Rivers are used as site for the disposal of refuse, human sewage, and waste waters from kitchens, abattoirs and industries. Streams and rivers running through areas of significant human influence such as farms, cities and industrial locations are therefore prone to pollution (1, 2).

The degree of pollution is generally assessed by studying physical and chemical characteristics of the water bodies (3).

Iraqi inland waters witness tremendous impacts through discharges of manufacturers, agricultural and domestic sewage (4, 5). Quite few studies were performed on Tigris River (6, 7, 8), but no work had considered Al-Dujaila canal in Al-Kut City. The present study has taken in consideration the investigation of abiotic conditions in this vital habitat on monthly basis.

Materials and Methods

Study area

Al-Dujaila River is one of the two branches of the Tigris River at Kut City, 225 km south of Baghdad City (Fig. 1). After branching from the Tigris, the Dujaila flows southeast toward Al-Kut City (study area) within Wasit Province, 220 km southwest of Baghdad City. The river is 57 km in length with and a cross-section is 40m.

Figure (1): The map of sampling location in the study area

Sampling

Samples for physical and chemical variables were performed from three sites during period extended from the October 2013 to April 2014. Water samples were collected for physiochemical analysis using pre-washed polyethylene bottle by water sample twice before filling.

The studied physio-chemical parameters include water temperature (by using precise mercury thermometer), hydrogen ion concentration (by using pH-meter), electrical conductivity (by using EC-meter), turbidity level (by using turbidity-meter), dissolved oxygen (titrimetric methods), biological oxygen demand (Winkler methods), nitrate, reactive phosphate (by using spectrophotometric methods), total hardness and chloride (by using titrimetric methods), were measured according to APHA(9,10).

Results

Table (1) and Figure (2), showed monthly changes in air temperature for the three selected stations. Values ranged between 17ºC in station-1 during December (2013) to 36º C in station-2 during April (2014).

Table (1) and Figure (3) ,however, indicate monthly variations in water temperature. The lowest value was 10ºC in station-2 during December (2013) and the highest 24ºC in station-2 during April (2014).

Table (1) and Figure (4), showed monthly changes in PH. The lowest (7.02) was encountered in October (2013) from station-2 and the highest (8.2) was recorded in November (2013), but values in general were slightly alkaline direction.

Table (1) and Figure (6), showed monthly changes in values of water salinity. The lowest (0.71ppt) was observed in station-3 during March (2014) and the highest (0.90ppt) measured from station-2 in October (2013).Table (1) and Figure (7), Show monthly changes in values of Turbidity. The lowest (21.0 NTU) was observed in station-3 in December (2013) and the highest (65 NTU) was observed in January (2014) from station-2.

Table (1) and Figure (8), revealed monthly variations in dissolved oxygen in selected stations Values declined during October (2013). The lowest (7.05 mg/L) was in October (2013) from station-2 and the highest (11.65 mg/L) was, in general, in January (2014) from station-1.

Table (1) and Figure (9), showed monthly variations in values of biological oxygen demands (BOD). The lowest (1.2 mg/L) was recorded in March (2014) from station-1 and the highest (7.05 mg/L) was in November (2013) from station-2.

Table (1) and Figure (10), demonstrated monthly changes in total dissolved solid. The lowest (743 mg/L) was encountered in March (2014) from station-3 and the highest (918 mg/L) was recorded in October (2013) from station-2.

Table (1) and Figure (11), showed monthly variations in total suspended solid. The lowest (32 mg/L) was observed in December (2013) from station-3 and the highest (95 mg/L) was observed in January (2014) from station-2.

Table (1) and Figure (12), revealed monthly variations in values of total hardness in the selected localities. Highest value (500 mg/L) was in November (2013) and encountered from station-2. The lowest (320 mg/L), however, was in January (2014) from station-1.

Table (1) and Figure (13), showed monthly changes in values of Chloride. The lowest (104 mg/L) was measured from station-1 in March (2014) and the highest (178 mg/L) was observed in November (2013) from station-2.

Table (1) and Figure (14), cleared monthly variations in Nitrate. The lowest (6 mg/L) was in April (2014) from station-1 and the highest (14.53 mg/L) was observed in November (2013) from station-2.

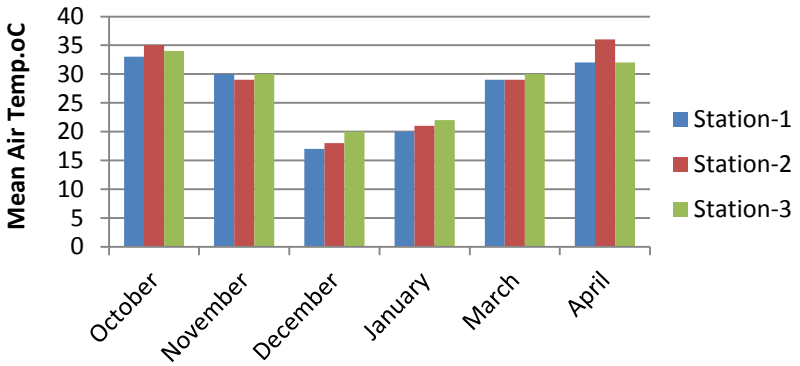
Table(1) and Figure (15), showed monthly changes in values of reactive phosphate. The lowest (0.16 mg/L) was observed in October (2013) from station-1 and the highest (0.60 mg/L) was observed in December (2013) from station-2.

Table (1): Monthly variation for Al-Dujaila River through period study 2013 – 2014

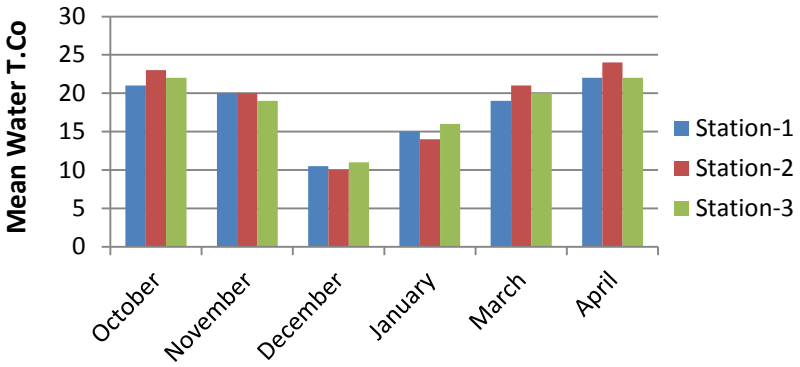
Time	Station	Air T. C °	Water T. C °	PH	E.C ms/cm	Sali. ppt	DO mg/l	DOB5 mg/l
October 2013	Station1	33	21	7.5	1193	0.76	8.01	1.5
	Station2	35	23	7.02	1378	0.90	7.05	6.56
	Station3	34	22	7.4	1194	0.76	7.61	3.1
November 2013	Station1	30	20	8.0	1274	0.81	9.1	1.4
	Station2	29	20	7.7	1358	0.89	8.02	7.05
	Station3	30	19	8.2	1285	0.82	8.30	4.02
December 2013	Station1	17	10.5	8.1	1216	0.77	10.85	3.11
	Station2	18	10	8.0	1299	0.83	8.42	5.6
	Station3	20	11	8.1	1170	0.75	9.12	3.5
January 2014	Station1	20	15	7.9	1198	0.76	11.65	2.7
	Station2	21	14	7.54	1225	0.78	9.1	6.3
	Station3	22	16	7.7	1215	0.77	10.22	3.29
March 2014	Station1	29	19	8.1	1138	0.72	9.3	1.2
	Station2	29	21	7.81	1259	0.81	8.1	4.8
	Station3	30	20	8.1	1115	0.71	8.95	2.4
April 2014	Station1	32	22	7.8	1285	0.82	8.5	1.9
	Station2	36	24	7.1	1316	0.84	7.2	5.7
	Station3	32	22	7.4	1295	0.83	7.8	2.6

Appendix table-1

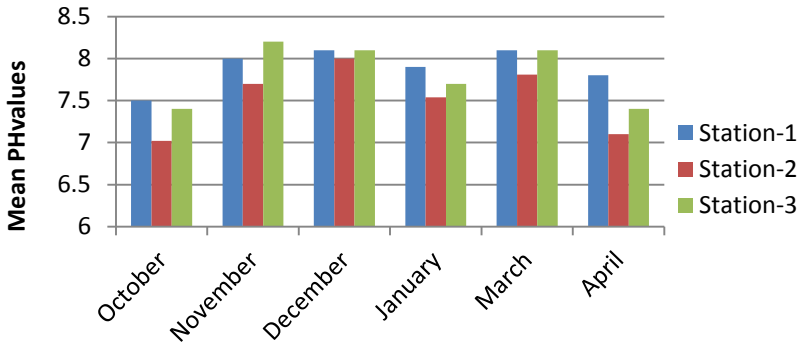
Time	Station	Turb. NTU	TSS mg/l	TDS mg/l	T.H mg/l	Cl^- mg/l	$NO3^=$ mg/l	$PO4^{-3}$ mg/l
October 2013	**Station1**	40	60	795	340	117.4	10.25	0.16
	Station2	47	75	918	430	137.2	14.13	0.33
	Station3	43	69	796	360	128.5	12.31	0.25
November 2013	**Station1**	36	46	848	372	127.8	8.93	0.18
	Station2	42	50	915	500	178	14.53	0.29
	Station3	38	43	857	400	134	12.35	0.21
December 2013	**Station1**	25	38	811	407	120	6.2	0.27
	Station2	33	41	866	440	138	8.34	0.60
	Station3	21	32	780	415	128	8.93	0.45
January 2014	**Station1**	47	73	799	320	117	9.7	0.24
	Station2	65	95	818	370	139	12.8	0.27
	Station3	52	76	810	350	115	10.6	0.25
March 2014	**Station1**	25	33	758	352	104	7	0.2
	Station2	36	41	839	390	125	7.5	0.5
	Station3	27	38	743	376	119	7.5	0.27
April 2014	**Station1**	22	35	857	366	120	6	0.3
	Station2	30	41	875	428	138	7.6	0.55
	Station3	25	37	863	416	127	7.3	0.4



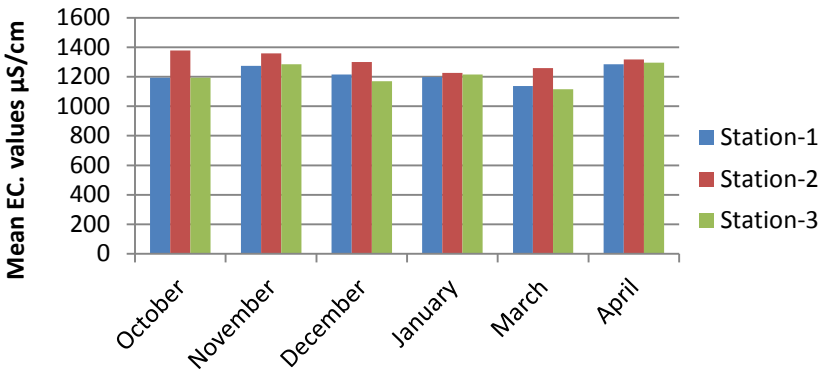
(Fig.2)Monthly changes in air temperture in three selected stations



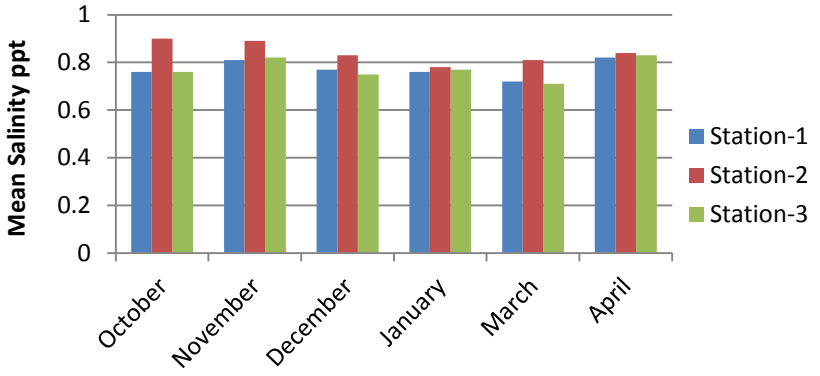
(Fig.3)Monthly changes in water temperture in three selected stations



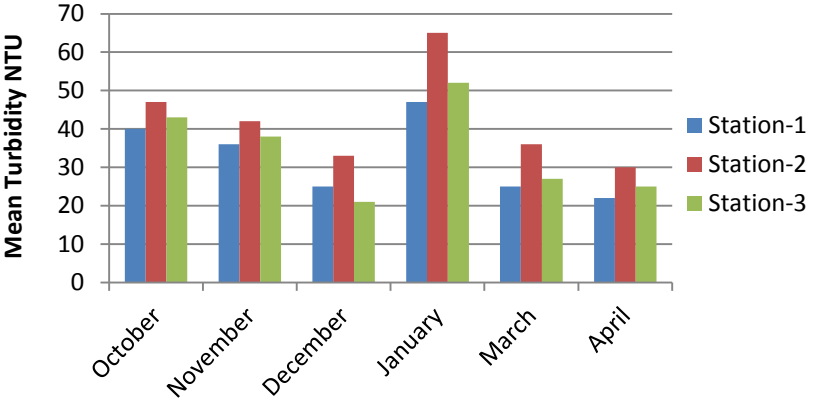
(Fig.4) Monthly changes in hydrogen concentrated in three selected stations



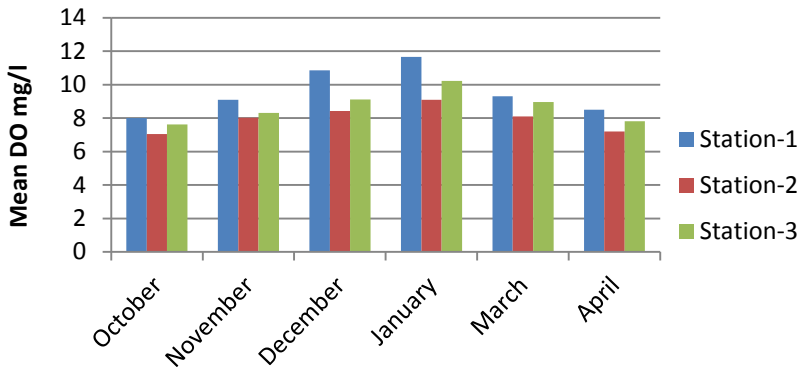
(Fig.5)Monthly changes in electrical Conductivity in three selected stations



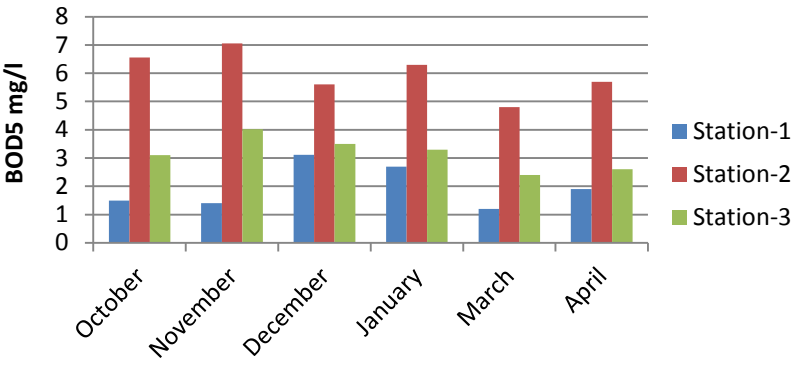
(Fig.6)Monthly changes in salinity concentrated in three selected stations



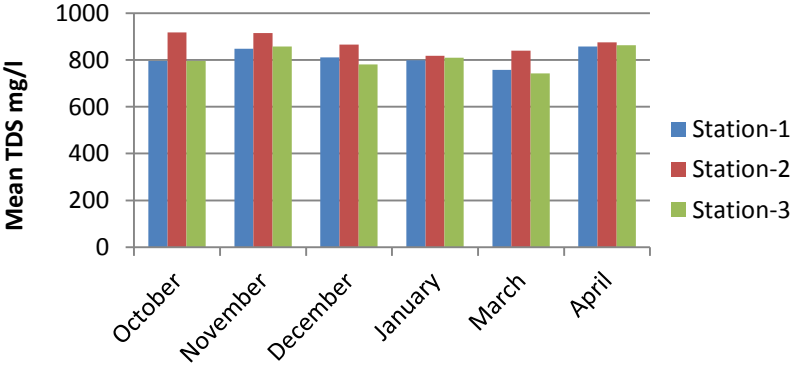
(Fig.7) Monthly changes in turbidity in three selected stations



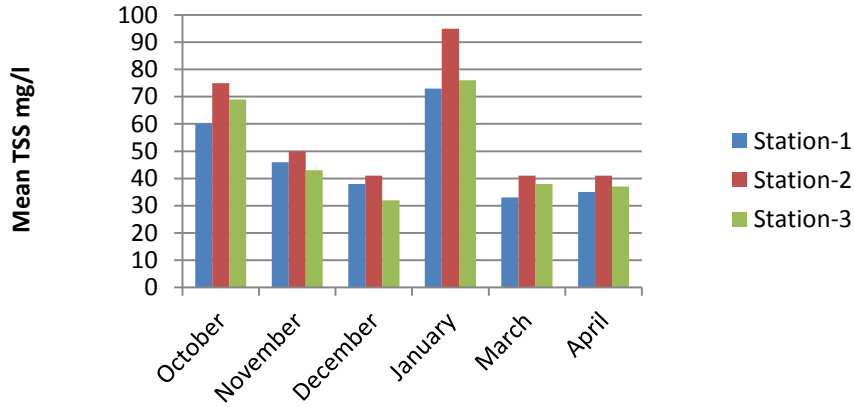
(Fig.8) Montly changes in dissolved Oxygen in three selected stations



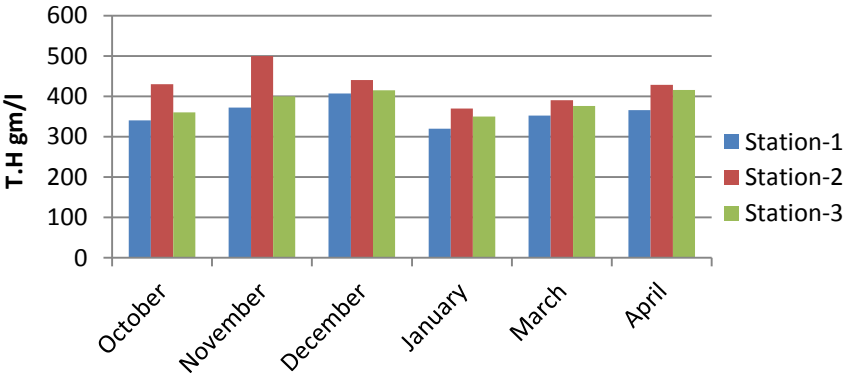
(Fig.9) Monthly changes in biological oxygen demand in three selected stations



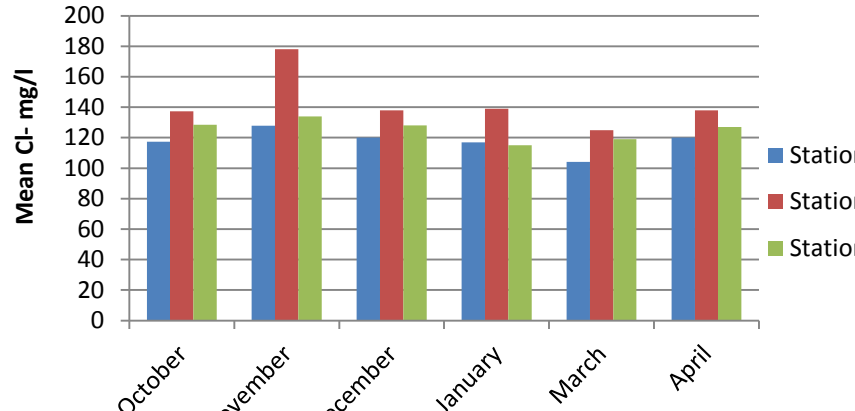
(Fig.10)Monthly changes in total dissolved solids in three selected stations



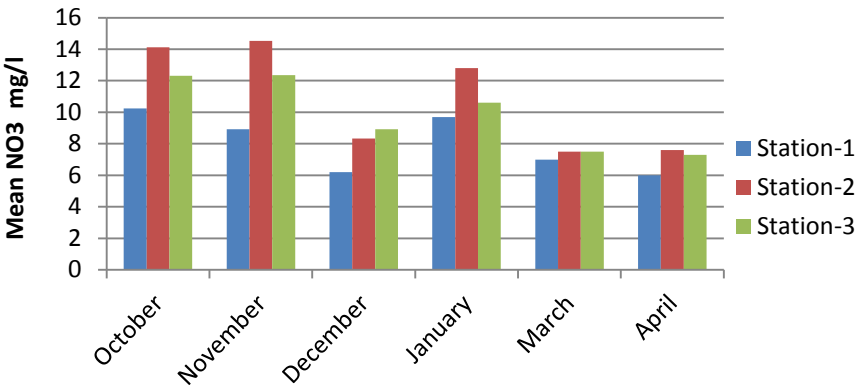
(Fig.11)Monthly changes in total suspended solids in three selected stations



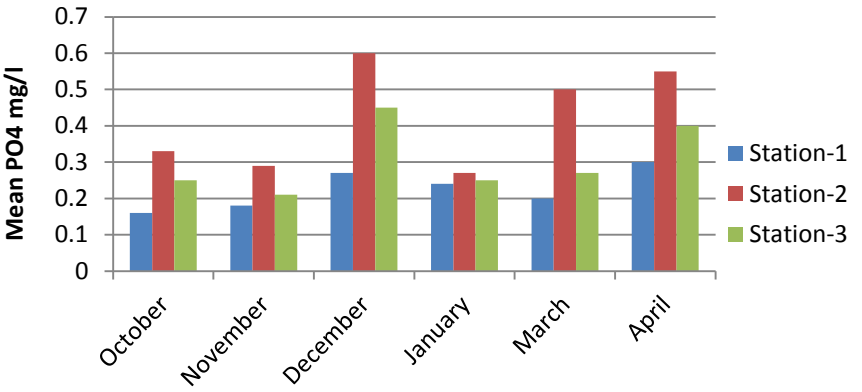
(Fig.12)Monthly changes in total hardness in three selected stations



(Fig.13)Monthly changes in Chloride in three selected stations



(Fig.14)Monthly changes in Nitrate concentrated in three selected stations



(Fig.15)Monthly changes in Phosphate concentrated in three selected stations

Discussion

Air and water temperature is an important factor in any aquatic environments affecting on biological processes, in this study it was ranged between 17 to 36 ◦C and 10 to 24 ◦C respectively. This result was similar to previous studies done by (11, 12).

The pH value of AL-Dujaila River in study sites during of most studied period was alkaline side above 7, and this result agreed with (13), they reported that Iraqi inland water is regarded to be on the alkaline side of neutrality, reflecting geological formations of the area and the results are agree with the finding that recorded by (14,15).

Electrical conductivity used as an indicator of water quality based on total dissolved salts (16). The increase EC values at station two reflects the strong effect of domestic sewage effluent discharge atthis area.Also, EC values recorded in the present work is coincided with findings of (17,18).

The study also revealed monthly changes in salinity, with notable increase during summer months due to evaporation (19).The presence of agricultural drainage systems namely, Dibuna, Al-Numaniya, Al-Ahrar and AL-Kut may contribute in rising salinity as well.

Water turbidity is caused by suspended matter such as clay, silt and planktons also turbidity degree of River water is an approximate measure of theintensity of the pollution (20). This result was similar to previous studies done by (21, 22).

Oxygen content of water is one of the important factors, and it is very necessary for all living organisms (23).The study finding coincided with other authors (24, 25, and 26) on Iraqi inland waters mainly Tigris. Low concentration of DO recorded from station-2 may relate to organic wastes discharged from Al-Kut City. Generally, the DO at most stations of canal water was within normal guideline values cited by (27) for the protection of aquatic life.

The biological oxygen demand is defined as the quantity of DO which is able to oxidize the organic components in the water with the assistance of microorganisms under defined experimental conditions (28). Generally, results indicate increasing levels of BOD; in particular at station-2 during November andOctober, this may be due to decomposition of organic matters run directly to the river with domestic sewage. These results were slightly higher than that reported by (29, 30) at the same river.

Values of total hardness in the selected stations exceeded 490 mg/L as CaCO3. This indicates that waters are very hard according to (31).Increase in hardness values was found to coincide with rise in salinity (32,33).The results of total hardnesswere agreed with those of (34,35). Chloride is a natural substance present in all portable water as well as sewage effluents as metallic salt. Generally highconcentration of chloride indicates organic pollution in the water (36).This result was similar to previous studies done by (37,38).

Total dissolved solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water (39). These results were slightly lower than that reported by (40, 41) at the same river. Total suspended solid reconsidered to be one of the major pollutants that contributes to the deterioration of water quality, contributing to higher costs for water treatment, decreases in fish resources, and the general aesthetics of the water (42), TSS values recorded in the present work is coincided with findings of (43,44).

Nitrate is the stable form of combined nitrogen, and it is an important factor which might limit growth of phytoplankton (45). The results of nitrate were agreed with those of (46, 47). Phosphorus is essential to the growth of algae and other biological organisms. The reactive phosphate concentration in studied river was ranged between 0.16 to 0.96 mg/l. The high concentration of phosphate may be due to sewage water effluent and fertilizer application in surrounding agricultural area. This result was close to that reported by (48).

Conclusions

1-The waste of factories, urban run-off, city sewage and the agricultural activities were affecting the physicochemical characteristics of Al-Dujaila River.

2-The results revealed that water parameters were most within the Iraqi standards, and WHO standards for the raw water.

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