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EVALUTION OF PHYSICO-CHEMICAL PROPERTIES IN AL-SWEIB RIVER, BASRAH PROVINCE, IRAQ

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ABSTRACT

Water quality of Al-Sweib River may be changed by several variations in the last years as a result of anthropogenic and agriculture activities include the lower levels of water in the river. Water samples were collected from three stations in January to December 2017; then, analyzed using 12 parameters such as water temperature, pH, TDS, EC, turbidity, TH, Ca⁺², Mg⁺², DO, BOD, Cl⁻ and alkalinity. The lowest rates of water temperature (° C) in study area were recorded (11.4 ° C) during January and highest (32°C) in August. Average of minimum value of Hydrogen ion (pH) concentration (7.07) in August and highest (7.95) in February. The total dissolved solid (TDS) values ranged from 1169.6 mg/l in December to 1655 mg/l in August. In the present study, electrical conductivity (EC) of samples varied from 1.38 mS/cm in November to 2.30 mS/cm in September. Turbidity rates of water in study area ranged from 11.70 NTU in April to 28.59 NTU in July. The observed total hardness (TH) value ranged from 594 mg/l in December to 908.33 mg/l in April. The calcium content of the water in Al-Sweib River was found in lowest value 136 mg/l in January and highest 196.33 mg/l in August. Concentration of magnesium ranged from 57.77 mg/l in October to 131.82 mg/l in April. Dissolved oxygen, BOD and alkaline of water at the stations within limited WHO. Concentration of chloride ranged from 274.97 mg/l in January to 538.5 mg/l in August.

Keywords: Water quality, Al-Sweib River, Physico-chemical parameter

1. INTRODUCTION

Water is the most essential and prime necessity of life and the availability of water is one of the crucial environmental [1]. Water of rivers, reservoirs, lakes and ponds are important for domestic activities, agriculture, industry and livestock production [2]. The degree of pollution is general assessed by studying physio-chemical characteristics of the water bodies and these parameters are prone to change to different types of pollution [3]. The increased use of metal-based fertilizer in agricultural revolution of government could result in continued rise in concentration of metal pollution in fresh water reservoir due to the water run-off [4]. The indiscriminate and large scale deforestation and over grazing in the watershed areas of river basins have caused soil erosion resulting in considerable silting of dams and shrinkage of river flows, this leads to the flooding of the rivers at the time of excessive, the disposal of waste caused to contamination of river and lakes chronically affecting the flora and fauna. [5]. Ideally however, water quality should be assessed using physical, chemical parameters in order to provide a full spectrum of information for adequate water management [6]. Non-treatment of domestic sewage effluents along with the excreta of various animals waste was affect directly or

2. MATERIALS AND METHODS

The study was conducted at Al-Sweib River is located in the Northeastern of Basrah province, and extends along 30 km from the East to the West to meeting the Shatt Al-Arab River at 5 km South of Qurna city. Samples from three stations were selected location of stations was determined by GPS, type of Taiwan along the river. Monthly water samples were collected from the mid of the river from January to December 2017. Station (1) located between latitude $31^{\circ} 34' N$ and longitude $47.50^{\circ} 70' E$, station (2) located to the western of station (1) between latitude $31.00^{\circ} 45' N$ and longitude $47.52^{\circ} 93' E$, station (3) located between latitude $31.05^{\circ} 20' N$ and longitude $47.52^{\circ} 61' E$ (Figure 1). Samples were monthly collected

indirectly discharged into rivers which had adversely affected physicochemical [7]. The water quality required to maintain ecosystem health is widely functioning. Some ecosystems of aquatic are able to resist large changes in quality of water without any exposure effects on environmental composition and function, while other ecosystems are sensitive to slight changes in the physiochemical characters of the water body [8]. Al-Sweib river is moderately salt (about 1.3 g/l). It is suitable for human activities, agricultural production and it has appropriate environment for growing of water plants, fish reproduction, and attraction of emigration water birds, since years ago the river provides Shatt Al-Arab by water from Al-Huwaiza marsh, when an Iranian side has seized the water that feeds of Huwaiza marsh, the river receives its waters from the Shatt al-Arab river. Al-Sweib River width varies between 80-200 m [9]. In Iraq, many of researchers are studied the waterbodies of Iraq, such as [10] about appraisal to lower reaches waters 'of the Euphrates River, Shatt Al-Arab River [11], Dokan Lake [12] and Iraqi southern marshes by [13]. The objective of study is to assess the water quality based on physiochemical parameters as well as monitoring it during 12 months for a year 2017.

from water surface for each station by using clean polyethylene bottles. Physiochemical parameters including, water temperature ($^{\circ} C$), (pH), total dissolved solid (TDS) in mg/l, electrical conductivity (EC) in mS/cm, were measured this variables were measured directly by Hanna instruments (a water proof HI-9146) and turbidity was estimated with a turbid meter HI- 93703C in Nephelometric turbidity units (NTU). The following parameters were evaluated in the laboratory, the term total hardness (TH), Calcium (Ca^{+2}), and Magnesium, (Mg^{+2}) was estimated by Ethylene diamine tetra acetic acid (EDTA) titration and the result are expressed in mg/l which used by [14], Dissolved oxygen (DO) and

biological oxygen demand (BOD⁵) were determined according of [15] and reported in mg/l, chloride (Cl) and alkalinity was determined by [16] in mg/l .Statistical program (SPSS) (ver. 17, 2011) (Statistical Package for Social Science) was

used for analysis at the results of using ANOVA test at significant level (0.05) and a test of least significant difference (LSD) and Pearson's correlation matrix for the physicochemical parameters at Al-Sweib river in 2017.

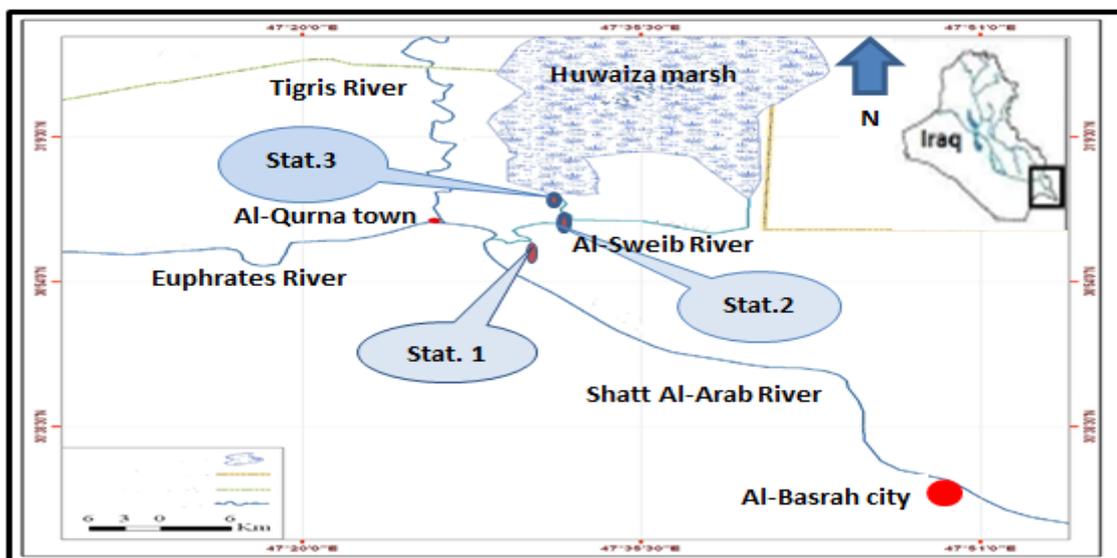


Fig. 1: Map of Al-Sweib River, Northeast of Basrah City

3. RESULT AND DISCUSSION

Physiochemical properties of 12 parameters average with standard deviations that were monthly recorded during the sampling that collected of present study period in three stations were shown in (Table1, Fig.2.). The lowest means of water temperature in three stations was recorded (11.40°C) in January and the highest (32°C) in August, which value $22.73^{\circ}\text{C} \pm 9.0$ (Fig.2, a. Table 1). ANOVA Analysis of ecological factors in three stations did not show significant differences ($F= 0.089$, $P> 0.05$) among the three stations for water temperature. Water temperature effects on solubility and exchange of dissolved gases in the monthly water samples in the three stations, this difference may due to the time of sample collection [17]. Minimum value of Hydrogen ion concentration was 7.07 in August and highest was 7.95 in February with average 7.56 ± 0.33 (Fig. 2, b. Table 1). The result showed significant differences ($P<0.05$) in the study

stations for these parameters: hydrogen ion (pH), total dissolved solid (TDS), electrical conductivity (EC) turbidity, total hardness (TH), calcium, magnesium, dissolved oxygen (DO), biological oxygen demand (BOD) and chloride and alkalinity ($F= 6.486$, $F= 9.981$, $F= 4.725$, $F= 3.429$, $F= 19.124$, $F= 16.311$, $F= 5.432$, $F= 7.715$, $F= 3.572$, $F= 9.526$, $F= 5.884$, $P<0.05$) respectively. The results show that rates of pH values in the present study area within the recorded ranges of Iraqi inland waters [18] and according to natural water specification, as referred by [16]. The total dissolved solid (TDS) values ranged from 1169.6 mg/l in December to 1655 mg/l in August and average $1412.2 \text{ mg/l} \pm 167.76$ (Fig.2, c. Table 1). Table 2 indicates the Pearson's matrix. The result showed strong correlations ($P<0.05$) among TDS values and pH, water temperature. Significant correlations were observed among electric conductivity values with the water temperature and TDS. The observed high values of total dissolved solids during the period of study could be because domestic effluent discharges,

anthropogenic activities, run-off with high suspended matter content and lower water levels [19]. The electrical conductivity in present study

of the river water varied from 1.38 mS/cm in November to 2.30 mS/cm in September with mean value $1.94 \text{ mS/cm} \pm 0.29$ (Fig. 2, d. Table 1).

Table 1: Statistical analysis of the physicochemical of 12 parameters in Al-Sweib River from January to December 2017.

Param.	Units	Mean	STD	Min.	Max.
Temp.	°C	22.73	± 9.00	11.40	32
pH	-	7.56	± 0.33	7.07	7.95
TDS	mg/l	1412.2	± 167.76	1169.6	1665
EC	mS/cm	1.94	± 0.29	1.38	2.30
turb.	NTU	15.83	± 4.60	11.44	28.59
TH	mg/l	749.94	± 102.57	594	908.33
Ca ⁺²	mg/l	160.6	± 22.12	136	196.33
Mg ⁺²	mg/l	84.71	± 23.08	57.77	131.82
DO	mg/l	7.32	± 0.72	6.03	8.20
BOD5	mg/l	1.68	± 1.09	0.45	3.62
Cl ⁻	mg/l	456.40	± 76.20	274.97	538.57
Alka.	mg/l	119.8	± 9.41	101.67	134.33

The values of EC were relatively high particularly in the hot months as well as the exposure of the water to domestic wastes, inorganic contamination and residues of agricultural land was observed during hot months [10-20]. Turbidity rates of water in study area ranged from 11.44 NTU in April to 28.59 NTU in July with average 15.83 ± 4.60 (Fig. 2, e. Table 1). A high values rates of turbidity were recorded in all stations of the study area, this may be due to the amount of insoluble suspended matter, which is caused by organic or inorganic substances, effluent, and heavy rainfall [21]. The observed total hardness (TH) value ranged from 594 mg/l in December to 908.33 mg/l in April with mean 749.9 ± 102.57 (Fig. 2, f. Table 1). Total hardness values exhibited a positive correlations ($P < 0.05$) among temperature, residues agricultural land, industrial waste, rocks and sewage [23]. The lowest dissolved oxygen

TDS and EC ($r = 0.853$, $r = 0.814$, $r = 0.670$) respectively (Table 2). The total hardness values rates were above 500 mg/l, they are less than referred in [22] . The calcium amount of the water in Al-Sweib River recorded 136 mg/l at lowest value in January and highest 196.33mg/l in August with improvement $160.6 \text{ mg/l} \pm 22.12$ (Fig. 2, g. Table 1). The values of calcium ions that have strong relationships with pH and TDS. Magnum ions and pH correlate ($P < 0.05$) with water temperature and total hardness. Concentration of magnesium ranged from 57.77 mg/l in October to 131.82 mg/l in April, at rate of $84.71 \text{ mg/l} \pm 23.08$ (Fig. 2, h. Table 1). Calcium and Magnesium ions refer to the state of equilibrium of water bodies, the sources of Ca⁺² and Mg⁺² in most water are diverse types of (DO) was 6.03 mg/l in August and highest in 8.20 mg/l in January and December with mean 7.32

mg/l \pm 0.72 (Fig. 2, i. Table 1). Dissolved oxygen was correlated with pH, water temperature, TDS, TH and Ca⁺²(Table 2). The minimum value of biological oxygen demand (BOD5) was 0.45mg/l in January and maximum 3.62mg/l in August with range 1.68 mg/l \pm 1.09 (Fig. 2, j. Table 1). Values of BOD refers to strong negative correlations between DO and pH, also there is a positive correlation with TDS and Ca⁺². The lower values of DO and highest of BOD recorded at station 3, that may be caused by of the sewage and human waste to the river directly through discharge that leads to the depletion of DO, this consistent with [2]. Concentration of chloride ranged from 274.97 mg/l in January to 538.5 mg/l in August with rate of 456.40 mg/l \pm 76.20 (Fig. 2, k. Table 1).

Chloride values is positively correlated with water temperature, TDS, EC, TH, Ca⁺² and BOD on the other hand a negatively with Dissolved oxygen (Table 2). Chlorides in Al-Sweib River can be mixed with the discharge of local effluents or domestic sewage disposal at different points that may cause in a moderate increase rate of chlorides [24]. The value of chloride ions is beyond limits of WHO standard. The result showed that Alkalinity varied from 101.67 mg/l in February to 134.33 mg/l in July and the mean was 119.8 mg/l \pm 9.41(Fig.2, l. Table 1). The result showed a significant correlation (r= 0.596, P<0.05) between alkalinity and turbidity (Table 2). Alkaline of water at the river in all stations seems within the range values that recorded by [16-25].

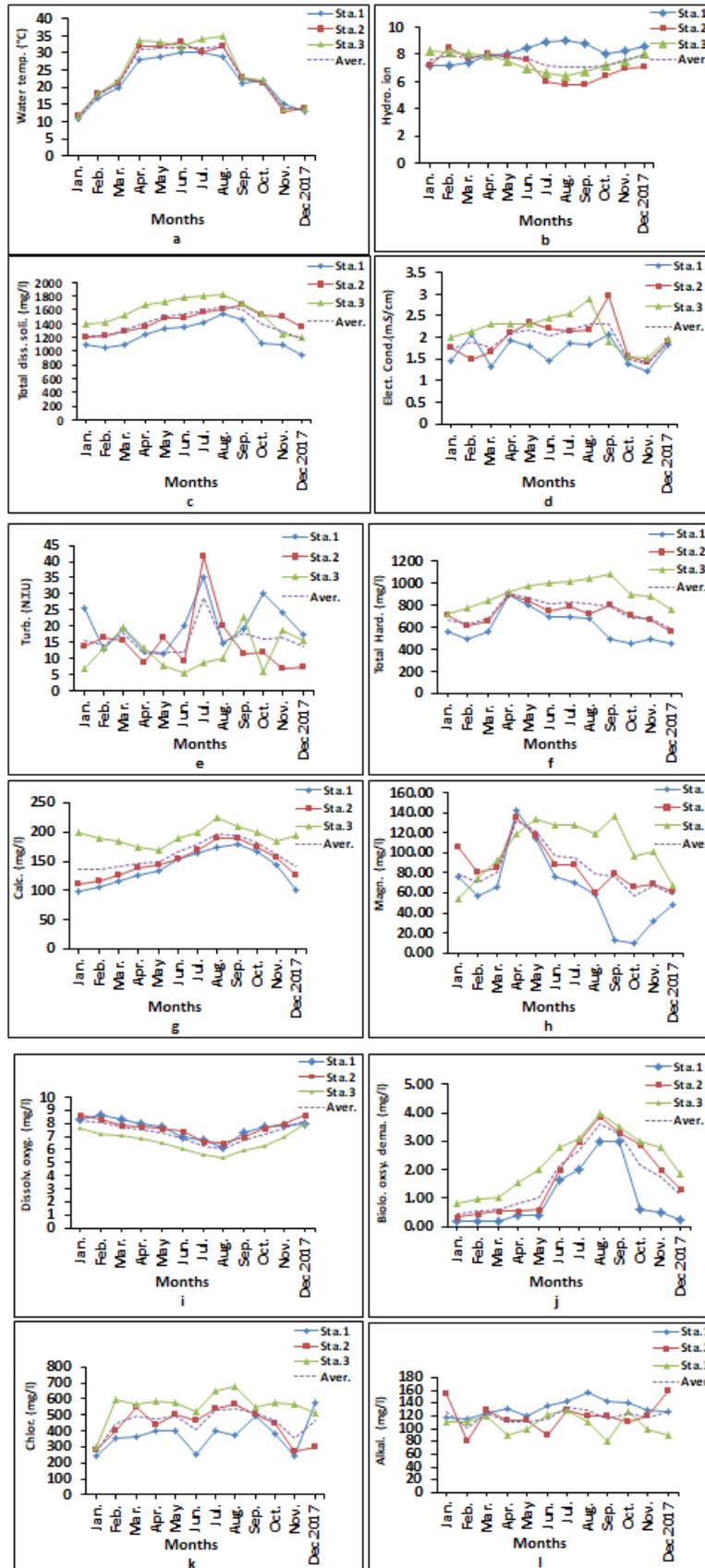


Fig. 2: Monthly variations in the means values of: T, pH, TDS, EC, turbidity, TH, Ca^{+2} , Mg^{+2} , DO, BOD, Cl^{-1} , and alkalinity in water samples in Al-Sweib River from January to December 2017.

Table 2: Pearson's correlations matrix of the physicochemical variables at Al-Sweib River in January to December 2017.

Parameters	pH	Temp.	TDS	EC	Turb.	TH	Ca+2	Mg+2	DO	BOD	Cl ⁻
Temp.	-0.135										
TDS	-0.651*	0.787**									
E.C	-0.207	0.632*	0.710**								
Turb.	-0.575	-0.036	0.222	0.027							
TH	-0.210	0.853**	0.814**	0.670*	-0.023						
Ca+2	-0.897**	0.429	0.807**	0.344	0.361	0.401					
Mg+2	0.274	0.674*	0.412	0.524	-0.235	0.847**	-0.147				
DO	0.750*	-0.713**	-0.953**	-0.585	-0.375	-0.673**	-0.889**	-0.211			
BOD5	-0.857**	0.408	0.790**	0.419	0.371	0.365	0.977**	-0.171	-0.890**		
Cl ⁻	-0.534	0.726**	0.863**	0.850**	0.266	0.598**	0.676**	0.256	-0.843**	0.710**	
Alka.	0.561	-0.118	0.147	-0.056	0.596*	-0.087	0.323	-0.283	-0.316	0.351	0.146

CONCLUSION

In the light of the above study, the following of conclusions can be observed: Some of physiochemical within limited of Iraqi river and WHO; water temperature, pH, EC, DO, BOD, and alkalinity, another parameters beyond of range such as TDS, turbidity, TH, Ca^{+2} , Mg^{+2} , Cl^- may be the affected by anthropogenic and agriculture activities include the lower levels of water in the river. Through of the study we observe that the river water is suitable for human and agricultural uses with emphasis on environmental monitoring from the relevant authorities.

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تقييم الخصائص الفيزيائية والكيميائية في نهر السويب، محافظة البصرة - العراق

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الخلاصة

إن التغيرات النسبية في الخصائص الفيزيائية والكيميائية لمياه نهر السويب في السنوات الأخيرة قد تعود للفاعليات البشرية والزراعية فضلاً عن انخفاض مناسيب المياه . جُمعت عينات المياه لمحطات الثلاث من شهر كانون الثاني ولغاية كانون الأول 2017. اختير 12 متغيراً بيئياً، وسجلت معدلات درجة حرارة الماء وألاس الهيدروجيني والمواد الصلبة الذائبة والتوصيلية الكهربائية والعكارة والعسرة الكلية وأيون الكالسيوم وأيون المغنسيوم والأوكسجين الذائب والمتطلب الحيوي للأوكسجين وأيون الكلورايد فضلاً عن القاعدية الكلية. سُجلت ادنى قيمة لدرجة حرارة الماء (11.4 م°) في كانون الثاني وأعلىها (32 م°) في آب، كانت قيمة الأس الهيدروجيني بين 7.07 في آب و7.95 في شباط وتراوحت قيمة المواد الصلبة الذائبة بين 1169.6 ملغم/لتر في كانون الأول و 1665 ملغم/ لتر في آب، وتباينت قيمة التوصيلية بين 1.3 ملي سيمنز/سم في تشرين الثاني و 2.30 ملي سيمنز/سم في أيلول، واستحصلت ادنى قيمة لعكارة الماء (11.44) وحدة كدره دولية في حزيران وأعلىها (28.59) وحدة كدره دولية في تموز وكان مدى العسرة الكلية بين 594 ملغم/لتر في كانون الأول و 908 ملغم/لتر في نيسان، سُجلت ادنى قيمة لأيون الكالسيوم 136 ملغم/لتر في حزيران وأعلىها 196.33 ملغم/لتر في آب، تراوح معدل تركيز أيون المغنسيوم بين 55.77 ملغم/لتر في تشرين الأول و 131.82 ملغم/لتر في نيسان وكانت قيم الأوكسجين الذائب والمتطلب الحيوي للأوكسجين والقاعدية ضمن المحددات العراقية لنظام صيانة الأنهار بينما تباينت قيمة الكلورايد بين 274.97 ملغم/لتر في كانون الأول و 538.5 ملغم/لتر في آب.

الكلمات المفتاحية: نوعية مياه، نهر السويب، الخصائص الفيزيائية والكيميائية.