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# Water quality status in different aquatic environments in Thi- Qar province based on NSF-WQI

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## Abstract :

The present study was conducted during the period Winter &Summer of 2016 in different aquatic environments in Thi-Qar province to determine water quality status based NSF-WQI and some Iraqi & international standards. Three stations were chosen e to achieve the study, (each station consist from two sites), station (1) Euphrates River, station (2) Al-Gharraf River, station (3) Al- Chibayish Marshes.

The study result water quality conditions have been classified as (medium – good) at (NSF-WQI), some factors (physical chemical properties ) was within of the some Iraqi & international standards.

Euphrates River recorded highest pollution in compare: with Al- Gharraf River and Al- Chibayish Marshes, thus the (NSF - WQI ) is considered a good , easy and efficient way to use guide to assess the quality of the water , can us adoption on it to assess various aquatic environments.

**Key worlds:** Water quality, NSF-WQI index, water pollution and physical chemical properties .

# تقييم نوعية المياه في البيئات المائية المختلفة لمحافظة ذي قار باستخدام دليل نوعية المياه (المؤسسة الوطنية للصرف الصحي)

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## الخلاصة

أجريت الدراسة الحالية خلال شتاء وصيف / 2016 لبيئات مائية مختلفة في محافظة ذي قار لتقييم حالة نوعية المياه فيها باستخدام دليل نوعية المياه (المؤسسة الوطنية للصرف الصحي ) وبعض معايير العراقية والدولية .

تم اختيار ثلاثة محطات لإتمام هذه الدراسة ، (كل محطة تتكون من موقعين)، المحطة (1) نهر الفرات ، المحطة (2) نهر الغراف، المحطة (3) أهوار الجبايش . وقد صنفت نوعية المياه بين (متوسطة – جيده ) حسب الدليل المستخدم , وكانت بعض الخصائص الفيزيائية والكيميائية تقع ضمن بعض المعايير العراقية والدولية. سجل نهر الفرات أعلى نسبة التلوث مقارنة مع نهر الغراف وأهوار الجبايش , يعتبر الدليل المستخدم وسيلة جيدة وسهلة وفعالة ويمكن الاعتماد عليه لتقييم حالة المياه في البيئات المائية المختلفة .

**الكلمات المفتاحية :** نوعية المياه , دليل ( المؤسسة الوطنية للصرف الصحي ) ، تلوث المياه و الخصائص الفيزيائية والكيميائية .

## 1- Introduction:

Water is an essential natural resource for human life. Furthermore, it is an important resource in developing economics and society in terms of agriculture, industry and various facilities. Rivers not only supply water for human consumption but also receive wastewaters discharged from all human activities (ICMM, 2007).

All Aquatic ecosystems in the world are under increasing stress due to the effects of the rapidly growing population, technological development, urbanization and economic growth. Human activities are causing aquatic species to disappear at an alarming rate (Viessman & Hammer, 1985).

The internal water in Iraq covers about (24000) km² which consist more than (5%) of Iraq area including, marshes, lakes, Tigris, Euphrates, their tributaries and branches (Jerry & Webb, 2004).

To the various types of pollutants from various sources, including sewage and wrong style flows in the waste and recycling treatment, including the remnants of war (UNEP, 2003) and negligence in the maintenance of laboratories and factories and monitor the implementation of environmental safety requirements. Among these organic and inorganic chemicals pollutant, which cause danger directly on the lives of most aquatic and human alike, by entering the food chain and accumulate in the levels of that chain and aquatic wildlife (FAO , 1994) .

There are several water quality guide that have been developed to aid water quality type in USA, and others countries .

Most of these indices are based on the WQI developed by the U.S. (NSF), National Sanitation Foundation ,developed these index, called the NSF Water Quality Index (NSF-WQI) to provide a standardized method for comparing the relative quality of different water bodies (Said,2004) .

Water quality index (WQI) is considered as an effective tool to categories of water resources for its quality and suitability for different uses. The (NSF -WQI) was applied to assessed the water quality of in Thi-Qar province - southern Iraq, and determine its suitability for drinking water and aquatic organisms life for the first time in the study area.

National Sanitation Foundation Water Quality Index (NSF-WQI) is used to determine the status of water quality, based on 9 parameters, some were judged more important than others, so a weighted mean is used to combine the values these factors include (DO, Fecal Coliform , BOD, pH , Water Temperature Change , Total Phosphate, Nitrates, Turbidity , Total Solid. all parameters in this modal applied without Fecal Coliform hence there was a modification of weight .

Added to the factors above were selected other factors for determine water quality especially those have affect on this quality , it suitability for drinking water and aquatic organisms life such as :(Air temperature , Electrical conductivity, Salinity, Sulfate, Total alkalinity, and Total hardness ) , also compare factors with some the Iraqi & international standards.

The present study aims to evaluate the water quality status by (NSF-WQI) , and compare status of some of the different bodies of water in environmentally province of Thi- Qar and find out the cause of the pollution and the possibility to put some solutions or appropriate proposals to solve, and this is done through:

1-Measuring some physical- chemical properties of water, as used 8 parameters of them for to Measuring (NSF-WQI).

2-Compared rates of some these characteristics between the different bodies of water and compared with Iraqi & international standards .

## 2- Material and method

### 2-1 Study of stations :

The completion of the current study was chosen three stations (Figure 1) as follows:

1- **The First Station**: Chosen at two sites in the **Euphrates River** in where of location (1) before entering the river the center of Al-Nassyria city, and the second site after the exit of the river from the center of the city, and took the rate of this locations representing this station.
2- **The Second Station**: Chosen at two sites in the **Al-Gharraf River** (Which comes from the Tigris River ) in where of location (1) before entering the center of Al-Gharraf city and the second site after the exit of the river also took the rate of this locations representing this station.
3- **The Third Station :** Chosen two sites in **Al-Chibayish Marshes** where of location (1) an area close to from sources of pollution because of the many people who live near to (place fishermen rally and be close to selling their fishing) and the second site is about 2 km away

from the first location, and took two sites rate represents this station.


Figure: (1) Map of the study area showed the study stations

## 2-2 Sample collection:

The sampling performed monthly (during winter & summer, 2016 ) for monitoring the field measurement of water of 2016 , it was expressed seasonally , triplicate samples were collected from each station, by polyethylene bottles volume (3) liter for the purpose of the required tests, and others Checked directly with the device (Multi) .

## 2-3 Field & Laboratory Measurements :

1- Air temperature ,Water temperature (Temp. C°), Electrical Conductivity (Con. µS /cm), Salinity (Sal.(‰, ppt), Dissolved Oxygen , (D O mg/L) and pH were measured in each station using a Multi-Parameter (Multi 340i meter), Water turbidity (Tur. NTU) was measured in the field by turbidity meter type HANNA (LP2000) , the device was calibrated before use, was measured in the field, as described in (APHA, 2003).
2- Biological Oxygen Demand ($BOD_5$) (Winkler's method) , Total Dissolved Solids (TDS) &Total Solid suspended (T S S ) evaporating dish method (Sum in: Total Solid =**T.S** )Sulfate (Spectrophotometer method 420 nm) was measured in the laboratory ( mg/L) as described in (APHA, 2003).
3- Total Alkalinity, Total Hardness, was measured in the laboratory (mg/L) as described in (Lind, 1979).
4- Reactive Nitrite (Ultraviolet method UV-spectrophotometer model 7200), Reactive phosphate (Ascorbic Acid Method – spectrophotometer -885nm ), was measured in the laboratory (µg/L) as described in (APHA, 1998).

## 2-4 NSF-WQI index :

National Sanitation Foundation of Water Quality Monitoring, , Water quality index is a 100-point scale that summarizes results from a total of nine different measurements when complete , some were judged more important than others, so a weighted mean is used to combine the values these factors include (DO, Fecal Coliform , BOD, pH ,water Temperature Change , Total Phosphate, Nitrates, Turbidity , Total Solid. all parameters in this index applied without Fecal Coliform hence there was a modification of weight as shown at (Effendi.*et.al*,2015) obtained by Calculator NSF-WQI index Online (http://www.water-research.net/ index. php /water-treatment/water-monitoring/monitoring-the-quality-of-surfacewaters )

**NSF-WQI = $\Sigma$ Wi x Li , i=0**

**NSF-WQI : Water Quality Index Score**

**Wi : The weight score , Li : The sub-index value**

Table( 1) NSF-WQI Classification Standards

| NO | NSF-WQI Score | Standards |
|---|---|---|
| 1 | 91 – 100 | Excellent |
| 2 | 71 – 90 | Good |
| 3 | 51 – 70 | Medium |
| 4 | 26 – 50 | Bad |
| 5 | 0 – 25 | Very Bad |

# 3- Results And Discussion :

Hydrological, chemical and biological characteristics of the waters of the rivers affected by many factors, including climate and properties of geological and vegetation (Wetzel, 2001).

Table (2) shows that overall average values varied in rather different ranges among stations in the same season , between the seasons, the temperature has a direct impact on life processes to aquatic organisms (Weiner, 2000), that the variation in water temperature depending on location may be due to thermal effects of the sun and move it through the water column (Saad, 1978). The longer the heat from the core to the density of water and determinants that are directly related to salinity, making it determines the distribution of organisms in the water body (Smith, 2004) especially the difference in the intensity of solar radiation between winter and summer, different length of lighting period and the effect of geographical location (Talling, 1980). Observed differences in the seasonal clear air temperature during this study, as well as the temperature of the water showed a wide range of seasonal changes, , it recorded as higher than the permissible limits of aquatic organisms life (CCME,2007) specially in summer season (Table 2) , which confirms the temperature of the aquatic environment affected by temperature air surrounding significant differences of air temperature and water temperature on-site differences were apparent at the level of ($P < 0.05$) .

Electrical Conductivity good indicator for Salinity, Total Solid suspended, Total Dissolved Solids (Wetzel , 2001) , in this study show the same figure nearly for these four factors in this study, the same figure appeared in the gradient with the difference in the values and this confirms the correlation between these four factors , that the differences in values between winter and summer because the quarterly variation of these values has recorded the highest values in the winter, it has been attributed to the decline in water levels and lack of discharge rates, or has reason to wash saline soils processes that take place during winter or due to rainwater that washed away with salts from neighboring territories .

(Hutchinson, 1957), while the low values in the summer due to the dilution quotient of water as a result of the high water level and increasing the discharge rate, while the differences between the study stations due to the difference in the type of water discharges, and in the studies of geological stations, the values of (EC) and TDS are recorded higher value than the acceptable limits when it compared with the Iraqi and international standards (Table 3), statistical analysis showed significant difference ($p < 0.05$) between stations and seasons, on-all (EC , Salinity , TDS ,TSS ) were apparent at the level of ( $P < 0.05$) , positive significant correlation between these factors.

The pH value controlled by the relationship between the concentration of hydrogen ion( + H) released from the Carbonic and the root of the hydroxyl (-OH) resulting from the decomposition of bicarbonates, characterized by the values of pH in the current study variations quarterly very slight also among study stations (Table 2) , the values of (pH) is recorded within acceptable limits when it compared with the Iraqi & international standards (Table 3), which set pH values between (6.5 to 9) and its value within the baseband side , this is consistent with numerous studies on local water ( Farhood , 2012), statistical analysis showed significant not difference ($p < 0.05$) between stations and seasons,

The present study showed (Table 2) that overall average values varied in narrow ranges among stations and seasons for DO , $BOD_5$ , and the factors concentration it's the result of the interaction of factors (photosynthesis, aeration, breathing, breaking down waste, and important factor temperature).

Higher concentrations of dissolved oxygen during the winter, possibly due to the low temperatures and caused an increase in solubility of gases in the water as well as the role of wind in it, and this is confirmed by the negative correlation between the temperature of the air and water with dissolved oxygen and is consistent with the findings of the (Nassar & Shams El-Din, 2006), as well as to lower the decomposition of organic material by microorganisms as this process is consuming whatever oxygen in the aquatic environment (Sugisaki, 1962), while the low dissolved oxygen values in the summer compared with the winter due to the high temperatures, which increases the level of decomposition of organic materials as a result of activity microbiology and thus dissolved oxygen consumption (Valdes & Real, 2004), to link the temperature is inversely correlated with the concentration of dissolved oxygen (Kinne, 1963), the DO , $BOD_5$ the values are recorded within acceptable limits when it compared with the Iraqi standards (Table 3 ) , statistical analysis showed spatial significant not difference ($p < 0.05$) between stations, but recorder that between the seasons.

Turbidity NTU : Caused it of the existence of stuck solids in the water from the clay and silt, it can also be due to the presence of bacteria and organisms minutes and plants afloat Among the most important factors affecting the brownish water drainage and speed of the current and the nature of the bottom and the quality of the soil the banks of the river and the density of vegetation and the size of the river basin and climate change, including the fallout from the air and the topography of the area and various human activities and turbidity direct impact in the photosynthesis process algae, especially phytoplankton because of the distraction caused by the absorption of light through the water column (Fleming, 1977) . It recorded higher value than the acceptable limited for Iraqi and international standard (Table 3), statistical analysis showed significant not difference ($p < 0.05$) between stations and seasons .

Iraqi rivers near the catchments area become highly turbid and show an increase in suspended solids during the rainy season, For this note the station (1) values higher than the station (2) Because of the high number of residents near the Euphrates River , but in Al-Chibayish Marshes the turbidity also increase during the low flow when the water comes from the rivers full with organic materials , for this note the station (3) values higher than the station (1, 2), another reason for this could be due to the fact that the area was very dry resulting in limited water flow in the river, This is consistent with the study of each of the( Al-Helaly , 2010; Al-Kunani,2011 , Mashkhool , 2012).

Alkaline water indirectly affect aquatic organisms, including phytoplankton through their influence in the flat water productivity (Reid, 1961), are affected by various factors such as the concentration of carbon dioxide , the process of photosynthesis , the activity of microbiology and breathing (Trimborn, 2008).

The results showed that the current study water is hardness type of non-carbonate because the hardness values more than the alkaline values according the Lind classification (Lind, 1979), this means that the hardness water resulting from metals association (calcium, magnesium, etc.) with ions sulfates, chlorides, nitrates (Tebbutt, 2000). Water can be described as very hardness to override the values of hardness (180 mg / L) a condition common in Iraqi waters (Hassan, 2004) . Statistical analysis showed a significant positive correlation between the concentrations of hardness and values of salinity as the overall top ten high values recorded during the winter, while lower values during the summer (Table 2)

The Hardness & alkaline water recording higher value than a the acceptable limited for Iraqi & international standards (Table 3 ), statistical analysis showed spatial significant not difference ($p < 0.05$) between stations, but recorder that between the seasons.

The more forms of sulfur presence in natural water is sulfate (APHA, 2005), High concentration of sulfates in the first leg result recorded affected by sewage, and the rise in the relative degree water temperature led to increased evaporation of water operations and an increase in the concentrations of many salts, including sulfur compounds (Wetzel,1983) it is recording higher value than a the acceptable limited for international standards (Table 3) , statistical analysis showed spatial significant not difference ($p < 0.05$) between stations, but recorder that between the seasons.

The discharge of sewage directly into the water and because the city of Nasiriya ($st_1$) is great compared with other city (st2, st3 ) , which represents one of the sources of soluble phosphate operations (Mokaya et. al., 2004) , (st1) only is recording higher value than a the acceptable limited for Iraqi standards , but ( $st_2$, $st_3$) set within acceptable limited for Iraqi standards (Table 3) , statistical analysis showed spatial significant difference ($p < 0.05$) between stations ( st1 with st2 ,st3), but not recorder that between the seasons.

The nitrates are the dominant form of compounds of nitrogen inorganic in the aquatic environment, a figure that exploits by most plants a, phytoplankton and rarely exceed( 10 mg / L ) in natural waters (Lind, 1979). And that the increase in nitrate levels in natural waters back to increase domestic and agricultural waste dumped , with regard to quarterly changes, the clear increase in nitrate levels during the winter and this is due to a decline in the relative degree water temperature and good ventilation would receive an increase in the concentration of dissolved oxygen, which works on the oxidation of nitrite to nitrate and not reduce nitrates in low-lying degree heat (Yoeman *et. al.*, 1988 ) it recording value without in some a the acceptable limited for Iraqi & international standards (Table 3 ), statistical analysis showed spatial significant not difference ($p < 0.05$) between stations, but recorder that between the seasons.

The temperature and the level and speed of the water flow and the amount and type of waste and sewage resulting from population centers and the proliferation of factories on the banks of the water bodies as well as pesticides, Climate fluctuate and fertilizers added to the type of groves surrounding the water bodies , are the cause of the difference in the values of factors (Sulfate, , Reactive Nitrite ,Reactive phosphate) , (Table 2) .

The study reported that all studied factors higher values in the station (1) Euphrates River from what it is at the stations, (2) Al-Gharraf River ,(3) Al-Chibayish Marshes )This may be due to multitude population centers nearby consequential multitude waste resulting from the activities of man and carry river water from waste through cities that passes in what are adding industrial activities .

The station (2) also recorded a lower concentration than the station (1) and the highest station (3), except for some of the elements such as **(**Sulfate, Total Alkalinity , Total Hardness, Reactive Nitrite ,Reactive phosphate), where the station(3) recorded the highest of them, and that the lack of population centers and industrial activities or for the abundance of aquatic plants in the third. Compared to the station (2) (Table 2).

Table (2) Water parameters concentration (rang) and Mean ± SD and mean con. in season and stations.

| Water parameter | Season | | | Mean con. in Station |
|---|---|---|---|---|
| | Station | Winter | Summer | |
| Air tem. C° | St1 | (9 - 12) 11 ± 0.2 | (33.5-35) 34 ± 0.1 | 22.5 ± 1.1 |
| | St2 | (11.5-12.5) 12 ± 0.22 | (34-36) 35 ± 0.4 | 23.5 ± 7.02 |
| | St3 | (12.5-14) 13 ± 0.4 | (33-35) 35 ± 0.41 | 24 ± 5.01 |
| Water tem. C° | St1 | (6.5-7.6) 7 ± 0.5 | (29-31) 30 ± 1.2 | 18.5 ± 5.11 |
| | St2 | (7- 8.5) 8 ±0.62 | (29-32) 30 ± 0.6 | 19 ± 6.5 |
| | St3 | (7.3 -8.5) 8 ± 0.53 | (28.5 -32) 30 ± 0.7 | 19 ± 7.2 |
| E.C ( µS /cm) | St1 | (5000-5420) 5220 ± 130.1 | (3520-4000)3820 ±125.1 | 4520 ± 130.3 |
| | St2 | (3500-4000)3720 ± 128.7 | (1900-2300)2100 ±110.2 | 2910 ±128.9 |
| | St3 | (3225-3600) 3521 ± 120.5 | (3225-3600)3521±120.5 | 4085.5 ±129.4 |
| Salinity(‰) | St1 | (3.1-3.5) 3.34 ± 1.2 | (2.2 -3) 2.5 ±1 | 2.92 ±2.1 |
| | St2 | (2.24-2.6 ) 2.4 ± 1.9 | (1.22 -1.5) 1.32 ±0.5 | 1.9 ± 3.2 |
| | St3 | ( 2.9 – 3.2 ) 3 ± 0.9 | (2- 2.5) 2.25 ±0.9 | 2.6 ±1.62 |
| TDS (mg/L) | St1 | (25600-3210) 2850 ± 124 | (2100-2500)2310 ±122.5 | 2580 ±140.5 |
| | St2 | (2300 -2900) 2650 ± 134 | (2000-2400)2280 ±120.1 | 2465 ±135 |
| | St3 | ( 2900 -3400) 3011 ± 132 | (2200-2700)2520 ±123.5 | 2765.5 ± 142.3 |
| T.T.S (mg/L) | St1 | (106- 125 ) 119 ± 20.4 | (94 – 110) 101 ± 21.4 | 110 ± 21.22 |
| | St2 | (101 – 131) 116 ± 22.3 | (88-100) 94 ± 20.2 | 105 ± 21.7 |
| | St3 | (111-141 ) 121 ± 30.2 | (101-132) 110 ± 32.1 | 116 ± 31.6 |
| PH | St1 | (8.2-8.6) 8.5 ± 1.1 | (7.2- 8) 7.8 ±1.4 | 8.15 ± 1.7 |
| | St2 | (8 -8.5) 8 ± 1.1 | (7.5- 8.1) 7.7 ±1.1 | 7.95 ±1.2 |
| | St3 | (7.8 -8.1) 8 ±0.9 | (7.2 -7.7) 7.5 ± 1.1 | 7.75 ± 1.1 |
| DO (mg/L) | St1 | (10.7-11.5) 11 ± 0.8 | (7.5 - 8.5) 8.2 ± 0.9 | 9.6 ± 2.2 |
| | St2 | (11-12) 11.5 ± 0.5 | (6.5-9) 8.5 ± 1.2 | 10 ±1.5 |
| | St3 | (9 -10.5) 10 ± 1.3 | (6.7-7.5) 7 ±1.5 | 8.5 ± 1.62 |
| $BOD_5$ ( mg/L) | St1 | (2- 2.5) 2.3 ± 0.7 | (1.5 -2 ) 1.7 ±0.7 | 2 ± 0.9 |
| | St2 | (1.75 -2.2) 2 ±0.65 | (1.2 -1.7) 1.5 ± 0.6 | 1.75 ± 1.1 |
| | St3 | (2.1 -2.7) 2.5 ±0.8 | (1.8-2.2) 2 ±0.55 | 2.25 ±1.4 |
| Turbidity (NTU) | St1 | (21.2-25) 22.6 ±1.12 | (19.6- 20.1) 19.22 ±0.6 | 20.91 ±2.1 |
| | St2 | (19.8-20.5) 19.9 ±0.05 | (16.8-18.5) 17.41 ± 1.1 | 18.7 ± 3.1 |
| | St3 | (22-26.2) 25.3 ±2.3 | (20.2-22.5) 20.5 ±1.7 | 22.9 ± 3.6 |
| Total Alkalinity mg ($CaCo_3$/L) | St1 | (165-190) 183 ±98.9 | (180-200) 190 ±87.9 | 186.5 ± 114.5 |
| | St2 | (165-179) 170 ±95.1 | (172-180) 175 ±88.8 | 172.5 ± 116.7 |
| | St3 | (160-180) 170 ±87.9 | (175-183) 177 ±89.2 | 173.5 ± 115.9 |
| Total Hardness (mg/L) $CaCo_3$ | St1 | (1520-1600) 1550 ±76.5 | (1280-1360) 1320 ±128 | 1435 ± 138.4 |
| | St2 | (1400-1450) 1425 ±67.9 | (1100-1250) 1115 ±121 | 1270 ± 125.7 |
| | St3 | (1240-1360) 1350 ±78.3 | (1080-1283) 1120 ±95.3 | 1235 ± 120.6 |
| Sulfate( mg/L) $SO_4$ | St1 | (350-450 ) 427 ±115.3 | (800-920) 851 ±142.3 | 639 ± 150.7 |
| | St2 | (325-360) 357 ±120.2 | (560-620) 676 ±121.1 | 516.5 ± 140.2 |
| | St3 | (241-270) 206 ± 132.5 | (475-583) 477 ±111.7 | 326.5 ± 115.8 |
| Reactive phosphate ( µg/L) | St1 | (0.5-0.8) 0.7 ± 0.4 | (0.31-0.6) 0.4 ±0.41 | 0.55 ±0.45 |
| | St2 | (0.21-0.4) 0.32 ±0.1 | (0.21-0.3) 0.25 ±0.1 | 0.29 ±0.45 |
| | St3 | (0.1-0.22) 0.2 ±0.11 | (0.09-0.13) 0.1 ±0.007 | 0.15 ± 0.02 |
| Reactive Nitrite µg/L) (NO3 | St1 | (34.2-41.2) 36 ± 12.6 | (15.2-17.2) 16.5 ± 10.5 | 26.25 ± 17.5 |
| | St2 | (33.1-38.7) 35 ± 8.4 | (13.5-12.5) 14.2 ±9.6 | 24.6 ±15.6 |
| | St3 | (30.4-36.7) 33.1 ±9.4 | (12.1-16.1) 14 ±11.3 | 23.6 ±16.5 |

Table (3) : Some Iraqi & International (globally) acceptable limits for drinking water , aquatic organisms life.

| Number | Water parameter | A | B | C | WHO2004 | WHO2008 | CCME2007 |
|---|---|---|---|---|---|---|---|
| 1 | Temperature | - | - | - | - | - | 15** |
| 2 | E.C ( µS /cm) | - | - | - | - | 2500 >* | |
| 3 | DO (mg/L) | >5* | | >5* | - | — | - |
| 4 | $BOD_5$ (mg/L) | <3* | <5** | <5* | - | - | - |
| 5 | PH | 6.5-8.5* | - | 6.5-8.5* | - | | 6.5-9** |
| 6 | NTU | 5* | - | - | - | - | 5** |
| 7 | TDS( µS /cm) | 1000* | - | - | - | — | 500** |
| 8 | Total Alkalinity(mg/L) | - | - | - | 100* | - | - |
| 9 | Total Hardness(mg/L) | 500>* | - | - | - | - | - |
| 9 | $PO_4$ (µg/L) | - | - | 0.4* | | - | 0.1** |
| 10 | $NO_3$ (µg/L) | 50* | - | 15* | - | - | 13** |
| 11 | Sulfate (mg/L) | - | - | - | 400* | - | - |

*Drinking Water ** Aquatic Organisms life

**A**= Iraqi determinants maintenance system for drinking water (2001)
**B**= Iraqi determinants maintenance system for drinking water No.419, (2009)
**C**= Iraqi determinants maintenance system of rivers from pollution No. 25 of 1967 of the aquatic organisms life ..

The results in this study of parameters above (Table 3) was within the range standards, this is consistent with a study (AL- Ghezi ,2014) .
The analysis using the NSF WQI index: (Euphrates River, Gharraf River and Chibayish Marshes water (Station: 1 , 2 , 3 Respectively), classification in each station is presented at (Table 4).

Table (4) NSF WQI Value of Station Study.

| Station | NSF-WQI Score | Classification |
|---|---|---|
| 1 | 69 | Medium |
| 2 | 73 | Good |
| 3 | 75 | Good |

The quality of the water at every station was few different, Parameters out range were Nitrates , Total Solid, Turbidity .These three NSF-WQI values ranged (69 – 75) and can be classified between ( Medium - good ) quality; this characteristic is dependent on the type activity intensity of the surrounding area (Saksena

& Garg , 2008) **,** Climate fluctuated and geological nature (Wetzel, 2001).

## Conclusion :

1-Water quality conditions in this study have been classified as (medium – good) at NSF-WQI index.
2-Some parameter was within the some Iraqi & International acceptable limits standards .
3-Euphrates River highest pollution compare: Al-Gharraf River and Al-Chibayish Marshes, Because of human activities , climate fluctuated , intensity of population, geological nature, it is passed through big Urban compare others, the type of portable pollutant in water from upstream until the study area.
4- The proliferation of plants in water bodies has worked to reduce the potential pollutions became to these aquatic bodies the ability to self-purification.

## Recommendations :

1- The (NSF - WQI ) index is considered a good , easy and efficient way to use guide to assess the quality of the water , can us adoption on it to assess various aquatic environments.
2- The demand from the responsible parties to increase water levels in a various aquatic bodies , this increase working at reducing pollutants in the water.
3- Using some aquatic plants as( biofilter , bioindicators , biomonitor ,biomarker ) in aquatic bodies to filtering , watching the pollutants.
4- Raise awareness when citizens about the danger of throwing pollutants into water bodies .

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