



## Study the Impact of the waste which discharged from Al-Karama and Sharq- Dijla water treatment plants in water pollution of Tigris River water

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### Abstract

This study was conducted to evaluate the effect of discharge of water purification plants ,on the purity of Tigris River water in Baghdad city. The two studied plants were involved in the study : Sharq –Dijla and Al-Karama water purification plants. The study was attempted to focus on probable pollutants. Chemical, physical tests were accomplished on water samples collected from four sites with fact of three replicates for each sample of each site of the river and the plant : before, after, inside the plants and at the pipe. This study started from October 2012 to September 2013. In case of heavy metals Results showed that the highest level of aluminum was 1.08 ppm during (December-January) at Sharq-Dijla plants, while the lowest level was 0.059 ppm during (August- September) at AL- Karama plants ,while results of iron which recorded the highest level 3.30 ppm during (December-January) at Sharq –Dijla plants, while the lowest level was 1.63 ppm during (August-September) at Sharq –Dijla plants. It was found that the highest level of turbidity was 119 N.T.U during (December-January) at Sharq- Dijla plants, while the lowest level was 33.0 N.T.U during ( June-July) at Sharq-Dijla plants. While the highest level of EC was 1068  $\mu$ S/cm during (December-January) at Sharq-Dijla plants, while the lowest level was 693  $\mu$ S/cm during ( June-July) at Sharq-Dijla plants .T.D.S recorded highest level during (December-January) at AL- Karama plants which was 687 ppm , while the lowest recorded level was 506 ppm during ( August- September) at Sharq-Dijla plants, also the highest level of T.S.S was 793 ppm during (December-January) at AL- Karama plants, while the lowest level was 410 ppm during ( August- September) at Sharq-Dijla plants .

**Key words:** Total dissolved solids(TDS),Total suspended solids(TSS),Turbidity.

## دراسة تأثيرالمخلفات الناتجة من تصفية محطتي إسالة الكرامة وشرق دجلة في تلوث مياه نهر دجلة

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### الخلاصة :

تم إجراء هذه الدراسة لتقييم مخلفات محطات معالجة المياه وتأثيراتها في تلوث نهر دجلة في مدينة بغداد.تمت دراسة:محطتي شرق دجلة و الكرامة ، تم إجراء فحوصات كيميائية وفيزيائية على عينات المياه المجموعة من أربعة مواقع لكل محطة:قبل ،داخل،بعد المحطة،وعند المصب،بواقع ثلاثة مكررات لكل عينة.تم الشروع بانجاز هذه الدراسة في شهر تشرين الأول 2012 وانتهت مدة الدراسة في أيلول 2013 . اظهرت

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نتائج فحوصات المعادن الثقيلة بان اعلى تركيز للالمنيوم كانت 1.08 ppm خلال شهري (كانون أول-كانون الثاني) عند محطة شرق دجلة، بينما اقل تركيز له 0.059 ppm خلال شهري (اب-ايلول) عند محطة الكرامة، بينما نسب الحديد فان اعلى تركيز سجل هو 3.30 ppm خلال شهري (كانون أول-كانون الثاني) عند محطة شرق دجلة. بينما اقل تركيز له 1.63 ppm خلال شهري (اب-ايلول) عند محطة شرق دجلة. اظهر فحص TDS بان اعلي قيمة له كانت 687 ppm خلال شهري (كانون أول-كانون الثاني) عند محطة الكرامة، بينما اقل قيمة مسجله له كانت 506 ppm خلال شهري (أب- أيلول) عند محطة شرق دجلة. وفقا لفحص TSS وجد بان أعلى قيمة مسجلة كانت 793 ppm خلال شهري (كانون أول-كانون الثاني) عند محطة الكرامة، بينما اقل قيمة مسجله له كانت 404 ppm خلال شهري (أب- أيلول) عند محطة الكرامة.

## Introduction:

Water treatment includes processes that treat the water supply of a public water system for the purpose of meeting primary and secondary drinking water standards [1]. Aluminum sulphate  $Al_2(SO_4)_3$  (alum) commonly used in drinking water treatment to enhance the removal of particulate via coagulation processes. The treatment of surface water with aluminum sulphate has been in operation for over a hundred years all over. The use of alum as a coagulant for water treatment often leads to higher concentrations of aluminum in the treated water than in the raw water itself. Typically, a portion of the alum added to the raw water is not removed during treatment and remains as residual aluminum in the treated water. The occurrence of aluminum in treated water has been considered for many years to be an undesirable aspect of treatment practice [2]. There is considerable concern throughout the world over the levels of aluminum found in drinking water sources (raw water) and treated drinking water [3,4]. Turbid water can look cloudy can also affect the color of the water. Elevated levels of turbidity may interfere with water treatment and disinfection and cause aesthetic problems. Because of the potential association of elevated particles of bacterial or microbiological contamination, the level of turbidity is used as a red flag for potential microbiological contamination or secondary water quality problems with the water [6]. TDS is a measure of the total amount of dissolved substances in the water sample. It is not a direct measure of a specific element or contaminant. An elevated TDS may be associated with an elevated water hardness, chemical deposits, corrosion by-products, staining, or salty bitter tastes. If the TDS content of the water is high, the primary recommendation would be to test the water for additional parameters, such as: total hardness, iron, manganese, sodium, chloride, sulfate, alkalinity, and nitrate, to determine the nature of the water quality problem. The TDS test is an indicator of the potential for water quality problems [7]. A suspended solid is the quantitative measurement of the amount of particulate materials in water sample and it is include both organic and inorganic matters such as plankton, silt, and clay [8]. TSS comes from decaying plants and animals, industrial wastes and sewage, suspended particulates originating from eroded soil from riverbanks. Fine sediments are transported in stream either as bed load or in suspension [9]. Tigris River is one of the two main important rivers in Iraq, the river passes through Iraqi land from the north to the south. Its length and join the Euphrates River in Al-Qurna in the south to form Shatt Al-Arab. While the river passing through Baghdad city received many pollutants according to the increase of population size and increase number of factories and industries on the river shed [10].

## Materials and methods

The studied plants are:

Sharq -Dijla plants: this plants is located near AL-Muthana bridge in the north of Baghdad.

AL-Karama plants: this plants located in Al -Ettaiffiah region near 14 Ramadhan bridge in Baghdad.

Two purification plants were included in this study.

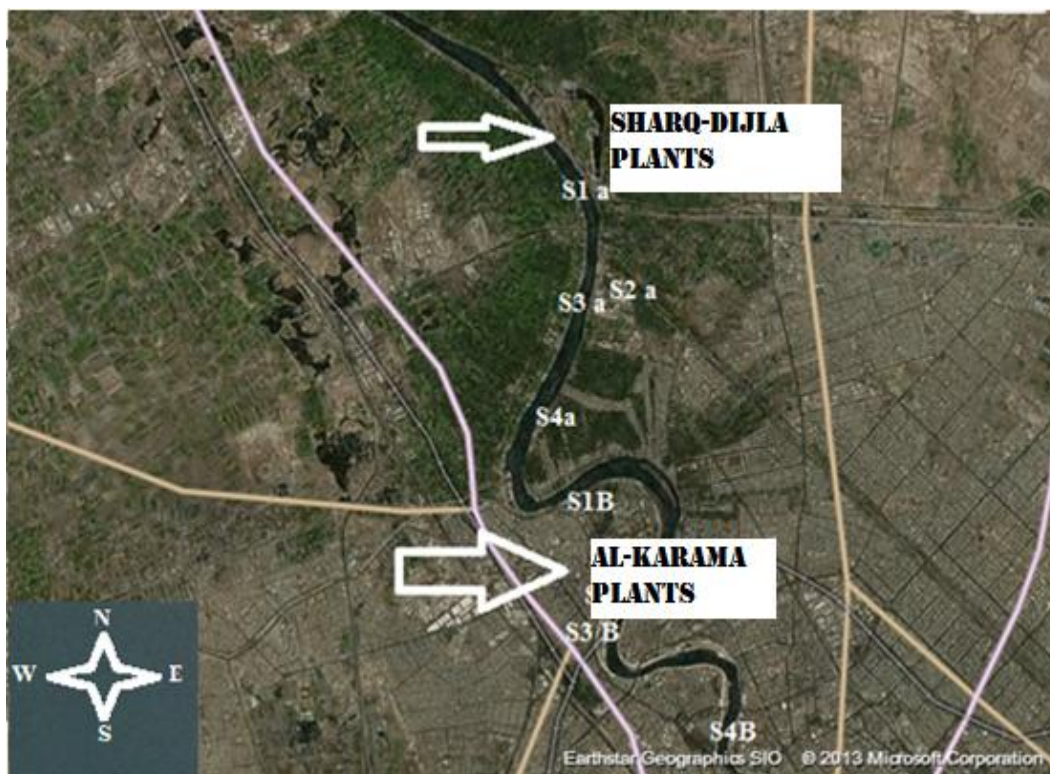
Water samples were collected from the river according to the follows sequences :

S1: Samples were collected from a place of the river before the plants in 1.5Km .

S2: Samples were collected from inside the plants.

S3: Samples were collected from outside the plants at the pipe .

S4: Samples were collected after the plants in 1.5 Km.



**Figure 1-** The studied plants <http://www.eurojournals.com/ejsr.htm>

### Sampling Procedure:

Samples was collected (bimonthly) seasonally from October 2012 to September 2013, at the two sites as explained earlier.

- 1) The samples were taken about 2m from the shore line at a depth of 45-50 cm.
- 2) Water sample for heavy metals analysis collected in 500ml polyethylene containers ,10 liter of water were collected from underwater surface about (45-50) cm after punning the container with water sample, then kept at 4°C in refrigerator [4]

Physical and chemical tests of water

Aluminum test

According to[11] the Aluminum level was measured by an atomic absorption \flame emission spectrophotometer , atomic stage (2500-1100 c) for3-4 sec. Finally cleaning stage with temperature was higher than the previous stage temperature with 200c for 3 sec. The amount of the injected sample within the oven is (10microliter) .The principle of this device to convert the electrical power to heat which is responsible for the aching process .This device measure the concentration less than 2ppm - 0.1ppb.

Turbidity test:

A turbidity meter was used by injecting water sample within glass container and placing it inside the device.

T.S.S (Total Suspended Solids) test:

A glass dish was heated by placing it within the oven at 80°C and then cooled in the Desiccators. This glass dish was weighted first able when its empty then 50ml of water from the sample(which was shacked previously) was added. The glass dish was heated then on a hot plate without boiling. The heating process continued until the sample completely dry. Then after the glass dish cooled [9]. It was weighed again so according to this equation:

T.S.S=the glass dish weight when it's filed- the glass dish weight when it's empty.

Total Dissolved Solids (TDS): Measured by using a portable was by TDS meter ( Siemens )

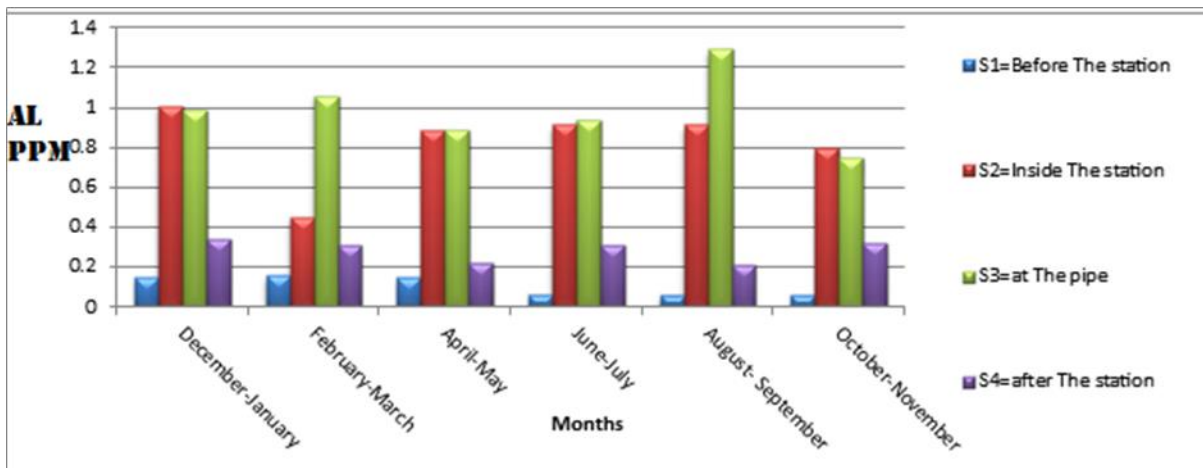
Statistical Analysis

The Statistical Analysis System- SAS (2010) was used to effect of factors (plants & month) in study parameters, lest significant difference –LSD test was used to significant compare between means this study

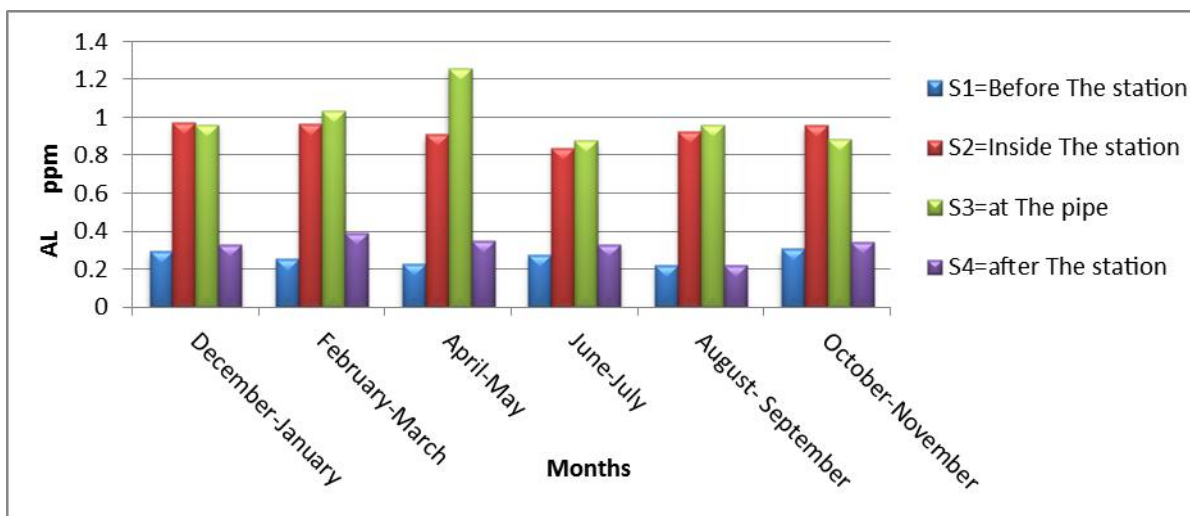
**Results and Discussion**

**Aluminum:**

Aluminum salts are also widely used in water treatment as coagulants to reduce organic matter, color, turbidity, and microorganism levels. The process usually consists of addition of an aluminum salt (often sulfate) at optimum pH and dosage, followed by flocculation, sedimentation, and filtration [12]. Results of Aluminum showed that the highest value of AL was 1.08 ppm in (December-January) at Sharq- Dijla plants ,(fig 2), while the lowest value was 0.059 ppm in (August-September) at Sharq-Dijla plants .(Fig2). Statistical analysis of the data revealed significant differences between months at each plants and also significance differences were detected among sampling location of each plants at the same months along the study period at (P <0.05).Those results agreed with [13] according 28 confirmed that the total aluminum concentration in discharge water was usually high. The sedimentation and filtration plants showed a total aluminum removal of 85% and 95% respectively when the plant operated at optimum conditions. [14] according 28 stated that the highest value of Aluminum was higher in winter while the lowest value was recorded in summer. The presence of certain concentration of (AL) in river water was explained by [15], in his results showed that approximately 11% of the aluminum input (raw water and alum) was not retained during treatment, and this residual aluminum was conservatively transported throughout the distribution system into plants discharge. Use of aluminum salts as coagulants in water treatment may lead to increased concentrations of aluminum in water. Where residual concentrations are high, aluminum may be deposited in the distribution system. Disturbance of the deposits by change in flow rate may increase aluminum levels [16]. The maximum allowed limit of aluminum according to[27],0.2mg/l, and the maximum allowed under According to [ 28] 0.2mg/l.



**Figure2-** Monthly effect of Aluminum Within locations (Sharq-Dijla plants) ppm



**Figure 3-** Monthly effect of Aluminum Within location in (AL-Karama plants) ppm

**Turbidity:**

Turbidity is a measurement of how cloudy water appears. Technically, it is a measure of how much light passes through water, and it is caused by suspended solid particles that scatter light [16]. Results showed that the highest value of turbidity was 119 N.T.U during (December-January) at Sharq- Dijla plants , Fig(4) , while the lowest value was 33.0 N.T.U during ( August -september) at Sharq-Dijla plants. Fig (4) .The statistical analysis of the data revealed significant differences between months at each plants and also differences were detected among sampling location of each plants at the same months along the study period at (P <0.05). The changes in turbidity levels of water during seasons, depend on the water content of suspended mater in the river , the amount of article alum added , the operation method , fitness of maintenance processes , and the age of the project have a great influence on turbidity values in water[17]. Those results agreed with [13] according 28 stated that the highest value of turbidity was in winter while the lowest value recorded in summer. Though disagreed with the study of [18] found that turbidity rates increased during summer. Statistical analysis of the data revealed that an inverse correlation between water temperature and turbidity ( $r = - 0.197$ ) .The organic materials that may cause turbidity reducing the amount of dissolved oxygen and increasing the acidity (decaying organic material produces carbonic acid which lowers the pH level Turbidity in water is caused by suspended and colloidal matter can also serve as breeding grounds for pathogenic bacteria [19] .The maximum allowed limits of turbidity according to[27], is 5 N.T.U., while the maximum allowed limits of turbidity according to according to [28] is 5 N.T.U.

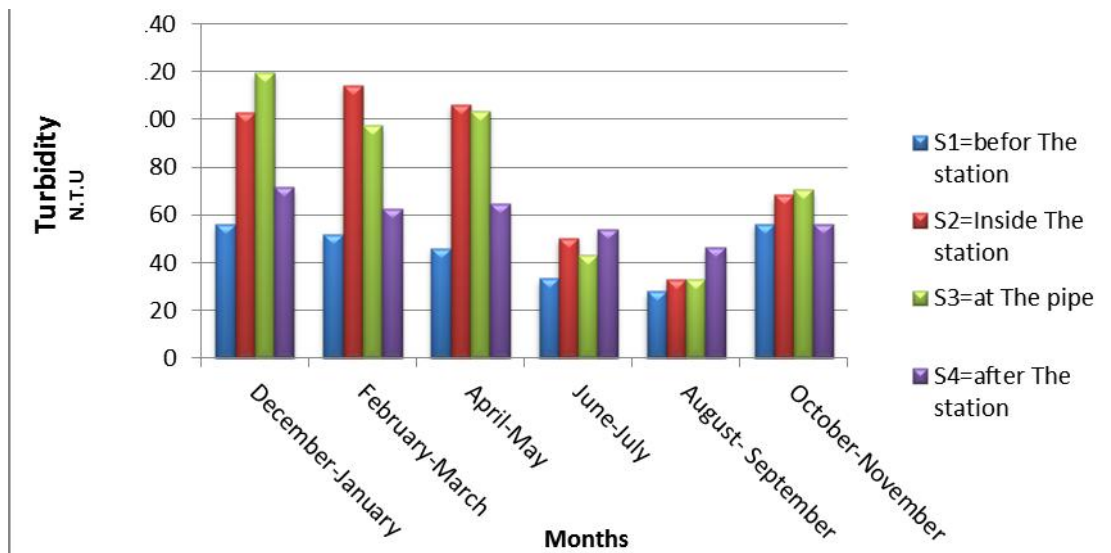


Figure 4-Monthly effect of Turbidity Within location in (Sharq-Dijla plants) ppm

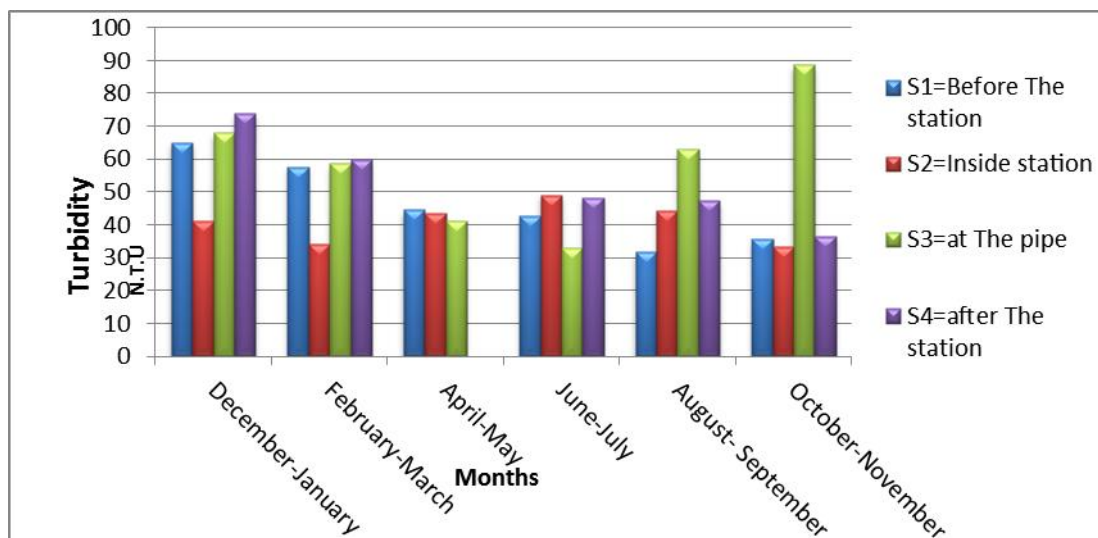
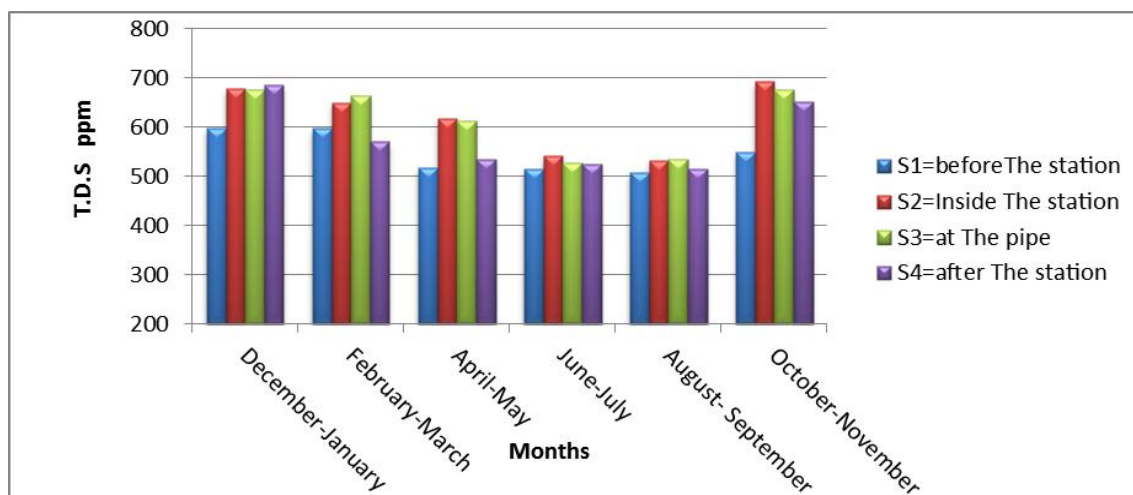


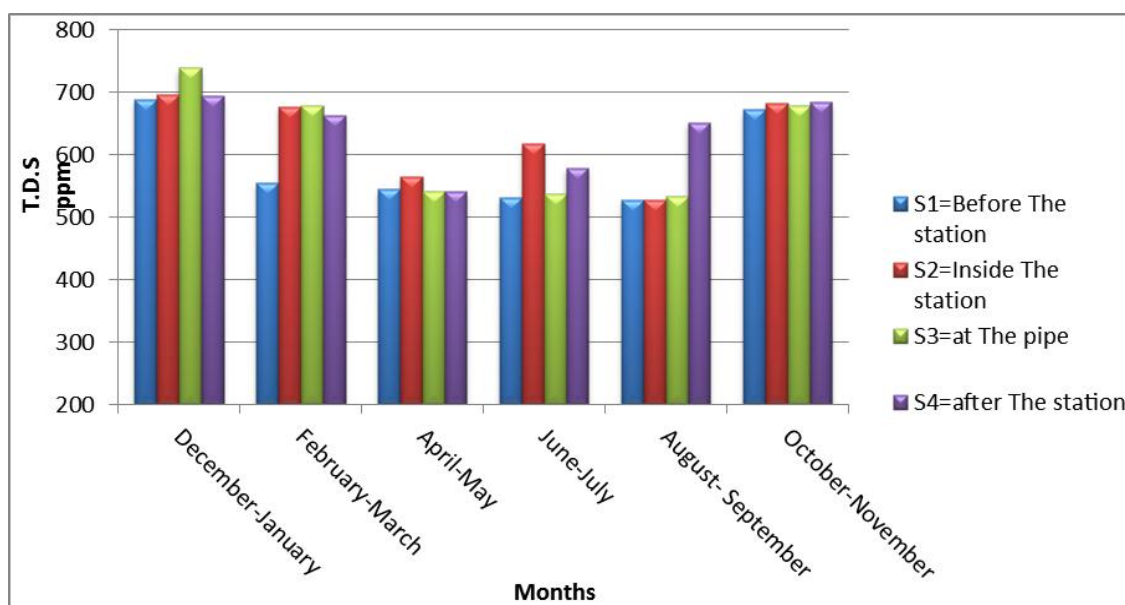
Figure 5-Monthly effect of turbidity Within locations in (AL-Karama plants) N.T.U

**TDS:**

Total dissolved solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogen carbonate, chloride, sulfate, and nitrate anions [20]. Results showed that the highest value of T.D.S was 687 ppm during (December-January) at AL-Karama plants,( fig 7). While the lowest value was 506 ppm during ( August- September) at Sharq-Dijla plants. (Fig 6). The increase of TDS was due to increase in salts concentration, the increase of the velocity of water may cause increase in TDS concentration [13]. This study disagreed with [21]. The statistical analysis of the data revealed significant differences between months at each plants and also significance differences were detected among sampling location of each plants at the same months along the study period at (P <0.05). The increasing of the dissolved salts in Tigris river related with seasonal variation ,increase in winter more than spring and summer because rain fall, soil wash and the river current which helps to increase the amount of dissolved salts in water . The presence of CO<sub>2</sub> which had high solubility act to increase carbons ions which bond to elements ions creating ions salts .The increase of water temperature affects the level of dissolved solids in water body, fertilizer run-off, wastewater and septic effluent, soil erosion , decaying plant and animals ,and geological features in the area[22]. Statistical analysis of the data revealed that an inverse correlation between water temperature and TDS (r= - 0.3012) .The maximum allowed limits of TDS according to[27],is 1000 ppm, while the maximum allowed limits of TDS according to [28] is 1000ppm.



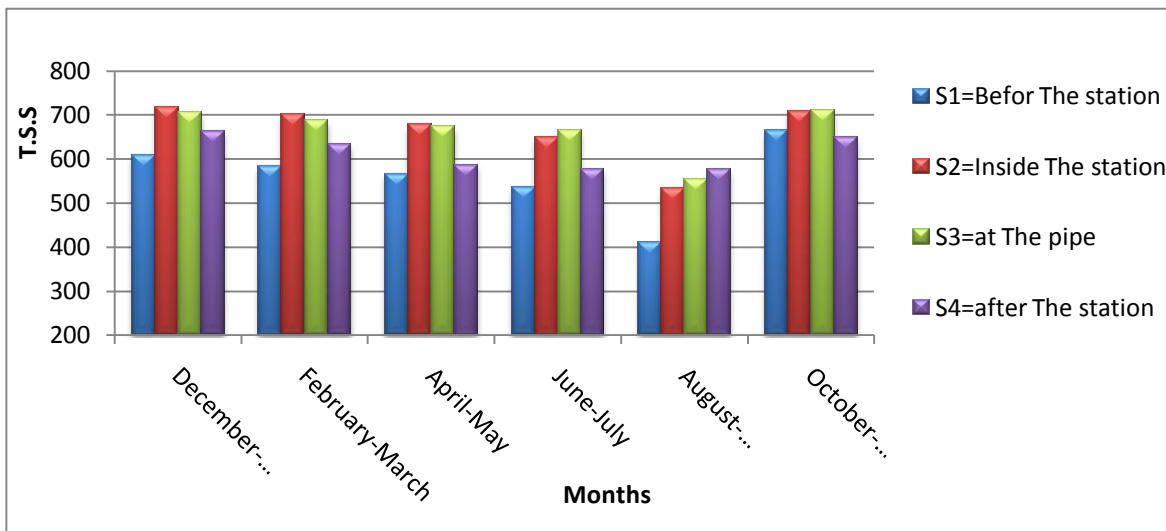
**Figure6-** Monthly effect of Total Dissolved solids with in locations in (Sharq-Dijla plants) ppm



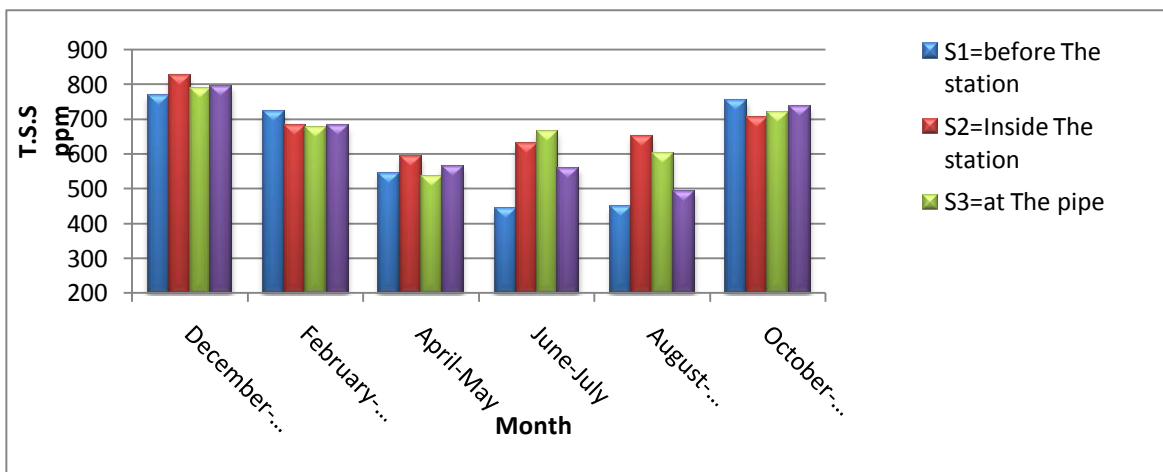
**Figure7-** Monthly effect of total Dissolved Solids Within locations in ( AL-Karama plants)ppm

**TSS:**

Total suspended solids can be defined as the dry weight of all particulate matter in a sample. Sediment is a natural component of streams, but excessive sediment can be carried into streams and rivers from erosion of unstable stream banks, construction sites, agricultural activities, and urban runoff [23]. Results of T.S.S. showed that the highest value of T.S.S was 793 ppm during (December-January) at AL- Karama plants, (fig 9). While the lowest value was 410 ppm during ( August-September) at Sharq-Dijla plants,( fig8). These results may be due to the weather effect the months that showed an increase in TSS concentration in winter months that included rains that carry many suspended materials such as dusts and others beside the increase in winds velocity during these months as a result of that increase velocity of water in its turbidity [24]. The statistical analysis of the data revealed significant differences between months at each plants and also significance differences were detected among sampling location of each plants at the same months along the study period at (P <0.05). Those results agreed with [25], according to [28] stated that the highest value of T.S.S was higher in winter while the lowest value was recorded in summer. The statistical analysis of the data revealed an inverse correlation between TSS and turbidity ( $r = -0.15848$ ). Inverse correlation also was noticed between TSS and turbidity as shown. In general the T.S.S and TDS values at AL-Karama plants higher than its values at Sharq-Dijla plants. maximum allowed limits of TDS according to [27], is 1000 ppm and The maximum allowed limits of TSS according to [27], is 0. An increase in the TDS and TSS rates with the descending of river towards the south; this is because of the increasing in the pollution on both river banks when passing through Baghdad city especially the industrial area. The results of the study results agreed with [26].



**Figure 8-** Monthly effect of Total Suspended solids Within locations in (Sharq-Dijla plants)ppm



**Figure 9-** Monthly effect of Suspended solids Within locations in (AL-Karama plants)ppm

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