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Enhancement of Water Quality for Shatt Al-Arab River and NW Arabian Gulf BY Granular Activated Carbon and local Sand

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Abstract

Shatt Al-Arab river is considered as one of the most important industrial, irrigation and drinking water resources. the river at its end discharges to Arabian Gulf. Water samples were collected from seven sites along the Shatt Al-Arab river and North West Arabian Gulf during summer, winter and spring 2010 and were determined some physico-chemical properties and heavy metals contaminations. The physical and chemical parameters of water were included the Temperature (T), Hydrogen activity (pH), Electric Conductivity (EC),Total Hardiness(TH),Calcium (Ca) , Magnesium (Mg), Sodium (Na) , Potassium (K), Chloride (Cl), Sulfate (SO_4), Nitrate (NO_3), Phosphate (PO_4), Silicate (SiO_4), Manganese (Mn), Iron (Fe), Copper (Cu), Nickel (Ni), Cobalt (Co) and Lead (Pb). The results of the study showed a differences between the studied properties and a clear significant differences were noticed during the seasons of the year and sites. The pH of the studied area varies from neutral to weak basic, and showed high conductivity (Total salinity) in addition to increase the concentration of TH, Ca, Mg, Na, K, Cl, SO_4, and NO_3 in the water river according to the drinking water criteria of (WHO), and Iraqi Standard limits (SI). Of the within . The mean of TH was above the international limits therefore it's classified as hard water. To decrease the high level of the chemical parameters :the water Shatt Al-Arab ,four different filtration systems were used . present study it was compared between activated carbon, activated carbon-sand filters, sand - activated carbon filters and sand filter respectively to obtain the difference for removal according to average flow rate of 10 m/sec. the study proves that activated granulated carbon was more efficient than carbon –sand, sand-carbon and sand respectively. The removal efficiency for major content ion and trace metals were observed in the order of $NO_3^- > Na^+ > PO4^{-3} > SO4^{-2} > K^+ > Ca^{2+} > Cl^- > Mg+^2$ and Mn< Fe <Cu< Co < Ni < pb So as to make the concentrations of these for major content ion and trace metals within accepted level of the river and did not exceed the limits of subtraction, which shows the removal of efficiency by filters.

Key words: Physico-chemical parameters, Heavy metals, Shatt Al-Arab estuary , North West Arabian Gulf

الخلاصة

يعتبر شط العرب من اهم المصادر للمياه الصناعية والزراعية ومياه الشرب والذي ينتهي بطرح مياهه الى الخليج العربي. أخذت عينات المياه من سبعة مواقع على طول شط العرب وشمال غرب الخليج العربي خلال فصول الصيف والشتاء والربيع ٢٠١٠ وتم تحليلها من اجل دراسة بعض الخواص الفيزيائية وكيميائية والتلوث بالمعادن الثقيلة . ومن هذة الخواص درجات حرارة المياه و الأس الهيدروجيني والتوصيل الكهربائي والعسرة الكلية والكالسيوم والمغنيسيوم والنترات والفوسفات و السيليكات والبوتاسيوم و الصوديوم والكلوريد والكبريتات والرصاص والنيكل ، النحاس والكوبلت والحديد والمنغنيز. أثبتت نتائج الدراسة وجود تباين في الخواص المدروسة وظهرت بينها فروق واضحة خلال فصول السنة والمواقع ، وقد اظهرت ان قيم الاس الهيدروجيني متعادلة تميل الى القاعدية الضعيفة ضمن منطقة الدراسة ،كما لوحظ الزيادة الواضحة في قيم العسرة الكلية و الكالسيوم والمغنسيوم والبوتاسيوم و الصوديوم والكلوريد والكبريتات لمياه البحر بالمقارنة بمياه شط العرب مما يؤكد تأثير تلك المياه على نوعية مياه شط العرب بالإضافة إلى مطروحات مياه الأنهر الفرعية التي تطرح مباشرة الى شط العرب باعتبارها ابرز وأكثر تأثير في النهر والتي تحتوي على نسب عالية من الملوثات العضوية واللاعضوية، ومتجاوزة بذلك محددات البيئة المحلية والدولية المسموح بها حيث تصنف مياه شط العرب بانها مياه عسرة جدا، لذا يتطلب التقليل من تأثير الزيادة في قيم التركيز وذلك عن طريق استخدام أربع مرشحات أحادية وثنائية الوسط المتكونة من (الكاربون الحبيبي المنشط و الرمل المحلي) لمعالجة مياه شط العرب ، وقد تم إمرار عينه من مياه الشط في كل من المرشحات الأربعة وبعد التعرف على خصائص مياه شط العرب من خلال إجراء فحوصات الفيزيائية والكيميائية على عدد كبير من النماذج تم اعتمادا على تركيز في موقع الثالث كنموذج للمعالجة .كما تم إجراء مقارنة مابين الكاربون المنشط والرمل المحلي ومرشحي الكاربون المنشط والرمل المحلي ،لمعرفة الفرق في الإزالة وبالاعتماد على معدل سرعة جريان ١٠م|ساعة. و قد

اثبت مرشح الكاربون الحبيبي المنشط اكثر كفاءة في الإزالة من مرشح الرمل –كاربون وكاربون–رمل والرمل على التوالي اذ وصلت كفاءة الإزالة للايونات الموجبة والسالبة و المعادن الثقيلة كانت حسب الترتيب : $NO_3^- > Na^+ > PO4^{-3} > SO4^{-2} > K^+ > Ca^{2+} > Cl^- > Mg^{+2}$ and Mn< Fe <Cu< Co < Ni < pb وذلك لجعل تركيز تلك العناصر ضمن تراكيز محددات الطرح للنهر ولم تتجاوز حدود الطرح مما يظهر كفاءة المرشحات في الازالة.

Introduction

Water Pollution is considered a great problem for the environment and stream due to release of pollutants ,Also the disposal of sewage , domestic wastes, industrial, agricultural discharges, production, refinery and transportation of crude oil effluent being discharged into the aquatic system excerpt more etheats upon the mater bodies (Ajmal et al.,1988; Ekpo and Ibok, 1999). These wastes are a potential source of heavy metals and other water pollutants in the aquatic environment (Pfeiffer et al.,1986; Unlu et al., 1996; Muley et al., 2007 ; Walker, 2002). Heavy metals pollution of stream and river water ecosystem is a worldwide environmental problem. Trace amounts of heavy metals are always present in fresh waters from the weathering of rock sand soils (Muwanga, 1997; Anderson, 2003; Babeland Opiso, 2007; Samarghandi *et al.,* 2007; Igwe *et al.*,2008; Al-Juboury, 2009). Recently, water quality monitoring has become a matter of concern in stream and river water systems ,these systems are affected by different parameter ,Runoff ,atmospheric deposition ,domestic and industrial effluent discharges which are consider as major sources of aquatic pollution (Wasswa, 1997;Linnik and Zubenko, 2000; Campbell, 2001; Lwanga*et al*., 2003 and Lomniczi *et al*., 2007) . To achieve continues monitoring of major pollutants a complete assessments of physical and chemical properties of main pollutants ,trace metals ,cations and anions (Awofolu *etal*., 2005; Mwiganga and Kansiime, 2005; Nyangababo*et al*, 2005b; Srivastava *et al*., 2008). Najla 2006 ,used sand filter as primary treatment to remove pollutants from the wastewater before passing it to the studied filters (14 days incubation).and then Nine filters were used to remove the pollutants from wastewater .Filters used were cement kiln dust, Date palm seeds, Barley straw, Calcium carbonate, Barley straw + CaCO3, Alum (alumium sulfate), Alum + FeCl3, Fulvic acid and Humic acid .The materials of filters were for days incubated with the wastewater which was filtered by the sand filter. And Chemical, physical characteristics of the wastewater were determined after filtration . In additional to that removal efficiency (%) for components were identify using solubility diagrams determined. From the results of her study, she recommended to use cement klint dust filter fort irrigating barley crop because of its ability to remove most of pollutants from wastewater which not differ significantly with date palm filter. Al.Imarah (2006) ,used column 40 cm length and 4.5 cm diameter filled with equal layer of filtration sand and activated carbon in flow rate for treatment of waste discharged (dairy and soft drinks industries) into Shatt Al-Arab river . The study proved that removal percent by filtration column of sand and activated carbon were alternatives for the effluents of both industries, higher % removal recorded from dairy and soft drinks effluents were (92.2 and 72.9%), (78.21 and 85.3%),(27.5 and48.64%),(43.7 and 28.5%),(20.4 and 51.7%),(42.8 and 37.3 %)for TSS ,BOD,TH,Cl,SO4 and TN respectively., while lower % removal recorded was 16.2% for phosphate , Complete removal 100% was recorded for pb form both effluent, while for Zn lower value 18% was recorded in dairy effluent ,Mn did not remove from soft drinks effluent. Other removals were Cd (51 and 66.6%) ,Cu(71.7 and 96.1%),Fe(71.8 and 40.4 %) and Ni (94.9 and 92.8%) from effluent of dairy and soft drink respectively.Shatt Al-Arab is directly exposed to many pollutants that result from disposing domestic ,agricultural and industrial wastes and that negatively effect water (Salman et al., 1977) .The present study is describing the chemical and physical properties of water in the Shatt Al-Arab estuary and North West Arabian Gulf , additionally our study includes removal of main pollutants using adsorption on activated carbon and local sand .

Description of Study Area

The Shatt Al-Arab river is the main important source that transport the freshwater to the NW Arabian Gulf region, it resulting from meeting of Tigris and Euphrates reveres and extend forward southeast , and has total length about 195 km from Qurna to Fao city. The hydrological system of the Shatt Al-Arab estuary depended essentially on the hydrological status of Tigris, Euphrates, Karoon and Sowaib reveres, also the Arabian Gulf waters that's mixed with the Shatt Al-Arab waters by tidal cycle.Turkey and Syria constructed dams at Tigris and Euphrates rivers .these processes affect the quantity of water reached to ShattAl-Araband ability to wash the pollutants .these are increase with disposal of sewage water to the rivers directly , the pollution of solid and liquid pollutants . the construction of agricultural drainage to remove salinities was being done at mid and south regions .such salinity at south Tigris and Euphrates. salinity in increasedof south Shatt Al-Arab such salinity is considered one of the main pollutants ,that affect the pollution .if we include the pollution of Arabian Gulf ,therefore the Arabian Gulf is considered semi closed and one of dangerous source in the world .this requires a great efforts . Water samples were collected Seasonally by clean polyethylene bottles(5 L capacity) , 30 cm depths at selected seven sites alongside the Shatt Al-Arab estuary and north west Arabian Gulf including Qurna(St1) , Al-Sindebad island (St2), Ashar (St3), Abu Al-Khaseeb (St4), Fao (St5), Rass Al-Bisha(St6) and Khor Al-Omia(St7). during summer ,winter and spring 2010 , Figure(1)

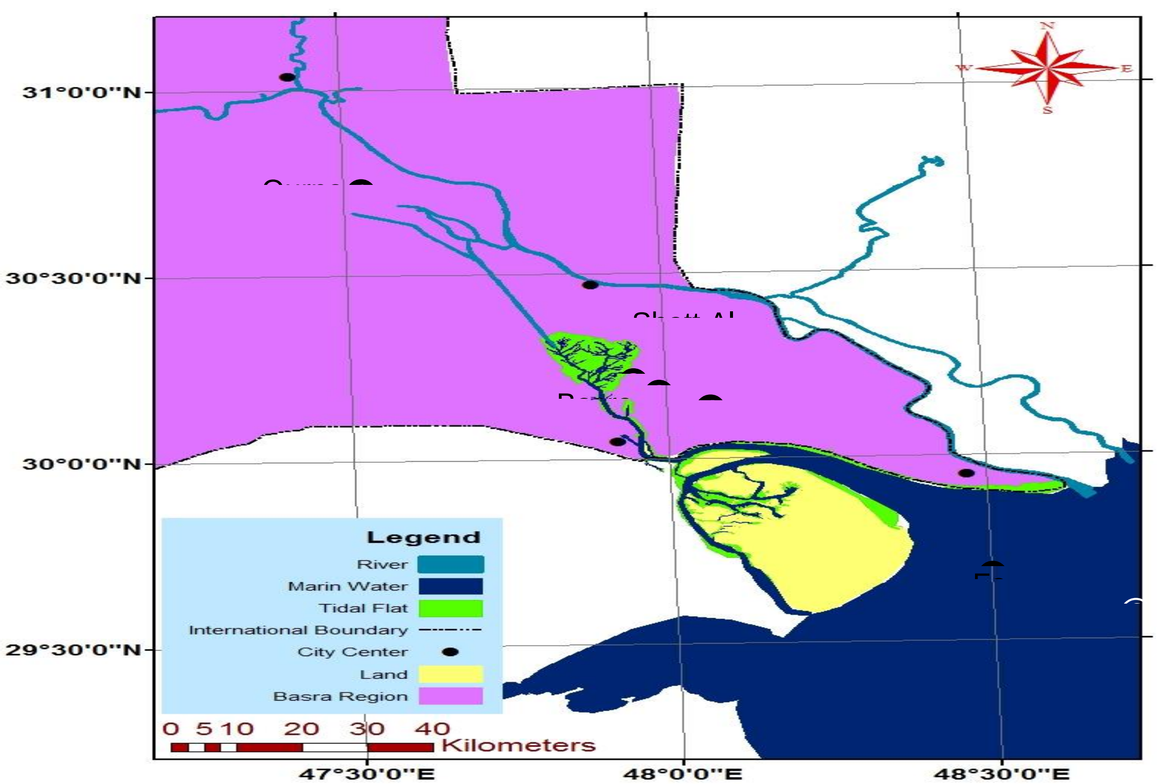

Figure (1) Map showing the studied area with sampling sites

Material and Methods

Water samples were kept into 5L polyethylene bottle in ice box and analyzed in the laboratory .Some of the physicochemical parameters including the water temperature (°C) , pH and Electrical conductivity were measured in the field with portable Multimeter HANNA Model (HI 9811-5). The other water parameters Nitrate (NO_3),phosphate (PO_4), SiO_3^{-2}, Chloride (Cl), Sulphate (SO_4), Ca^{2+}, Mg^{2+}, Na^+, and K^+ were measured in the laboratory according to standard specifications presented by the American public health association(Rzoska,1980;APHA,1988),Furthermore, some trace elements were determined. The digestion of water samples were carried out by taking 100 ml of water sample in a clean glass beaker congener with distilled water then add to 5 ml of concentrated nitric acid to each sample independently, and then placed over a Hot plate until evaporation to dryness, then repeated again using 5 ml of conc. nitric acid and evaporation continued again until dryness and then completed to the original volume of 50 ml with distilled water and kept in refrigerator prior to analysis (Chapman and Pratt, 1961). It is carried out through experiment, depending on four glass filters cylindrical from with 6cm diameter, and 120 cm height, the first filter formed from granular activated carbon, granular activated carbon obtain from (BDH) with diameter (0.15-2.0) mm. height (60) cm. The second filter composed of sand export from (Al-Nawafth company) with the average grain size was (0.6-1.2) mm and thickness (60) cm .the third filter composed of two similar layers the upper composed of granular activated Carbon and the lower composed of sand, each media was with thickness of (30) mm. The fourth filter composed of two similar layers upper of sand lower was composed of granular activated carbon can with well (30)mm. A 5 L of water (sites 3) was passed through each filter with rate of flow (10mm)/ sec. and connect for the end of lower filter, plastic tube guarded by mechanic valve of flow. All experimental were carry out at 27°C and pH (7-7.5).

Results & Discussion

The results of the physical and chemical parameters and heavy metals studied for water samples in the selected seven sites are listed in **Table 1**.It showed that the present study exhibit the seasonal and regional variation in all the studies variations. The results show observed increase through summer compared to winter and spring seasons 2010. Temperature during the sampling of different seasons was varied from (11.5-32.7) °C . The overall range in water temperature was minimum in winter and maximum in summer , seemingly these values followed almost identical seasonal cycles. This is due to the temperature of the water which has been affected directly to the climate of the city of Basra, hot in summer and cold in winter .During the study period, pH was from 7.56 to 8.54 , these values increased in winter and spring and decreased in summer (Wetzel ,2001; Al-Saadi et.al.,2000 ; Hassan et.al.,2001; Al-Mousawi et.al.,1994;Maulood and Hinton, 1979). A slight drop in pH value was observed at the sampling sites 3 This may be attributed to the discharge of effluents sewage waters entering the river which loaded with a large amount of organic acids. The pH values of sites during the studied period were within the desirable levels recommended by (WHO, 2006 and USEPA, 2004).

Electrical conductivity values of Shatt Al-Arab river and North West Arabian Gulf ranged from (1.89 - 58.08) mmohs/cm during the investigation period. The results of electrical conductivity were higher in the summer season than in the winter and spring seasons . due to increased discharge of river water in winter and the lack of drainage water and high temperatures in the summer. At various sampling sites, point sources sewage waters were found to increase water conductivity. The maximum values were recorded at sites 3 and 4 in Shatt Al-Arab which receive the effluents of sewage water to the river directly through discharge points compared to other sites.EC of Shatt Al-Arab river is found within the WHO and Standard Iraq acceptable limit. and recorded the values of connection high in sites of 5,6 and 7 in NW Arabian Gulf compared to other sites which recorded lower values where at 1 ,due to contain the waters of the North West Arabian Gulf to high concentrations of salts dissolved water by comparing the values of other sites and delivery electricity is relatively high during the passage of the river city of Basra and the south was due to an increase in put wastewater to the river.Nutrients ,nitrate-nitrogen, phosphate and silicate concentrations ranged from 3.81to 49.16 μg-at.N/l ,0.682 to 7.25 μg-at.P/l and 9.521 to 79.811 μg-at.SiO_2/l respectively . These values were increased at summer and decreased at winter and spring duo to decrease of water levels and rise of temperature which contribute to the increase of evaporation average and consequently to the increase of nitrate-nitrogen and phosphate ,silicate concentrations . In addition, the decreasing of water levels led these nutrients in water to be more concentrated during this period, these results agree with many studies (Kassim, 1986; Al-Lami, 1986; Al-Saffar, 2006; Al-Kenzawi, 2007; Adam *etal.*, 2007).While the low nutrients concentration was during spring . This decreasing may be returned for increasing the diversity, distribution, and growth of aquatic plants, and phytoplankton, so that the most amounts from nutrients should be up taken by these organisms (Maulood *etal.*, 1981; Al-Lami, 1986; Al-Zubaidi *et al.*, 2006; Al-Kenzawi, 2007). Among all sites, the highest concentration of nitrate and phosphate were recorded in water of site 3 during three season , located downstream Shatt Al-Arab River, which is impacted by the most heavily populated area of Basrah City. Downstream river increase in nutrient is likely due to a combination of anthropogenic inputs as well as salinity- related geochemical release of phosphorus (Lampman *et* al., 1999).Nitrification process might also be attributed for the increased concentration of nitrate downstream Shatt Al-Arab River (Bernhardt et al., 2002; Hamilton et al.,

2001) stated that nitrification is accounted for <20% to>50% of total ammonium removal in different streams. Untreated municipal and industrial wastewater as well as fertilizers might be ascribed to high phosphate concentration (Vanni *et al.*, 2001). Dissolved forms of phosphorus are readily adsorbed into sediment particles and can be transported downstream, however, desorption of phosphate can occur when dissolved phosphate concentration is lower relative to an equilibrium phosphate value of no net exchange (House, 2003). whereas the lowest concentrations at the sites 1 , 6 and 7 , because this sites were away from sewage discharge and the interaction of marine current with tidal movement of Shatt Al-Arab River ,which are considered dilution factor for this area or due to consumption of nitrate by marine phytoplankton . As opposed to both nitrate and phosphate ,The silicate content was higher than that of the other nutrients at all sites during three seasons and high values of silicate through the summer that may be because of the decay of diatoms by high temperature(Wetzel at el.,2000)or by increase in the solubility of metal salts in water(Goldman at el .,1983), this result agrees with many studies in Iraqi aquatic systems(Hassan ,1997; Hassan ,2004 Al-Saadi at el. ,1996). Also the Silicate concentration was high in sites 3 in adjusting effluent discharge during summer. Our findings coincide with(Hillibricht at el.,1988). It had been deduced that high water temperature serve in changing insoluble SiO_3 to soluble state (Reid at el.,196).Decomposition of diatomic shells, which associate with elevated temperatures, also adds substantial proportion of silicate to the environment (Happy at el.,1984; Klarer at el.,1975).While the concentrations of SiO_2 decreasing in winter and spring , This can be contributed to decreasing of water level and increasing the diatoms numbers (Hussien *et al*. (1991; Allammy,1986 ; kassim, 1986). highest silica concentration was measured at site 3. The predominant source of silica in aquatic ecosystem is the natural weathering of silicate materials, whereas human impact on silica concentration is through discharge of detergents and diffusion of fertilizers that contain small amounts of met silicates (Tregyer et al., 1995), whereas anthropogenic source may amount to 6% of total silica inputs into river (Sferratore et al. 2006).Nutrients of Shatt Al-Arab River and NW Arabian Gulf is found within the WHO and standard Iraq acceptable limit.Values of total hardness in the selected sites exceeded 400 mg/L as CaCO3. This indicates that waters are very hard according to Lind (1979) and APHA (1985). Although higher values encountered, in general, in summer season is related to decline in water level and evaporation rate (Bhuvanoswarn, et al., 1999). Increase in hardness values was found to coincide with rise in salinity (Hassan, 1988; Al-Gaffily, 1992). On the other hand the study revealed that values of total hardness exceeded those of total alkalinity. This indicates that hardness is caused by other ions rather than Ca+2 and Mg+2 ions that participate in formation of non carbonic hardness (Lind, 1979). Other inland localities showed even higher values of hardness (Al-Saadi, et al., 1996; Hassan, 1997; Fahad, 2001).The seasonally variations of Ca2+, Mg2+, Cl- , SO4 -2 , Na+, and K+ in the Shatt al-Arab and North West Arabian Gulf during the investigation period . The ranges of Ca2+ and Mg2+ Cl- , SO4 -2 , Na+, and K+ concentrations were found to be 177.2 – 1812.176 , 165.32 – 959.831,398.22-7247.751,995.311-5140.213,195-9455.55and 18.23-623.415 mg/l respectively at different sites during three seasons. All the concentration of calcium were higher than magnesium concentration among most of the study period at all sites, that probably due to high abilities of calcium ion to react with dioxide carbon more than for magnesium(Munawar ,1970 ; Al-Saadi.at el.,1983). the highest value of Ca+2, Mg +2 , Cl- , SO4 -2 , Na+, and K+in summer and the lowest value during the winter and spring because of the high temperature and the increased rate of evaporation .The highest values of Ca+2 , Mg +2 ,Cl- , SO4 -2 , Na+, and K+ at sites 3 may be attributed to the quantities of sewage water discharged to the Shatt al-Arab river , in addition to the height or decrease in water levels because the existence of intersecting braches and its impact on speed and the lowest precipitation averages or the temperature effects and weather factors such as rains and evaporation rates and dust storms which from the calcium compounds 40%(APHA.,2003. 21).concentrations highest Ca2+, Mg2+, Cl- ,SO4 -2, Na+, and K+ at the sites 6 and 7 , may be to contain the waters of the North West Arabian Gulf to high concentrations of salts dissolved water by comparing the values of other sites .The concentrations of Ca2+, Mg2+, Cl- , SO4 -2 , Na+, and K+ in Shatt AL-Arab river and North West Arabian Gulf is not found within the WHO and standard Iraq acceptable limit. Except Ca2+ and Cl- at sites 1,2. Shatt AL-Arab receives quantities of pollutants and particularly heavy metals which derived from domestic wastes directly. the discharge of water was taken from the branches of Shatt al-Arab passing through Basrah city .furthermore ,the pollution in increased by the activities derived from irrigation ,drainage and the use of pesticides and fertilizer different source of river pollution (Mustafa, 1985).The concentrations of heavy metals (Fe , Cu ,Ni , Co ,Pb and Mn) in the water of the Shatt AL-Arab estuary and northwest Arabian Gulf (Table 1), Seasonally, The highest values of heavy metals were observed in summer ,while the lowest values were observed in winter and spring seasons respectively. the reason can be attributed to effect of a low water flow rate and high water temperatures will increase the range of evaporation and may be due to the increase of dead organisms decomposition because of the increase in temperature during this period (Abaychi and Douable,1985) while decreasing during the Winter and spring seasons ,This indicates that the concentrations of heavy metals decreased with increasing water flow rate. **or** may be due to the rain which causes the dilution and this is consistent with the Al-khafaji (1996) . due to the different neighborhoods (animal or plant) to provide appropriate conditions for their growth and reproduction**.** it was due to heavy drainage of washing water from the neighboring agricultural lands into the rivers .The trend of element concentration in water is Fe > Cu >Ni > Co >Pb > Mn for all sites. distribution of the trace metals along the river showed high average values in the sites 3 , 4 , 2 and 5 respectively , The main source of pollution in the four stations duo to direct discharges from domestic sewage drainage systems which are not linked to any treatment facility through Shatt AL-Arab branches ,while the lowest values were observed in the sites 1 , 6 and 7 respectively . the reason is that this sites were away from sewage discharge and the interaction of marine current with tidal movement of Shatt Al-Arab River ,which are considered dilution factor for this area .Fe, Mn, Co, Ni, Cu, and Pb were the Trace elements detected in the water from the reservoir. There were variations in the concentrations of these metals from the various stations . Their sources may be attributed to the nature of the catchment area, industrial waste discharges, municipal or domestics wastes, and other electrical, agricultural wastes(fertilizers), and solid waste dump and geological weathering of parent rocks, metal inputs from rural areas(metals contained in pesticides and herbicides) and atmospheric sources (which include burning of fuels).(Abernathy et al. , 1984). A large numbers of samples exceed the (21) sample, then depending the high value of Shatt AL-Arab River was taken at site 3 during summer season for treatment by using filtration by locally sand and absorption by granular activated carbon. After process using filtration and adsorption, then taking reading average. The percent chemical parameters removal efficiency was calculated as follows: $RP(\%) = [(Ci - Ct)/Ci] \times 100$. Where RP removal percentage (%), Ci and Ct are the initial concentration and the concentration of chemical parameters (ppm) after treatment. It has been found that using granular activated Carbon filter which the removal efficiency from carbon /sand filter and sand/Carbon filter and sand filter consequently. The concentration of the metals were observed in the order of $NO_3^- > Na^+ > PO_4^{-3} > SO_4^{-2} > K^+ > Ca^{2+} > Cl^- > Mg^{2+}$ and $Mn < Fe < Cu < Co < Ni < pb$. (Table 2). It has been observed, that the higher removal percentage was with Nitrate as the removal efficiency reached 88.82 % for first filter and 68.27 %for second filter and 61.35 % for the third filter and 54.24 % for the forth filter. The efficiency of phosphate reaches to 65.52% .for the first filter and 44.83 % for the second filter and 36.56%for the third filter and 24.14 %for the fourth filter. The efficiency of calcium reaches to 49.1 % .for the first filter and 45.33 % for the second filter and 41.18 %for the third filter and 34.02 %for the fourth filter. The efficiency of magnesium reaches to 40.72 % .for the first filter and 32.61 % for the second filter and 28.14 %for the third filter and 23.27 %for the fourth filter. The efficiency of potassium reaches to 55.68 % .for the first filter and 43.84 % for the second filter and 38.94 %for the third filter and 20.22 %for the fourth filter . The efficiency of sodium reaches to 68.53 % .for the first filter and 52.53 % for the second filter and 45.16 %for the third filter and 34.1 %for the fourth filter .The efficiency of chloride reaches to 47.31 % .for the first filter and 39.31 % for the second filter and 31.71 %for the third filter and 27.17 %for the fourth filter. The efficiency of Sulfate reaches to 57.48 % .for the first filter and 44.78 % for the second filter and 40.14 %for the third filter and 28.46 %for the fourth filter. It has been observed that the highest heavy metal removal Dawn for lead reaches to 89% for the first filter and 61 % for the second filter and 50 % for the third filter and 33 %for the fourth filter . For, the efficiency Nickel was 84% for the first filter, 59% for the second ,46% for the third, and 28% for the fourth.. The Efficiency of Cobalt was 80%for the first and 55% for the second and 43% for the third and 24% for the fourth. The Efficiency of then copper which the removal efficiency was 74.71% for the first filter and 48.27% for the second and 35.63% for the third

21.83% for the fourth filter. The Efficiency of iron removal was 72.85% for the first , and 44.79% for the second and 32.35% for the third and 20.8% for the fourth. The efficiency of manganese was reaches to 47.57% for the first filter and 25.24% for the second filter and 14.56% for the third filter and 12.62% for the fourth filter .The difference in removal efficiency between for some chemical properties and trace metal for sample water river at site 3. these related to trace metal , and Distribution of element and distribution of two phase and suspension (Lester, 1987; Hussein,et.al.,1991). The removal of trace metals, by filtration, and sedimentation, and adsorption. The suspended part of waste which were removal by sand in column filtration and the soluble metal removed by adsorption on activated carbon (Harne , 2004) .

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Table(1) Physicochemical parameters and trace metal of the Tigris river water during summer , winter and spring 2010

parameter	unite	S1			S2			S3			S4		
		spring	winter	summer	spring	winter	summer	spring	winter	summer	spring	winter	summer
W.T	^0C	21.6	11.5	23.2	22.4	12.5	30.7	23.7	13.5	31.8	24.6	12.8	30.8
pH		8.26	8.12	8.1	8.1	8.06	7.9	7.91	7.71	7.56	8.17	8.13	8.03
E.C	mmohs/cm	1.89	1.99	2.01	2.5	3.03	3.17	2.96	3.15	3.56	2.84	3.14	3.55
Hardness	mg / L	900	930	1000	976	1023	1100	1371	1415	1500	1125	1185	1250
Ca	mg / L	177.2	198.44	238.95	195.44	211.24	261.25	265.345	297.73	354.43	203.465	227.81	265.25
Mg	mg / L	165.32	184.561	200.41	185.301	203.322	220.98	249.881	265.711	280.443	201.311	219.812	240.334
SO_4	mg / L	995.311	1001.23	1040.1	1053.422	1100.711	1159.78	2000.12	2018.113	2076.32	1427.833	1496.744	1540.46
Cl	mg / L	398.22	441.214	499.84	425.314	485.116	520.311	985.883	1010.235	1099.654	665.311	698.765	749.793
Na	mg / L	195	235	275.98	542.13	733.11	877.9	718.11	967.31	1112.34	622.131	801.23	987.2
K	mg / L	18.23	22.43	27.11	58.92	75.22	89.44	63.41	81.313	101.547	61.31	79.82	98.77
NO_3	µg /L	3.81	12.65	26.46	8.84	18.56	38.3	12.45	22.78	49.16	9.73	19.18	42.2
PO_4	µg /L	0.682	1.06	1.875	1.981	2.841	4.125	3.375	4.125	7.25	2.187	3.313	5.187
SIO_2	µg /L	36.213	42.531	61.921	45.281	53.781	69.321	57.819	76.981	79.811	52.321	59.801	72.872
pb	ppm	0.0241	0.0321	0.0521	0.0532	0.0731	0.0931	0.0801	0.102	0.178	0.0727	0.0951	0.107
Cu	ppm	0.19	0.291	0.33	0.354	0.491	0.52	0.532	0.675	0.87	0.411	0.532	0.62
Co	ppm	0.053	0.071	0.087	0.078	0.098	0.1101	0.099	0.121	0.1611	0.0872	0.101	0.132
Ni	ppm	0.059	0.079	0.098	0.097	0.132	0.152	0.131	0.202	0.321	0.102	0.178	0.221
Mn	ppm	0.0102	0.0369	0.041	0.0282	0.0542	0.071	0.0452	0.093	0.103	0.0344	0.073	0.0946
Fe	ppm	1.305	1.69	2.17	1.98	2.19	2.88	2.74	3.99	4.42	2.33	3.01	3.36

parameter	S5			S6			S7			WHO	SI
	spring	winter	summer	spring	winter	summer	spring	winter	summer		
W.T	23.5	11.5	32.7	23.5	12.5	31.6	22.6	11.5	31.5	35	35
pH	8.15	8	7.9	8.29	8.2	8.15	8.54	8.35	8.25	6.5-9.5	6.5-9.5
E.C	22.51	30.1	41.5	36.8	38.8	48.98	45.61	51.21	58.08		
Hardness	1913	1978	2000	5953	5981	6000	7425	7455	7500	500	500
Ca	395.462	455.433	475.91	1354.241	1395.98	1443.74	1729.213	1788.66	1812.1767	75	200
Mg	298.141	301.311	331.889	717.877	732.567	751.822	901.311	941.778	959.831	100	150
SO_4	2602.744	2628.334	2688.86	2657.553	2672.998	2699.889	5098.112	5102.351	5140.213	250	400
Cl	5113.441	5197.561	5248.372	5913.423	5952.314	5998.142	7185.345	7201.811	7247.751	45-250	600
Na	1013.14	1175.44	1356.144	1376.32	2215.17	3567.881	4665.81	6782.19	9455.55	200-250	200
K	341.71	389.55	515.332	485.32	510.321	545.733	513.44	597.721	623.415	10-12	10-12
NO_3	7.56	16.88	35.57	5.89	14.51	29.62	4.88	13.91	28.89	50	50
PO_4	1.751	2.145	3.37	0.875	1.321	2.187	0.831	1.22	1.981	0.5	3
SIO_2	41.511	46.731	64.289	11.717	21.285	39.786	9.521	19.322	36.356		

pb	0.0501	0.0641	0.083	0.0327	0.0598	0.0721	0.0291	0.0488	0.0601	0.01	0.05
Cu	0.325	0.431	0.453	0.311	0.406	0.411	0.224	0.376	0.399	1.0	1.0
Co	0.0698	0.0901	0.101	0.0604	0.0899	0.0987	0.0599	0.0876	0.0889	0.1	0.05
Ni	0.082	0.101	0.142	0.072	0.097	0.112	0.0631	0.083	0.102	0.02	0.2
Mn	0.026	0.0501	0.069	0.01427	0.0409	0.0514	0.01126	0.0381	0.0491	0.1	0.1
Fe	1.86	2.01	2.55	1.644	1.99	2.21	1.5821	1.87	2.19	0.3	0.3

Table 2 shows the conc. of removed material before treatment and conc. after treatment at Site 3 and at a rate of 10 m/h and removal rates

Test	blank	Filter 1	Filter 2	Filter 3	Filter 4	**Removal percentage %**			
						Filter 1	Filter 2	Filter 3	Filter 4
NO_3	49.16	5.5	15.6	19	22.5	88.82	68.27	61.35	54.24
PO_4	7.25	2.5	4	4.6	5.5	65.52	44.83	36.56	24.14
Ca	354.443	180	194	208	224	49.1	45.33	41.18	34.02
Mg	280.43	168	190	200	215	40.72	32.61	28.14	23.27
K	101.54	45	56	62	81	55.68	43.84	38.94	20.22
Na	1112.34	350	530	610	733	68.53	52.53	45.16	34.1
CL	1099.654	580	660	750	800	47.31	39.31	31.71	27.17
SO_4	2076.32	890	1150	1230	1490	57.48	44.78	40.14	28.46
pb	0.178	0.01	0.06	0.08	0.113	89	61	55	33
cu	0.87	0.22	0.45	0.56	0.68	74.71	48.27	35.63	21.83
Ni	0.321	0.044	0.123	0.166	0.224	84	59	46	28
Co	0.161	0.02	0.067	0.088	0.112	80	55	43	24
Fe	4.42	1.2	2.44	2.55	3.5	72.85	44.79	32.35	20.8
Mn	0.103	0.054	0.077	0.08	0.09	47.57	25.24	14.56	12.62

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