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Research Article

Physico Chemical Characterization for Water of Shatt Al- Basrah Channel, 2009-2010

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ABSTRACT

During the period 2009-2010,the concentrations of certain physical pH, EC, and Turbidity; chemical: Salinity, TDS, Chloride, Calcium, Magnesium, Bicarbonate, Sulphate, Sodium, Potassium as well as Nutrients (Phosphate, Nitrite, Nitrate, and Silicate) and trace elements (Fe, Cu, Pb, Co, and Ni) were estimated in water samples from three stations along Shatt Al-Basrah Channel, 1) at the beginning of the channel which is connected to Garmat Ali River, 2) The middle of the Channel representing the discharging point of waste water from The city of Basrah, and 3) the end of the channel at which Khawr Al-Zubair lagoon begins. Recorded levels for most of the chemical parameters were alternative throughout the study seasons and assigned mainly due to the pollution by either domestic, Agricultural or domestic or industrial pollutions. For heavy metals, higher levels of Fe, Co, Cd, and Pb were recorded at station 2 as a result of waste water pollution, while Ni was recorded at station 3 due to the effect of petroleum pollution from nearby refinery.

Keyword: Physical; chemical; Basrah; water; parameter

INTRODUCTION

The quality of water is defined in terms of physical, chemical, and biological characterizations and ascertaining its quality is important before use for various intended purposes such as potable, agricultural, and industrial water usages [1]. Shatt Al-Basrah canal is an extended drainage canal for the Main Outlet Drainage (MOD) to draw saline return water from irrigated agricultural lands which turned later to marshland reclamation. This was to be achieved by diverting flow from Al-Hammar marsh and flushing it out directly to the Arabian Gulf via Khawr Al-Zubair and Khawr Abdullah [2]. Nitrate and phosphate are essential nutrients for plant growth. These nutrients are derived from variety of sources including decomposition of plant and animal materials, river runoff from agriculture field sand industrial wastes. There concentrations in water can vary significantly with time [3].

Naturally, N and P concentrations in rivers vary with basin geology, vegetation and climate[4]. Natural NO_3 and PO_4 concentrations in rivers range 0.05-0.2 and 0.002-0.025 mg/l respectively [5]. Alexander and Smith [6] (2006) reported that during the last 30 years, total nitrogen and total phosphorous concentrations in the U.S. were decreased slightly following a reduction in agricultural intensity. On the other hand, the concentrations of nutrients experienced tremendous increase during 50 years in the waters of Yangtze river in China [7] due to the intensification of Agriculture following reformation [8].

METHODOLOGY

Three stations were selected along Shatt Al-Basrah channel, Station 1 (**S_1**) represents the entrance to the channel, station 2 (**S_2**) represents the middle part of the channel after the joined point of Shatt Al-Basrah channel with the Main Outlet Drainage (MOD), and station 3 (**S_3**) is nearly at the exit point of Shatt Al-Basrah channel to Khawr Al-Zubair, as shown in figure 1. These locations represent different ecological and environmental changes. Based on seasonal water quality measurements, water samples were collected seasonally from the selected sites, and adopting the following methodology, pH, conductivity, salinity, and TDS were measured in the field by using calibrated portable instruments.

Chemical parameters were measured in the lab by according to standard methods [9], Sodium and Potassium by flame photometer, Sulphate by turbidimetry, bicarbonate by titration. For the determination of nitrite and nitrate, water sample is mixed with ammonium chloride at pH= 8.5, nitrate is reduced to nitrite after passing the sample across a column of Cadmium metal, the resulting sample is treated with a solution of sulphanic amide then with 1-naphthyl ethylene diammine to produce a solution with pink color, its intensity is related directly to the concentration of both nitrite and nitrate in the sample, the absorbance is measured at 543 nm. For this measurement, sodium nitrite and sodium nitrate are used as standard solutions.

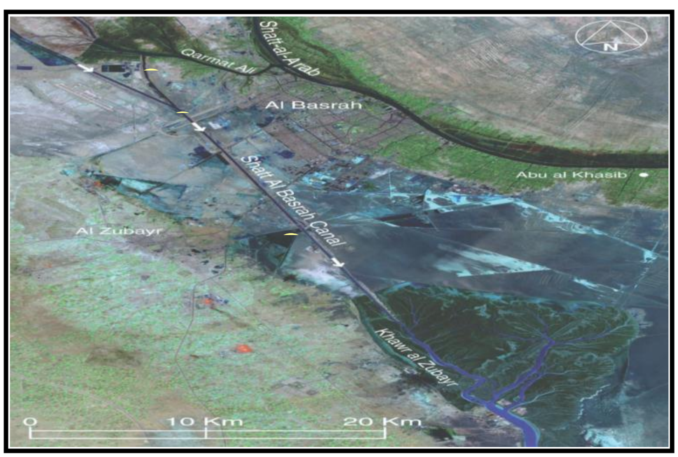

Fig. 1. Location map of southern Iraq showing the sampling stations 1-3 along Shatt Al-Basrah Channel

Phosphate was measured according to Murphy and Riley [10] (1962) in which the blue colour of phospho – molybdenum complex is formed after the reduction of the yellow complex. The intensity of the complex is related directly to the concentration of phosphate, its absorbance is measured at 880 nm.Silicate in the studied stations was measured by mixed reagent of ammonium molybdate and oxalic acid and the intensity of the complex formed was measured at 810 nm.

For trace elements, water samples were collected in 1 liter polyethylene bottles, few drops of nitric acid is added to each sample, cooled, and transferred to the lab in cooling box. In the lab, each sample was digested in Teflon beaker until dryness with acid mixture of nitric and hydrochloric acids, then each sample was dissolved in 25 ml distilled water, and samples were kept in store prior to analysis. The concentrations of trace elements Fe, Cu, Pb, Co, and Ni were determined by atomic absorption spectrometer model PyeUnicum SP9.

RESULTS AND DISCUSSION

Within monitoring programs, generally relevant physical, chemical, and biological parameters are monthly, seasonally or annually sampled and analyzed for the water quality variations. This monitoring may allow proper identification of contaminants and their sources [11].

In this study, station 1 is affected heavily by fresh water coming from Al-Hammar marsh, station 3 is heavily affected by polluted water from certain industrial estate such as Al-Shuaibah petroleum refinery, petrochemical, iron casting and fertilizer of Khawr Al-Zubair, as well as saline water from the Arabian Gulf during high tide.

The seasonally measured values of selected parameters in the waters of Shatt Al-Basrah channel at the selected stations S_1, S_2 and S_3 are shown in figures 2-22. Seasonal changes in pH showed high difference between Aut. 2009 and Spr. 2010 at S_3, Fig.2. Highest value of salinity was reported at S_3, and they increased with relatively fixed rate from Aut. 2009 to Summer 2010, Fig. 3. Electrical conductivity has the same behavior of salinity, Fig.4. Reported turbidity in this study was high at S_3 and the highest values were recorded during Spr. 2010, Fig.5, due to blooming and phytoplankton's abundance, [13].

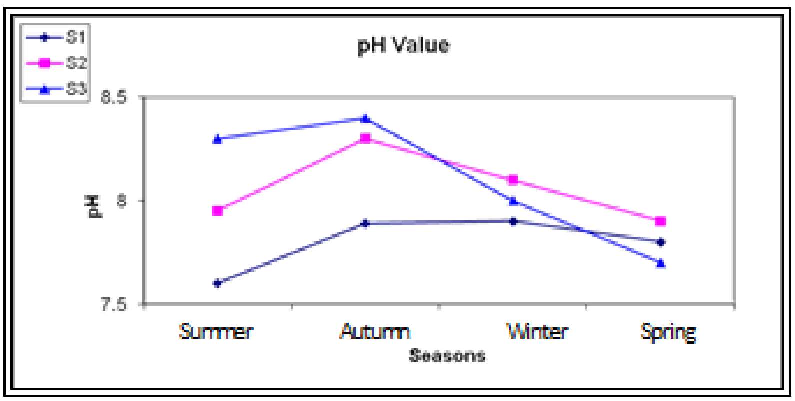

Fig.2: Seasonal variation of pH in the water of Shatt Al-Basrah Channal during the study period

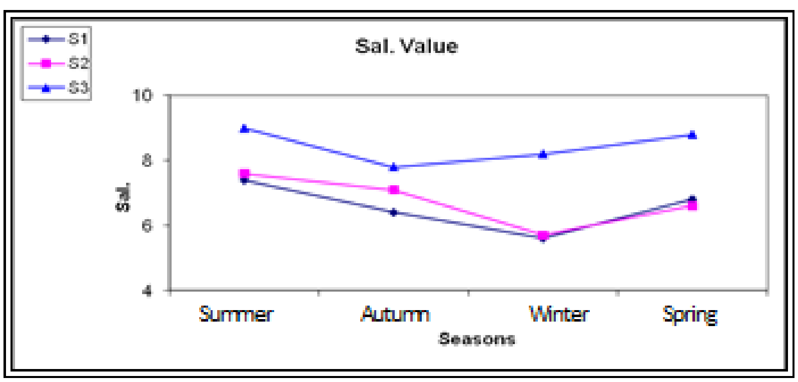

Fig.3: Seasonal variation of Salinity in the water of Shatt Al-Basrah Channal during the study period

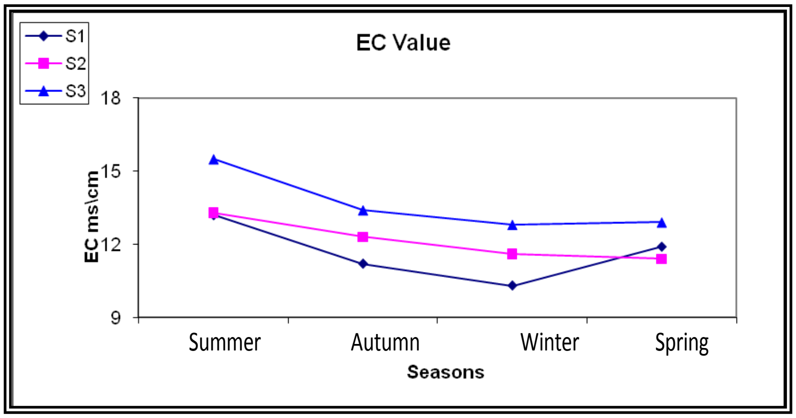

Fig.4: Seasonal variation of Electrical conductivity in the water of Shatt Al-Basrah Channal during the study period

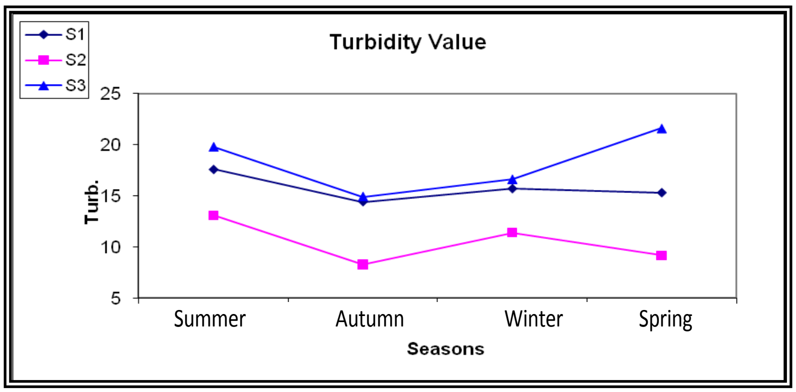

Fig.5: Seasonal variation of Turbidity in the water of Shatt Al-Basrah Channal during the study period

Total Dissolved Solids (TDS) are high in S_3, Fig.6, and the lowest values at all studied stations were during Winter 2010 probably due to dilution as a result of raining. Chloride is behave in the same trend of the TDS, Fig.7.

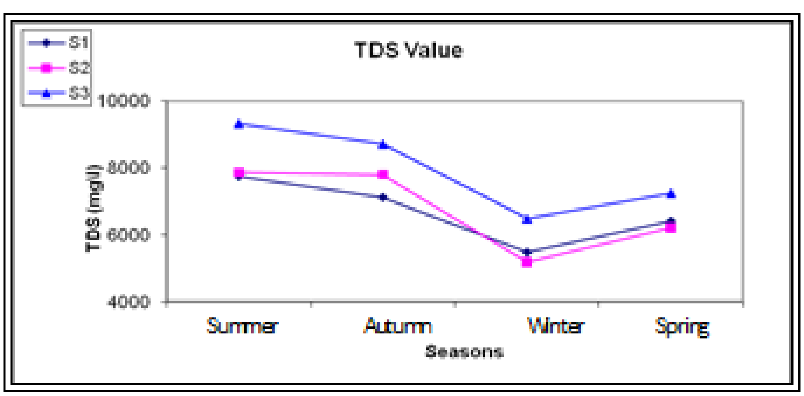

Fig.6: Seasonal variation of Total Dissolved Solids in the water of Shatt Al-Basrah Channal during the study period

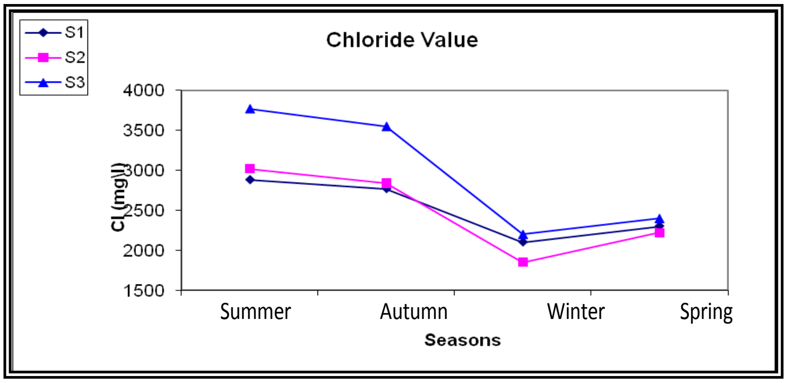

Fig.7: Seasonal variation of Chloride in the water of Shatt Al-Basrah Channal during the study period

For calcium, there were some alternatives at stations 2 and 3 while it is decreased heavily at station 3 from Autumn 2009 towards Winter 2010, Fig.8, due to the transfer of soil and sewage water treated by air from Hamdan waste treatment station which through its waste towards Shatt Al-Basrah Channal. Magnesium on the other hand seemed to be fixed at all stations during the study period, Fig.9. Concentrations of bicarbonates are oscillating at station 3 as they decreased during Winter 2010 and increased during Spring 2010 then they decreased during Summer 2010, while the oscillation of bicarbonates are limited and undetectable at stations 1&2 during all seasons, Fig.10. At all studied stations ,sulphates are decreased during Winter 2010 and gradually increased during Spring and Summer 2010, Fig.11. Sodium and Potassium have the same behavior at all stations, their concentrations decreased during Winter 2010 then increased during Spring and Summer 2010, and the lowest values reported for both ions were at S_3 during Winter 2010, Figs 12&13 respectively.

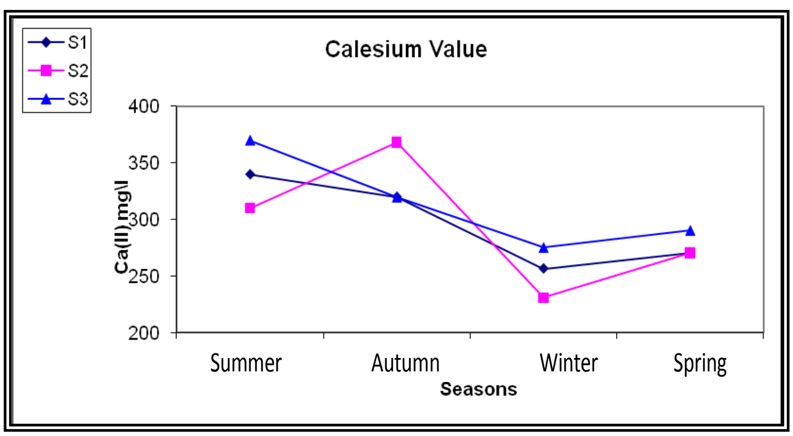

Fig.8: Seasonal variation of Calcium in the water of Shatt Al-Basrah Channal during the study period

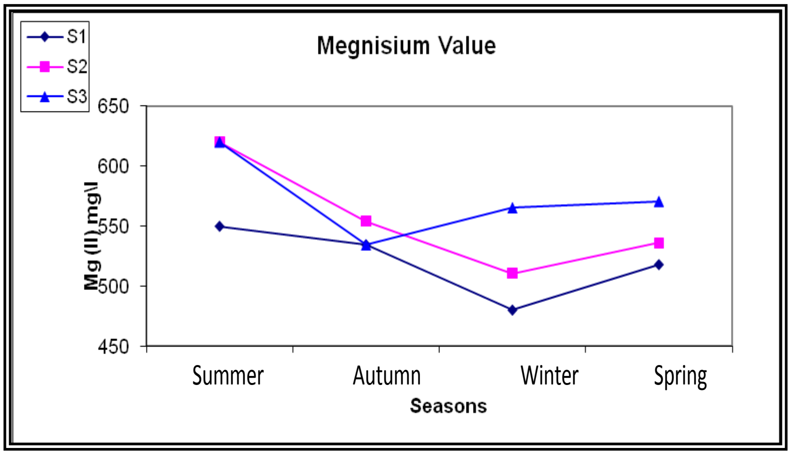

Fig.9: Seasonal variation of Magnesium in the water of Shatt Al-Basrah Channal during the study period

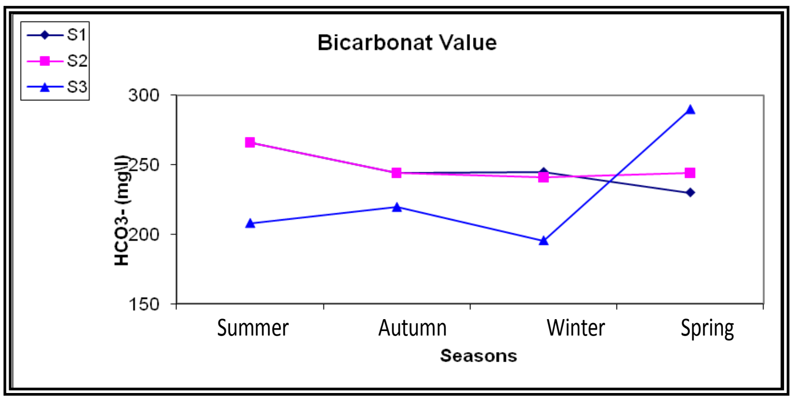

Fig.10: Seasonal variation of Bicarbonate in the water of Shatt Al-Basrah Channal during the study period

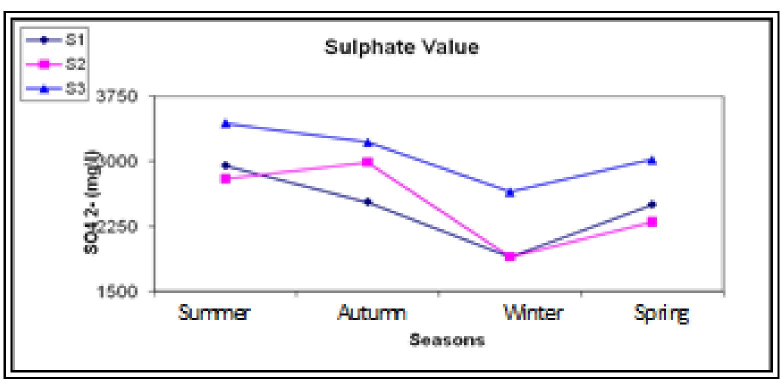

Fig.11: Seasonal variation of Sulphate in the water of Shatt Al-Basrah Channal during the study period

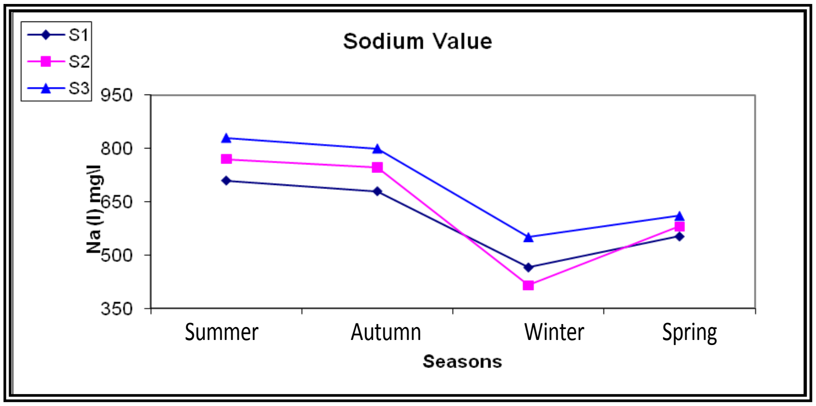

Fig.12: Seasonal variation of Sodium in the water of Shatt Al-Basrah Channal during the study period

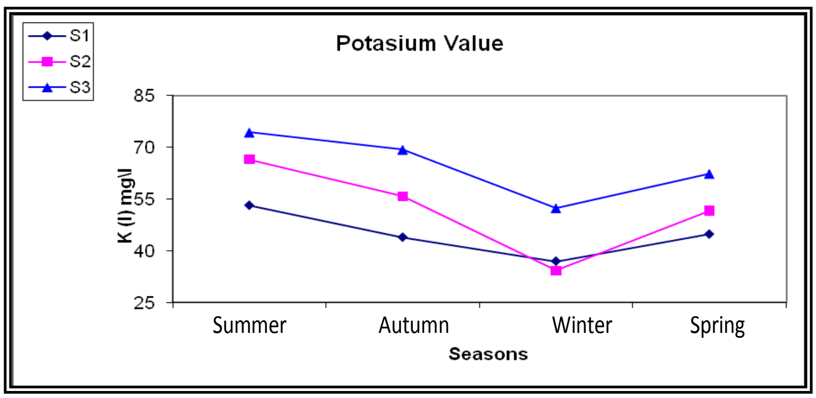

Fig.13: Seasonal variation of Potassium in the water of Shatt Al-Basrah Channal during the study period

The seasonal variations of nutrients (phosphates, nitrites, nitrates and silicates) in the waters of Shatt Al Basrah channel during the study period are shown in figures 14 – 17 respectively. Lowest values reported for phosphates were during Spring 2010 at all stations, moreover, S2 was reported to be higher in phosphate contents during all seasons, Fig.14. For nitrate, there was an interferences in concentrations among the seasons as well as stations. During Spring nitrite was higher at Stations 1&2 and during Autumn 2009 nitrite was high at all stations, while during Summer, nitrite was low at all stations, Fig.15. At stations 2&34 nitrate showed the same behavior of nitrite, it exchange alternatively during Autumn and Spring seasons, while at S1 values of nitrates were low during all seasons of study, Fig.16. Silicates were reported as higher concentrations at all stations of Shatt Al-Basrah Channel during all seasons of study and ranged 70 – 100 ug Si-SiO2/ml, Fig.17.

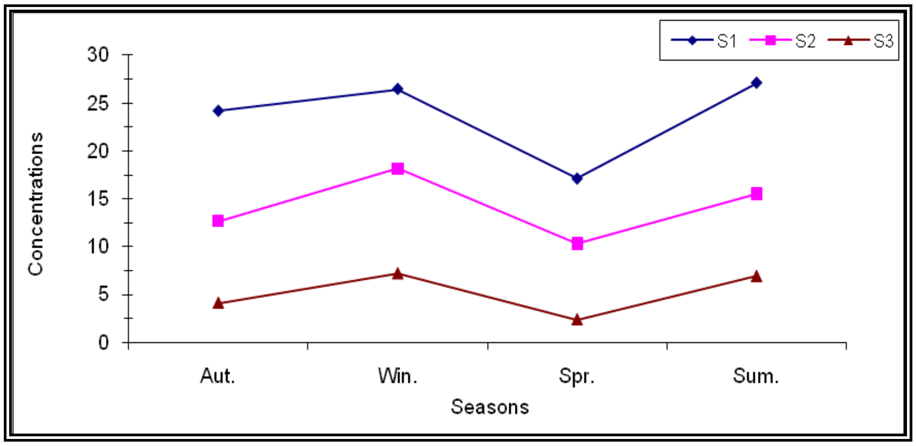

Fig.14: Seasonal variation of Phosphate in the water of Shatt Al-Basrah Channal during the study period

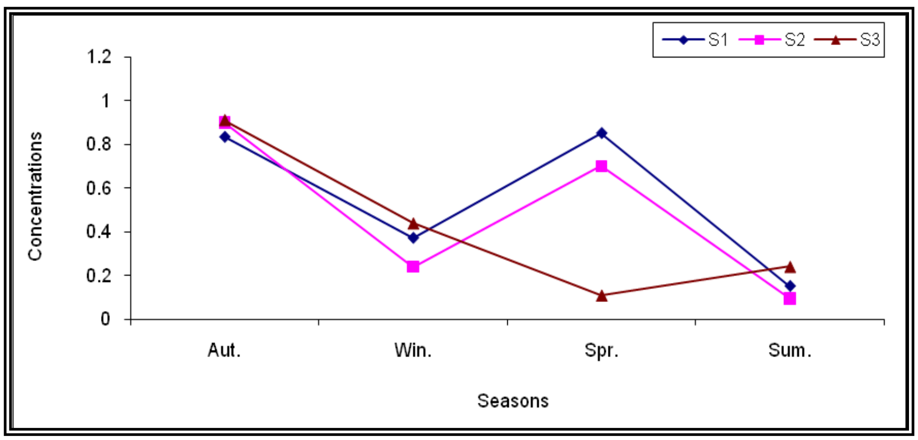

Fig.15: Seasonal variation of Nitrite in the water of Shatt Al-Basrah Channal during the study period

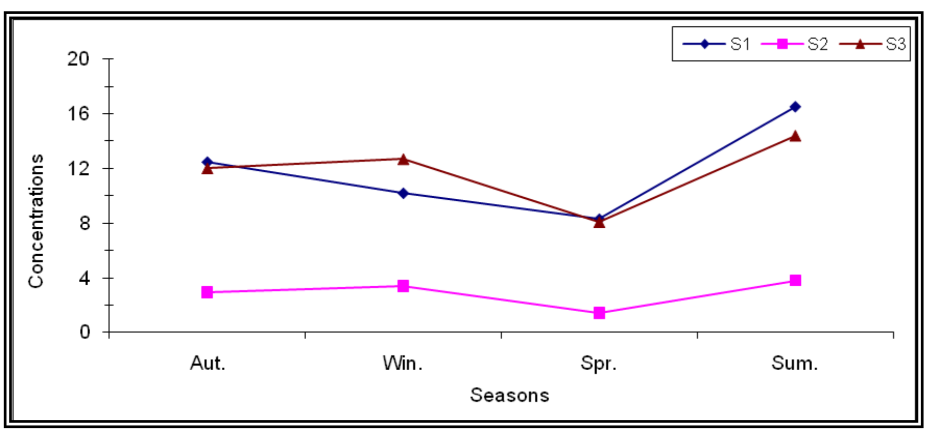

Fig.16. Seasonal variation of Nitrate in the water of Shatt Al-Basrah Channal during the study period

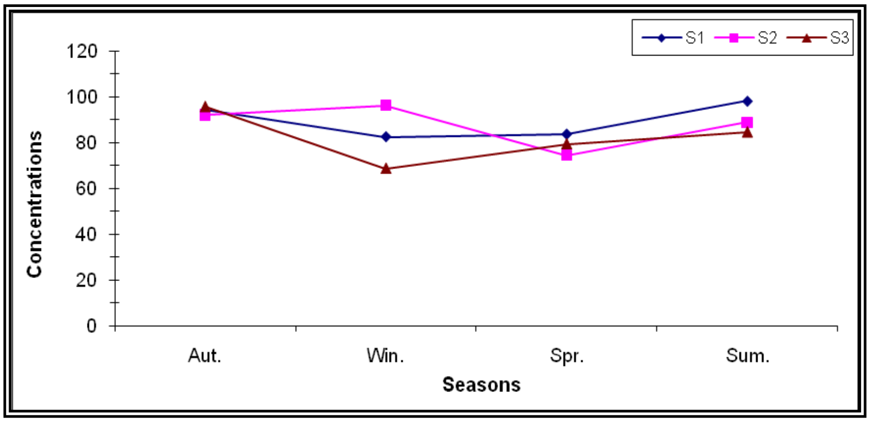

Fig.17. Seasonal variation of Silicate in the water of Shatt Al-Basrah Channal during the study period

The seasonal variations of trace metals (Fe, Cu, Pb, Co, and Ni) in the waters of Shatt Al-Basrah channel during the study period are shown in figures 18 – 22 respectively. The levels of trace elements in the water of Shatt Al-Basrah Channel during the period of study were alternative in the studied stations and higher levels for Fe, Pb, Co, and Cu in station 2, while Ni was higher in station 3, this may be due to the exposure of station 2 to various types of pollutants mostly is the sewage water from Basrah city [13].

The none availability of geochemical studies is the main factor to explain the different compositions of trace elements in the study area[14]. As Shatt Al-Basrah Channel is an extinction of Al Hammar marsh, Southern Iraq, the characterization of Al-Hammar marsh will reflected upon the water properties of Shatt Al-Basrah Channel [15].

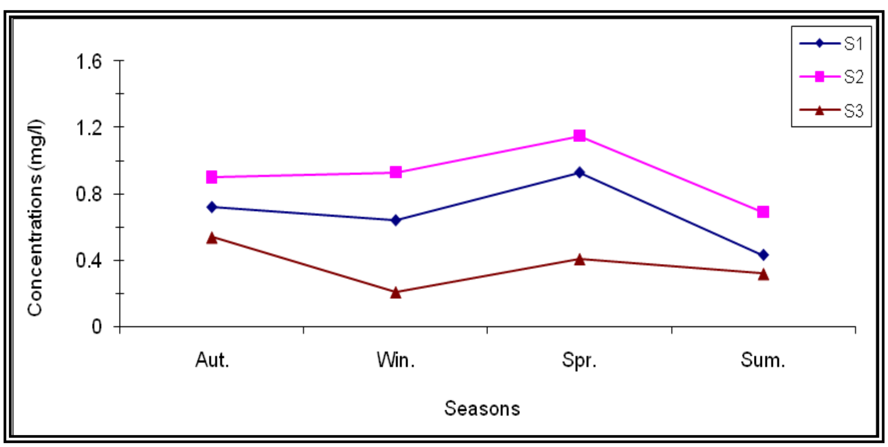

Fig.18. Seasonal variation of (Fe) in the water of Shatt Al-Basrah Channal during the study period

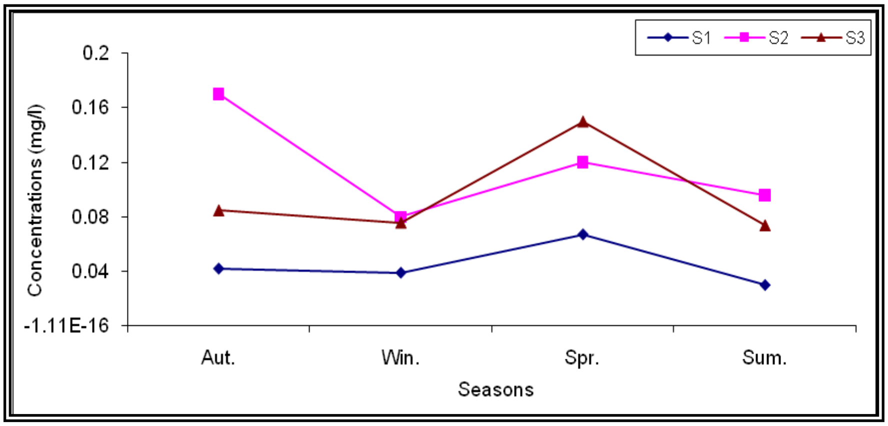

Fig.19. Seasonal variation of (Cu) in the water of Shatt Al-Basrah Channal during the study period

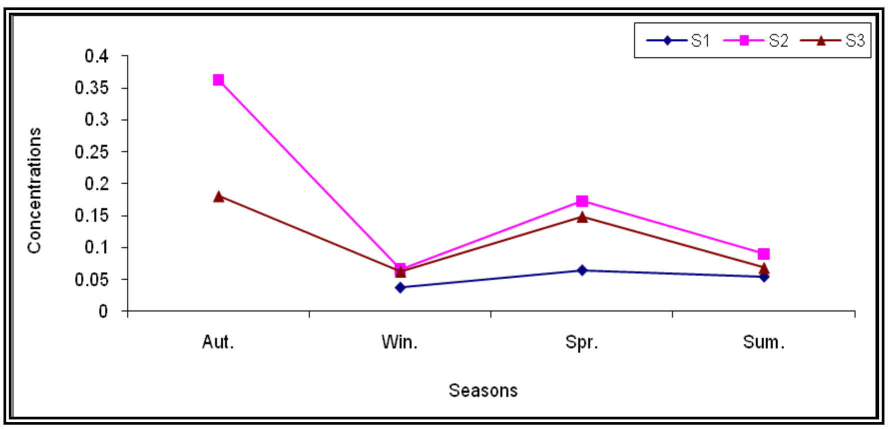

Fig.20. Seasonal variation of (Pb) in the water of Shatt Al-Basrah Channal during the study period

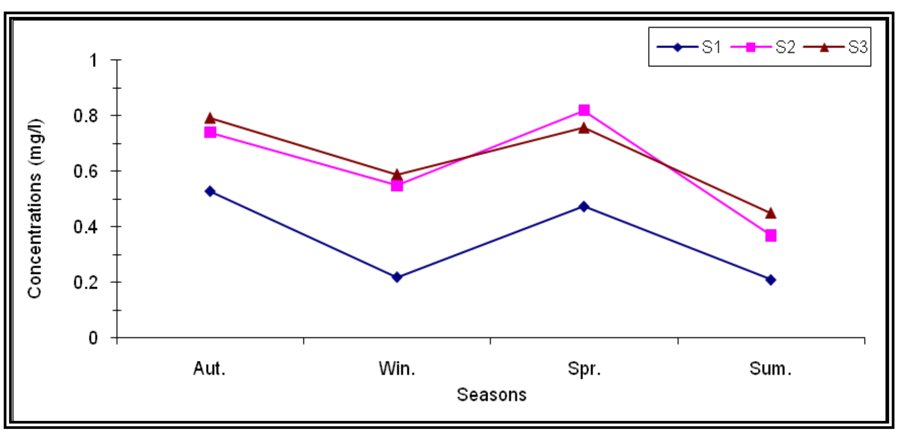

Fig.21. Seasonal variation of (Co) in the water of Shatt Al-Basrah Channal during the study period

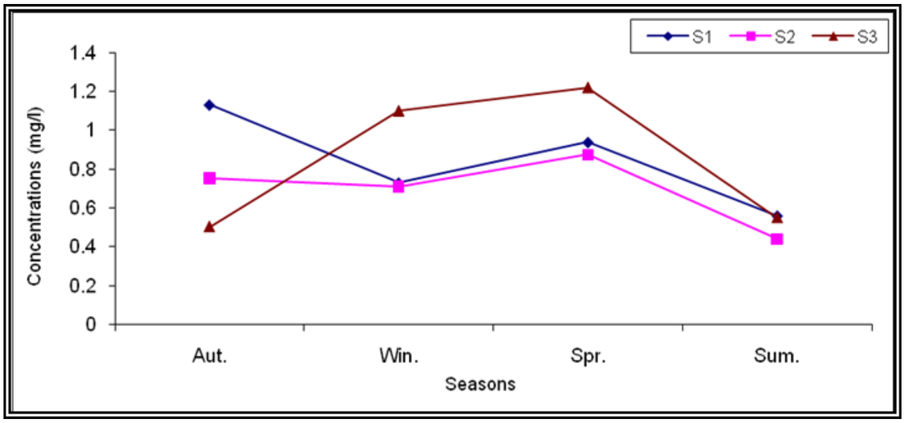

Fig.22. Seasonal variation of (Ni) in the water of Shatt Al-Basrah Channal during the study period

CONCLUSION

As a conclusion the distribution of different types of pollutants in the waters of Shatt Al-Basrah Channel is liable to alternate due to discharging of waste water directly to the channel with out any treatment or even reduction in concentrations[16].The major factor for pollution in the Shatt Al-Basrah Channel is due to waste water from nearby sources, because water flow from marsh land through out the channel has no effect [17].

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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