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Oxygen Measurement as an Indicator of the Pollution of the Shatt Al - Arab River and the North - West of the Arabian Gulf

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ABSTRACT

The environmental factors of the Shatt al-Arab River and the Northwest Arabian Gulf were measured by the YASI measuring instrument. The dissolved oxygen factor in the water was selected as indicator of contamination of the area. Significant differences were observed in the oxygen measurements of water samples in nine stations of the Shatt al-Arab and the Arabian Gulf, with the highest concentration at Shatt al-Arab stations ranging between 8 and 8.8 mg / l. The lowest oxygen value was 5.5 mg / L in the marine fishing area station. The atomic absorption spectroscopy (AAS) was used to measure cadmium and lead in water and the highest value of the two elements in marine waters in the fishing area was 0.076 and 0.999 mg / L respectively.

Introduction:

Many metals found in our environment are nutritionally nonessential. There is a group of metallic elements that exhibits certain chemical and electrical properties and are generally those having a density greater than5 g/cm^3. These metals exceed the atomic mass of calcium. Most of the heavy metals are extremely toxic because as ions or in certain compounds, they are soluble in water and may be readily absorbed into plant or animal tissue. After absorption, the metals tend to combine with biomolecules, such as proteins and nucleic acids, impairing their functions; particularly, Cd, Pb, and Hg are generally considered as the most toxic to humans and animals (Atta et al., 2012; Raldua et al., 2007 and Greenfield et al., 2008).

In natural fresh water, Cd usually occurs at very low concentrations (<0.01µg/L). However, the concentration varies by area and environmental pollution. Many Cd containing wastes end up in lakes and marine water. Wastes from Pb mines, motor oils, rubber tires, has many industrial uses, such as in electroplating, in low melting alloys, in low friction, fatigue resistant bearing alloys, in solders, in batteries, in pigments, and as a barrier in atomic fission control. Therefore, it is to be expected that low to moderate Cd content of the environment is widespread (Lee, 2015).

Although Pb intake from paints, water pipes, tin, cans, and insecticides has markedly declined, the exposure to other forms of Pb such as in motor vehicle exhausts and tobacco smoke has either stabilized or increased, and therefore, Pb is still a potential problem in aquatic systems because of its industrial importance.The Shatt al-Arab River and Arabian Gulf suffer from the waste of fuel of ships and boats in that area, which caused an increase in environmental pollution. Therefore, the objective of the current study is to measure oxygen in nine selected stations with the measurement of the pollution ratios of cadmium and lead to the selected stations.

Material and Methods:

Nine stations were chosen extending along the Iraqi fresh and marine waters from various regions in southern of Basra governorate (Fig. 1) and distributed as follows (St.1 – St.4) in Shatt Alarab river and (St.5-St.9) were chosen from nearby zone of the Fao city towards Khor Abdullah. All the samples were collected during autumn season, October 2011. All the samples were collected by water sampler instrument at depth 10-15 cm from surface water and the physico-chemical properties including the pH, salinity (mg/l), temperature (°C), Dissolved Oxygen (mg/l) and total solid (mg/l) were measured in field byusing the instrument of water checker HANNA (YASI) model HI9828.

The water samples were filtered through Whitman 541 filter paper immediately after the samples have been transported to the laboratory. The filtered samples were acidified with HNO_3 and were kept at 4 ºC prior to the analysis.For indicating the nature and the sources of the polluting substances, heavy metals measured the total cadmium (Cd), and lead (Pb) after digestion and measurement operations through transferred 100 ml from sample to beaker then adding 5 ml of nitric acid to solution and also by using watch glass as cover above it, after that the solution was put on hot plate (almost to dry) and onceagain 5 ml from nitric acid was added in order to emphasize the completion of digestion operation, then complemented to 50 ml by deionized water and put in polyethylene containers (Csuros and Csuros, 2002).The atomic absorption spectrometer type, Phoenix-q 86AA was used for measurement of total cadmium and lead. In addition to that, the standard curve method was used for calculated the concentration of metals.

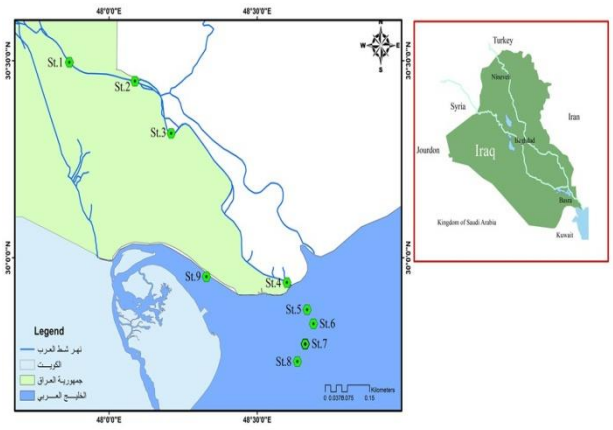

Figure1. Location of the samples selected in Shatt-Alarab River and North West Arabian Gulf

Results and discussion:

Generally, physicochemical analysis gave useful information on the levels of contamination in water. The results are shown in Table (1). The data recorded for all the stations have shown the DO value at extent (5.36 – 8.6 mg/l) and the highest value was recorded in station (St.1) while the lowest value was recorded in station (St.7) (Fig. 2). This data was consistent with other environmental studies in southern of Iraq such as study of Abdulnabi (2016) who's recorded the dissolved oxygen range between (5.6 – 9.40 mg/l). Dissolved oxygen is one of the important features of many organisms in the water system. It is affected by many sources, most important of which are temperature change and the increase of various contaminants, such as chemical and biological, when increasing organic pollutants leads to the consumption of dissolved oxygen resulting in low concentration in water. Thus it will drive the life of living organisms to danger (Sánchez*et al*., 2007).

This data refer to more contamination in station (St.7 & St.8) because these regions were an important commercial road which is affected by increasing the waste of commercial ships and fishing vessels in addition to other marine activities.

Cadmium and lead were measured in the waters of all stations as shown in Table (2). The total concentration at range between (0.03 - 0.076 mg/l), station (St.6) was recorded the highest value when compared with all measurements while the lowest value was recorded in stations (St.8). This may be attributed to this area is important in marine navigation for large number and different loads of oil and commercial ships where they pass through it to the Arabian Gulf (Abdulnabi et al., 2015). Cadmium is a nonessential trace element and is present in air, water, and food(Mc Geer et al., 2011). In natural fresh water, Cd usually occurs at very low concentrations (<0.01µg/L). However, the concentration varies by area and environmental pollution. Many Cd containing wastes end up in lakes and marine water, motor oils, rubber tires, has many industrial uses, such as in electroplating, in low melting alloys, in low friction, fatigue resistant bearing alloys, in solders, in batteries, in pigments, and as a barrier in atomic fission control. Therefore, it is to be expected that low to moderate Cd content of the environment is widespread (Lee, 2015). The data of cadmium

concentration was compared with various globally allowed limits and showed lower values when compared withCanadian environmental quality guidelines (CCME, 2014) that recorded about 0.1 mg/l.

Table1.Physicochemical parameters of selected water samples

Station	Temp. C°	DO mg/l	TDS mg/l	pH	Salinity mg/l
St. 1	19	8.6	2.25	7.68	1.6
St. 2	19	8.1	2.4	7.7	1.99
St. 3	20.2	8	1.67	7.9	1.3
St. 4	21.10	8.27	6.74	8.03	5.08
St. 5	21.19	6.8	21.60	8	20.82
St. 6	22.33	7	38.08	8.15	39.19
St. 7	21.8	5.36	40.44	8.12	41.92
St. 8	20.75	5.5	37.88	7.30	38.19
St. 9	21.4	6.6	31.39	8.08	31.5

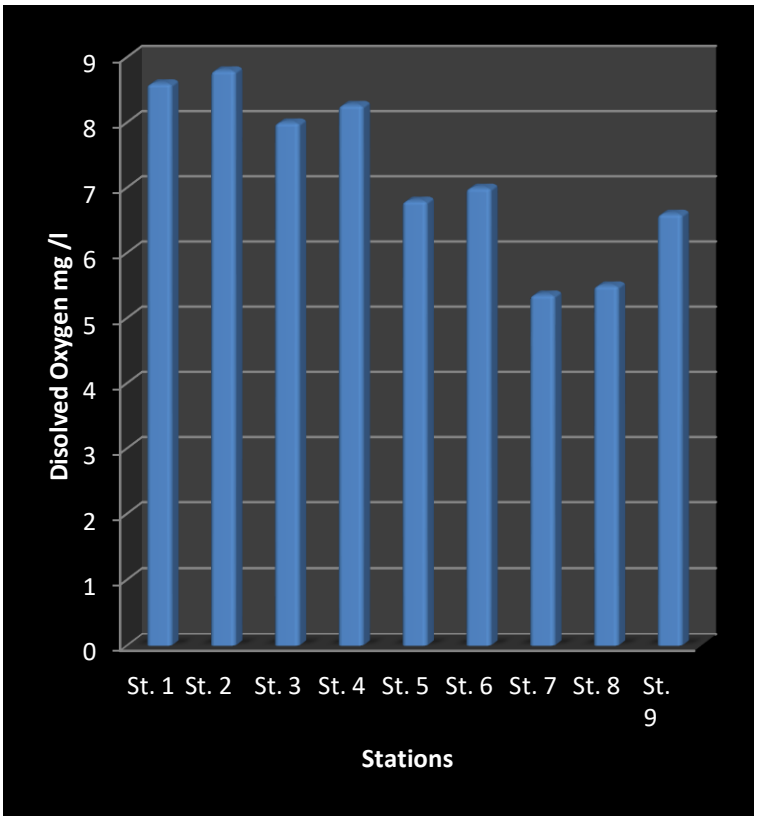

Figure2. Concentration of Oxygen (mg/l) in nine stations of Shatt-Alarab River and North West of Arabian Gulf.

Lead was measured and recorded for all stations; the total concentrations at extent were (0.74-1.005 mg/l). Station (St.4) and (St.6) recorded the highest values when compared with other stations (Table 2) because these stationswere an important commercial navigation and these sites are affected by the large activities of the marine fishing in addition to the passage of ships that liberate many residues, including oil and waste streams. And also recorded equal values of total concentrations for lead about 0.91- 0.96 mg/l for St.1, St.2, and St.3 in Shatt Al-Arab River because these stations are important areas and affected by several activities as natural and anthropogenic sources. Although Pb intake from paints, water pipes, tin, cans, and insecticides has markedly declined, the exposure to other forms of Pb such as in motor vehicle exhausts and tobacco smoke has either stabilized or increased, and therefore, Pb is still a potential problem in aquatic systems because of its industrial importance (Wright and Welbourn, 2002).The data recorded higher values for lead concentration when compared with some globally allowed limits as CCME (2014) that recorded about 0.05 mg/l.

Table2. Concentration of total Cadmium and Lead of stations selected from surface waters of fresh and marine samples.

Station	Conc. Of Cd mg/l	Conc. Of Pb mg/l
St. 1	0.0509	0.919
St. 2	0.049	0.932
St.3	0.055	0.961
St.4	0.046	1.005
St.5	0.06	0.904
St.6	0.076	0.994
St.7	0.049	0.854
St.8	0.03	0.745
St.9	0.044	0.855

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