A study of Boron Concentration in samples which are taken from the waters of the Shatt al-Arab River in Basrah Governorates (Southern Iraq) by using ICP-OES Technique.

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Abstract
This research aims to know the boron concentration in samples taken from water which collected from the river of Shatt al-Arab. It passage through Faw and Abu Al-khaseeb district in Basrah governorate located in southern Iraq. The measurements were made by analyzing the samples were taken from 24 different sites by inductively coupled plasma mass spectrometry Technique. The concentration of Boron in the study was Between (0.30206) ppm in (Al-Doweb) and (1.1918) ppm in (near of Abadan refinery) within the Shatt al-Arab. The results of this research can be used to help implement the water quality standard by the competent departments in order to keep water sources free from pollution. The study showed that the boron concentration is most samples taken from the studied sites are not high, with the exception of some samples that may indicate the possibility of pollution in the future may pose a danger to humans and the environment.

Index Terms: Boron, Water samples, ICP-OES, Shatt al-Arab, Basrah Governorate

1. INTRODUCTION
Boron is a non-metallic element that located within IIIA group of the periodic table and has +3 oxidation state. It has an atomic weight of 10.81 and an atomic number of 5. In fact, Boron is a mixture of two stable isotopes, $^{11}$B (80.2%) and $^{10}$B (19.8%) [1]. It is found in soil, rocks and water as a natural component. There are high concentrations of boron, such as 100 ppm in the boron rich parts. As for the Earth's crust, the boron concentration is less than 10ppm[2]. a combined state was found such as boric acid, borax, tourmaline, kernite, colemanite, borates and ulexite, where boron does not appear as an element on the earth[3-6]. Borate and boric acid can be used in the manufacture of detergents, soaps, glass, flame retardants The absorption of neutrons by nuclear facilities can lead to toxicity of Boron in the environment. Borates are used in agricultural fields, such as pesticides, fertilizers and
herbicides because it is not carcinogenic to mammals and insect resistance is low compared to organic insecticides[7,8]. Boron occurs in the form of borosilicate in igneous and metamorphic rocks and weatherproof deposits and is not readily available to plants. Figure1 illustrates the chemical composition of three boron compounds.

![Boric acid, Boron oxide, Anhydrous borax](image)

**Fig. 1. Chemical compositions of three boron compounds [9]**

The natural borate content of surface water and groundwater is usually small. Since the content of borate is a component of household washing materials, the content of borate in surface water can increase significantly as a result of wastewater discharge[10]. In fresh water, the amount of boron depends on these factors such as proximity to coastal areas, the geochemical nature of the drainage area and the inputs of industrial and municipal liquid wastes. Borax decays at 75°C. It misses $\text{5H}_2\text{O}$ at 100°C, $\text{9H}_2\text{O}$ at 150°C. The anhydrous borax melting point is above 700 °C and decomposes at 1575 °C, and it turns into anhydrous at 320 °C [11].

In ICP-OES technology, the boron concentration is obtained based on the value of the electromagnetic radiation emitted by the excited B atoms. The wavelengths detected for boron are usually 182.52, 249.678 and 249.773 nm. Detection limits differ from (0.005 - 0.01) mg/L. Common interventions are chromium and iron [12].

One type of plasma source is an ICP that contains electrical currents generated by electromagnetic induction process in an expelling gas like argon gas. In the aqueous phase, samples are usually prepared, taking into account the steps that involve extraction and purification, after which they are inserted into the plasma of the device depending on the sprays room and the spray [13-15]. ICP-OES is one of the types of ICP that has the ability to detect the electromagnetic radiation that is emitted by the atoms and ions that generate energy from plasma source. Through the wavelength of the emitted radiation, elements can be distinguished [13].

The aim of research is to checking for complex reactions as well as interactions with the movement of water, and estimate the risks resulting from water samples. in fact, the water samples that were examined through this research were taken from Shatt Al-Arab in the center and south of Basrah Governorate southern Iraq, see Figure 2.
2. Calibration Curve for boron concentration for water samples:

Calibration is done using the appropriate program options From the device. Using the titration curve, the boron concentration was calculated at (0.148 - 1.782) mg/L. The water samples had been sampled That were estimated by ICP-OES method. Regarding the calibration graph, a stock solution of titration solution borate was used was Equipped by ICP-OES technique at (249.772) nm.. Linear calibration is observed, followed by a regression factor calculation, and the results were tested in (mg/L). Regression equation 

\[ y = 1251x - 78.46 \] 

\[ R^2 = 1 \]  

From the standard curve the boron concentration was read directly, see figure (3).

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**Fig. 2.** The part of the Shatt al-Arab from which samples were taken from stations, (s) represents the station number, map from Google Earth.

**Fig. 3.** Calibration curve forboron concentration in water (mg/L) vs Emission intensity (c/s).
3. RESULTS AND DISCUSSIONS

The boron concentrations of the water samples included in this study were presented in Table 1. They were collected from sites in South Shatt Al-Arab in Basrah Governorate.

Table 1: Measurements of Boron concentration in Shatt al-Arab river passage through Faw and Abu Al-khaseeb district in Basrah governorate in southern Iraq using ICP-OES

| No of site | Location of samples | Geographical coordinates | Concentration of boron in water of Shatt-AL-Arab |
|------------|---------------------|--------------------------|-----------------------------------------------|
| S1         | Ras Al-Bisha 1      | 29.944100 48.579589      | 0.37194                                       |
| S2         | Ras Al-Bisha 2      | 29.947315 48.558309      | 0.40455                                       |
| S3         | Faw                 | 29.960253 48.514000      | 0.42044                                       |
| S4         | Al-naghaa Ah- oula  | 29.969885 48.494414      | 0.53892                                       |
| S5         | Faw2                | 29.99234 48.457444       | 0.43411                                       |
| S6         | Maamer1             | 30.093654 48.413654      | 0.38006                                       |
| S7         | Maamer2             | 30.075514 48.434565      | 0.37785                                       |
| S8         | Al- dora1           | 30.124459 48.379678      | 0.38302                                       |
| S9         | Al- dora 2          | 30.142494 48.388653      | 0.38755                                       |
| S10        | Al- fadaghea        | 30.174017 48.415161      | 0.56824                                       |
| S11        | Al- dwaser          | 30.201173 48.405297      | 0.44873                                       |
| S12        | Kout bander         | 30.221582 48.380895      | 0.60441                                       |
| S13        | Al- doweb           | 30.252557 48.347145      | 0.30206                                       |
| S14        | Al- waslea          | 30.284480 48.320061      | 0.67613                                       |
| S15        | Near the Abadan refinery | 30.338567 48.259639   | 1.1918                                         |
**Table 1:** Boron concentrations in different sites of Shatt Al-Arab in Basra Governorate.

| Site   | Location                        | Concen. (mg/L)  | B. Concentration |
|--------|---------------------------------|-----------------|------------------|
| S16    | Sehan1                          | 30.315084       | 0.72893          |
|        |                                 | 48.219374       |                  |
| S17    | Sehan 2                         | 30.333736       | 0.51761          |
|        |                                 | 48.191323       |                  |
| S18    | Al-shahenea                     | 30.358689       | 0.58276          |
|        |                                 | 48.186078       |                  |
| S19    | South om al resas               | 30.412506       | 0.62444          |
|        |                                 | 48.171222       |                  |
| S20    | north om al resas               | 30.449480       | 0.65287          |
|        |                                 | 48.0932         |                  |
| S21    | Fertilizer factory              | 30.456046       | 0.90392          |
|        |                                 | 48.0303         |                  |
| S22    | Abu Flus Port                   | 30.457676       | 0.73193          |
|        |                                 | 48.0201813      |                  |
| S23    | Coast games city                | 30.462373       | 0.82477          |
|        |                                 | 48.002819       |                  |
| S24    | Near Abu moghera River          | 30.465469       | 0.86360          |
|        |                                 | 47.962847       |                  |

**Fig. 4.** Concentration of Boron in the water of ShattAl-Arab in Basrah Governorate by using (ICP-OES).

The boron concentrations that were found from water samples taken from different places from the south of the Shatt al-Arab in Basra Governorate were presented in Table 1 shows the presence of a high level of boron in some of the studied water samples, and there are samples containing relatively low concentrations. Table 1 shows the classification of 24 sites in the
south of the Shatt al-Arab, from the Ras al-Bisha region near the Persian Gulf to the region of Abu Al-Khaseeb. The boron concentration ranged from 0.30206 ppm in (Al-doweb) to 1.1918 ppm in (near of Abadan refinery). Where it was observed that there are (10) samples containing boron concentration below (0.5) ppm. It starts from (0.30206 - 0.44873) ppm and (14) samples containing boron concentration above (0.5) ppm Which starts from (0.53892 - 1.1918) ppm.

In 1993, the World Health Organization has developed health-based guidelines for 0.3 mg/L for boron. This value was raised to 0.5 mg/L in the first place in 1998. Moreover, In 2000, it was decided to leave the guideline at 0.5 mg/L until data is available from ongoing research that may change the current view of boron toxicity or boron treatment technology [13,16].In 2000, it was decided to leave the guideline at 0.5 mg/L until data is available from ongoing research that may change the current view of boron toxicity or boron treatment technology. In 1998 the European Union set a value of 1.0 mg/L boron for the quality of water for human consumption [17, 18]. New Zealand also set the standard boron in drinking water 1.4mg/L [19,20].

4. Conclusions

This study focused mainly on the southern parts of the Shatt al-Arab located in Basrah Governorate, Because of industrial, agricultural, and household waste, the Shatt al-Arab has become subject to persistent pollution, posing a threat to the environment due to the passage of this big river into the city and the use of its water for irrigation. Crops and hunting. The results of the laboratory examination conducted on twenty-four water samples within the study area indicated that the boron concentration may exceed the internationally approved values in some regions, which constitutes a threat to the public health environment, and the high concentration may be due to pollutants that mix with water and this requires intervention to treat sources of pollution or waste removal from the riverbed. It is also recommended to conduct continuous tests to focus Boron for plants watered from the Shatt al-Arab to ensure that they are free of high concentrations of boron, as well as to limit fishing in areas with high concentrations of boron.

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