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

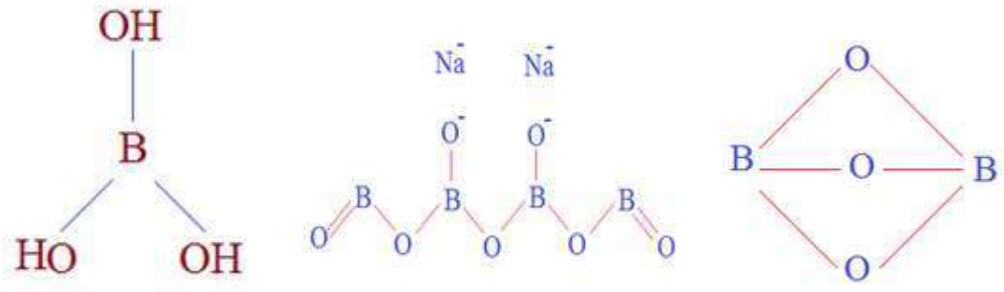
This research aims to know the boron concentration in samples taken from water which collected from the river of Shatt al-Arab .It passage through Faw and Abu Al-khaseeb district in Basrah governorate located in southern Iraq. The measurements were made by analyzing the samples were taken from 24 different 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]. acombined 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**

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 $5H_2O$ at 100°C, $9H_2O$ 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.

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.*

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).

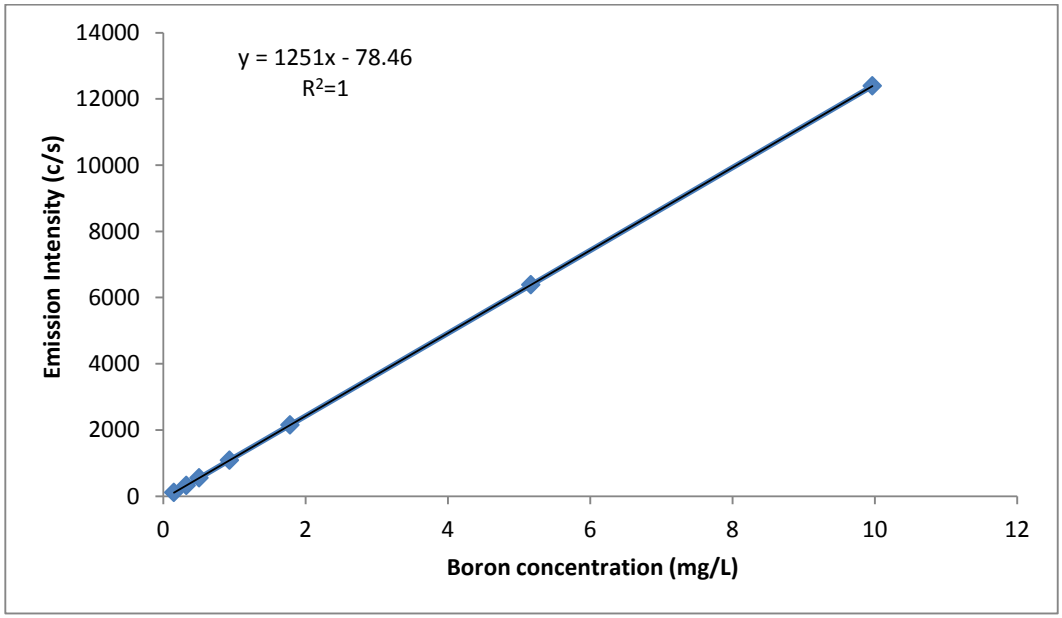


Fig. 3. Calibration curve for boron concentration in water (mg/L) vs Emission intensity (c/s).

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

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

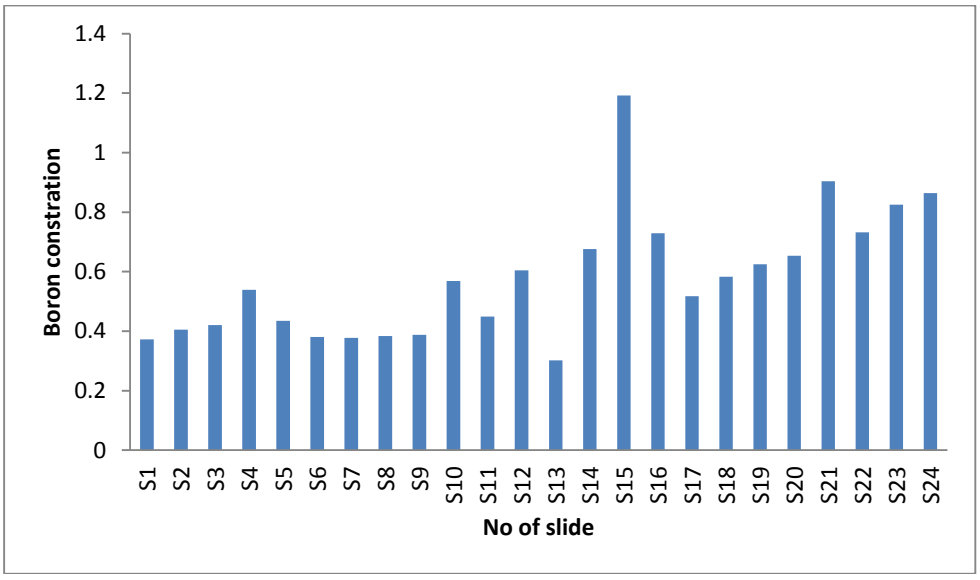


Fig. 4. *Concentration of Boron in the water of ShattAl-Arab in Basrah Governorate by using (ICP-OES).*

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 Table1 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 0.5mg/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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