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Boron Concentration in Groundwater from Southern Basrah Governorate - Iraq

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ABSTRACT

In southern Basrah in Iraq, this research is aimed at measuring the concentrations of Boron $^{10}B_5$. Measuring the water wells and water samples collected at 43 different locations were carried out using the Inductively coupled plasma/Optical Emission Spectrometry (ICP-OES) method. The concentration ranged from 0.2 mg/L (Al Marbad District) to 9.3 mg/L (Al Shuaiba farm 2). The study's findings are given and compared to those of other studies. These observations could be used to make an additionally unique contribution to the preservation and application of water quality standards to related organizations of radioactive contaminant-free samples required for humans if an incident of contamination occurs. Furthermore, 43 surface water samples were found to be more boron-like than detected levels. The increase in water flow outside the root level by the monsoon rain is responsible. This is due to acute boron contamination will therefore soon occur.

1. Introduction

Boron is a member of the non-metallic family of elements. It has an atomic number of 5 and a weight of 10.81. Boron has two isotopes: boron-10, which has a 19.8% abundance, and boron-11, which has an 80.2% abundance (Algrifi & Salman, 2022a). The same applies. It is found in rocks, soil, and water as a natural element. The Earth's crust content is estimated at 10 ppm and about 100 ppm in boron-rich areas (Algrifi, & Salman, 2022b). It is nor free in Earth but is linked to borax, turmaline, colemanite, kernite, and borate (Ismail & Jaafar, 2011; Ismail, & Jaafar, 2010; Naghii, Wall & Samman, 1996; Goldberg & Suarez, 2011).

A boric acid, borates, and borate may be present in the environment utilized for moderately-disinfected items, make-up, and pharmaceuticals. Boric and boric acid can be used in glass, soap, and powder cleaning and can result in environmental toxicity with the use of flame retardants and atomic neutron absorbers. Fertilizers are utilized in agriculture, pesticides, and herbicides since their usage is not mammalian and is insect resistant compared to organic pesticides (Çöl & Çöl, 2003; Altieri, et al., 2009). Boron is found in metamorphic and sedimentary rocks as borosilicate, which is resistant yet inaccessible to plants. Figure 1 contains some chemical boron compounds.

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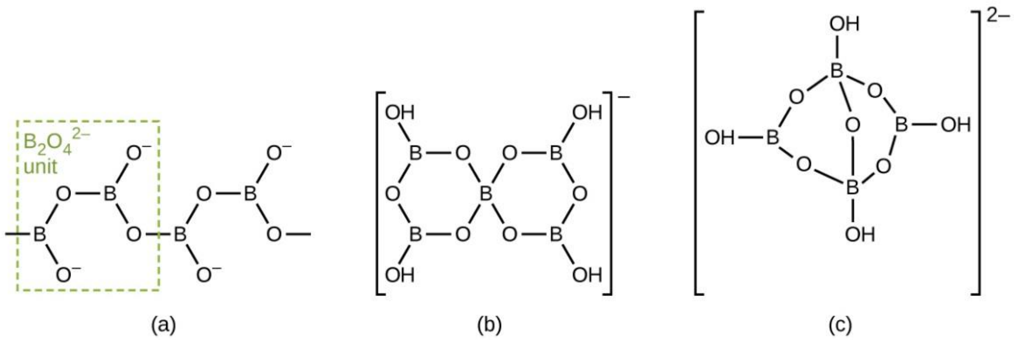

Fig. 1. The borate anions are (a) CaB_2O_4, (b) KB5O8·4H2O, and (c) Na2B4O7·10H2O. The anion in CaB2O4 is an "infinite" chain

Basic boron is insoluble in water (Ballarini, et al., 2010). The aim of this research is to look at the interactions that occur during water circulation, as well as to assess the risks of water samples in terms of their safety for creatures. This study included water samples from areas of the southern Basra Governorate in southern Iraq (Figure 2).

Fig. 2. Southern Basra locations for the samples collected

2. Materials and Methods

Water samples have been collected from 43 sites in the Governorate of Southern Basrah in April 2021. The boron concentration measurements were carried out in the laboratory of the Zarazma company centrally located in the vicinity of Tehran, the capital of the Islamic Republic of Iran by using an ICP-MS, Perkin device made in the USA. The ICP-OES technique was used to measure the amount of boron in water wells and water samples (Sawamura, et al., 1983). The (ICP-OES) is an efficient tool for determining how different samples contain metals. A multitude of different devices or sample injection procedures will then be used to inject samples into a radiofrequency-induced plasma of argon. The plasma sample nebula is quickly dried, evaporated, and propelled by high temperatures. A wavelength selection tool with a lens or mirror is gathered for the radial or axial configuration of the plasma-atomic emissions and photographed in the inner slit. The single element may be cost-effectively measured with a simple combination of monochromator/photomultiplier (PMT) and a combination of polychrome and a panel detector allows simultaneous multifactor detection of as much as 30 elements. In terms of sample volume and sensitivity, the analytical performance of these systems is comparable to that of the most inorganic analytical techniques. The ICP-OES method was used to collect and estimate the samples.

3. Results and Discussion

Table 1 indicates Boron concentrations in water samples collected from several locations in southern Basrah, Iraq. In this study, water samples and water wells are discussed. Table 1 indicated that boron concentrations in water were somewhat greater than the majority of public tap water, well water, and surface water washes in the governorate for testing boron concentrations in water, in addition to Figure 3. Figure 3 shows the findings of 43 samples categorized into 40 sites in the South Basrah governorate region, from W1 to W43. The highest boron content (9.3 mg/L) was found in the town of (Al Shuaiba farm (2) and the lowest boron concentration (0.2 mg/L) was found in the (Al Marbad District) region.

WHO began managing boron levels (0.3-0.5 mg/L) in 1993 and ranked first in 1998. Furthermore, the 0.5 mg/L criteria were agreed upon in 2000, pending the results of additional research that may modify the current understanding of boron toxicity or boron-treatment technologies (Algrifi & Salman, 2022a).

The European Union recommended in 1998 that boron levels in drinking water should not exceed 1.0 mg/L (Ogbonna, et al., 2011). A greater quantity of boron in water samples might be attributed to water-boron leaching since the highest transportable boron level is found in acidic water in the research locations (Subber & Ali, 2012; Pitrus & Amin, 1988). In addition, wastewater irrigation may be obtained by using boron compounds as fertilizers, pesticides, and herbicides regularly. As a result, boron leaching may occur underwater.

Table 1
ICP-OES analysis of boron water samples in southern Basrah Governorate water

Sites numbers	Sites	Boron Concentration mg/L
W1	Sea side Dora	0.57
W2	Sihan	0.42
W3	Al Siba	0.48
W4	Ras Al Bisha	5.28
W5	FAO Center	1.09
W6	Al Mumlahih	5.63
W7	Hamdan	0.53
W8	Abu Mughira	0.53
W9	Al-Saraji	0.59
W10	Mhjran	0.52
W11	Muhilah	0.54
W12	Jaykur	0.58
W13	Al Baradhaiya	0.54
W14	Um Qasr farm1	0.38
W15	Um Qasr farm2	0.37
W16	Um Qasr farm3	4.3
W17	Um Qasr farm4	6.82
W18	Um Qasr farm5	5.26
W19	Um Qasr farm6	0.37
W20	Um Qasr Center	0.65
W21	Al Hadaama	6.8
W22	Khor Al Zubair Center	0.32
W23	Khor Al Zubair Farm1	4.91
W24	Khor Al Zubair Farm2	0.37
W25	Khor Al Zubair Farm3	0.32
W26	Zubair Center	0.23
W27	Al Easkari district	0.23
W28	Al Shuhada district	0.22
W29	Al Khatwa district	0.19
W30	Al Sahafiiyn district	0.47
W31	Al'athar	0.21
W32	Al Marbad	0.2
W33	Al Qaim District	0.21
W34	Al Burjsia	1.1
W35	Al Shuaiba Center	0.21
W36	Al Shuaiba farm1	5.68
W37	Al Shuaiba farm2	9.3
W38	Al Shuaiba farm3	7.72
W39	Al Shuaiba farm4	7.79
W40	Al Shuaiba farm5	6.66
W41	Al Siba (tap water)	0.4
W42	Hamdan (tap water)	0.48
W43	Jaykur (tap water)	0.48

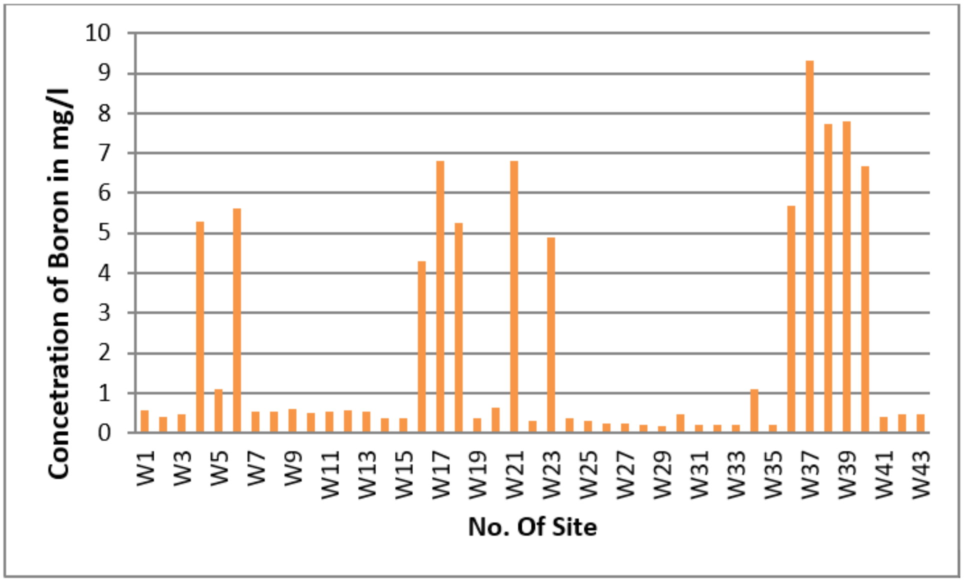

Fig. 3. In the southern Basrah governorate boron concentration in water wells and water samples using ICP-OES

4. Conclusions

The study discovered that water samples in the locations investigated are significantly mineralized. The ability to utilize samples of clean water is critical to both individual and public health. With the suspended isolation of water-sedimented soil and subsequently treating the water, good quality water samples have been preserved. Pollution control methods that prevent harmful materials from entering the water supply, as well as excellent organizational procedures at the water's surface, are likely to keep raw water supplies safe. As a result, a US Geological Survey (USGS) assessment contains almost 20% of private contamination, with 23% posing a serious danger to human health. The Environmental Protection Agency's (EPA) drinking water guidelines, which ban more than 90 contaminants, do not apply to private water samples. The user must ensure the safety and purity of the water before it reaches the tap. It is the responsibility of the water owner. The Centers for Disease Control and Prevention applauds the fact that owners check their water once a year (CDC). Finally, the boron level varied from 0.2 mg/l to 9.3 mg/l in the water samples analyzed. The estimated values are higher than the acceptable IMAC limit of 5 mg/l.

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