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Boron Concentration in Water Samples Of North Basrah Governorate (Iraq) Using Carmine Method

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ABSTRACT: - Significant risks for human health may results from exposure to non pathogenic toxic contaminants that are often globally ubiquitous in waters from which drinking water is derived to measure the Boron, ${}^{10}_{5}B$ concentration in water samples in North of Basra governorate in Iraq. The measurements were performed by analyzing the water samples collected from 55 locations using Carmine method. The Boron concentrations which is obtained ranged from 0.525 ppm in Al Qurna - Al Nahirat (3) to 1.089 ppm in Al Hawair - Company Street in water samples. The results are presented and compared with other studies. The results could be utilized to make distinctive supplementary contributions when contamination event occurs and to implement water quality standards by concerned authorities to maintain radioactive contamination-free drinking water supplies for the people. The study further reveals that 55 surface water samples have boron below detection limit. The presence of boron in drinking water sources in this territory is of natural origin. Thus, there is possibility of severe pollution problem with boron in near future.

KEYWORDS: - Boron, Carmine method , Basra governorate, soil samples ,Boric Acid.

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I. INTRODUCTION

The Boron is a non-metallic element that belongs to Group IIIA of the periodic table and has an oxidation state of +3. It has an atomic number of 5 and atomic weight of 10.81. Boron is actually a mixture of two stable isotopes, ${}^{10}B$ (19.8%) and ${}^{11}B$ (80.2%) [1]. Boron is a naturally-occurring element found in rocks, soil, and water. The concentration of boron in the earth's crust has been estimated to be <10 ppm, but concentrations as high as 100 ppm can be found in boron-rich areas [2]. It does not appear on the earth in elemental form but is found in combined state as borax, boric acid, tourmaline, colemanite, kernite, ulexite and borates [3-6]. In aqueous solution at pH < 7, it occurs mainly as un-dissociated boric acid (H_3BO_3) but at higher pH boric acid accepts hydroxyl ions from water thus forming a tetrahedral borate anion [7]. Boron deficiency is much more common in crops that are grown in soil that have higher amount of free carbonates, low organic matter, and high pH [8]. Boric acid, borates and per borates can introduced to environment as these have been used in mild antiseptics, cosmetics, pharmaceuticals [9]. Boric acid and borates are used in glass manufacture, soaps and detergents, flame retardants, and neutron absorbers for nuclear installations can cause boron toxicity in environment. Borates have various agricultural uses as fertilizer, insecticide and herbicide because they are not carcinogenic to mammalian and lack of insect resistance compared with organic insecticides [10,11]. Boron occurs as borosilicate in igneous, metamorphic, sedimentary rocks which are resistant to weathering and not readily available to plants. The chemical structure of some boron compounds is found in Figure 1.

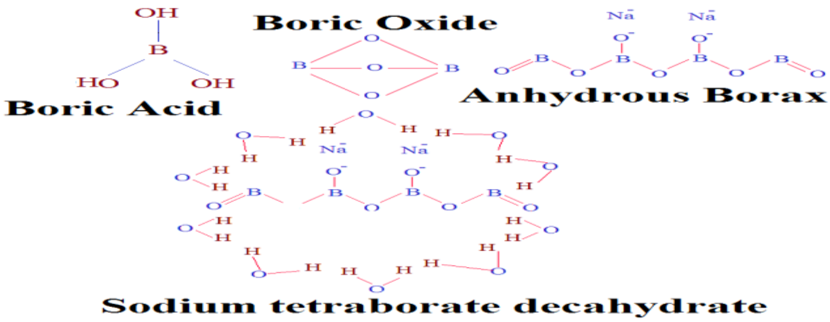

Fig.1. Chemical Structures of some boron compounds [12] (Chemfinder.com, 2006)

Elemental boron is insoluble in water [13]. Borax (decahydrate) does not have a boiling point. Borax decomposes at 75°C, and loses $5H_2O$ at 100°C, $9H_2O$ at 150°C, and becomes anhydrous at 320°C. The melting point for anhydrous borax is above 700°C and it decomposes at 1575°C [14]. Boric acid is a weak acid with a 9.2 pKA and exists primarily as the undissociated acid (H_3BO_3) in aqueous solution at physiological pH [2]. This work represents the preliminary findings from Boron concentration measurement data which were collected from different regions in north Basrah city. The general aim is to investigate the complex interactions and exchanges with the flow of water, and estimate how much hazards brought with waters. In fact, the study area is located inside Basra Governorate which is located in the extreme northern part of Iraq, see Fig.2.

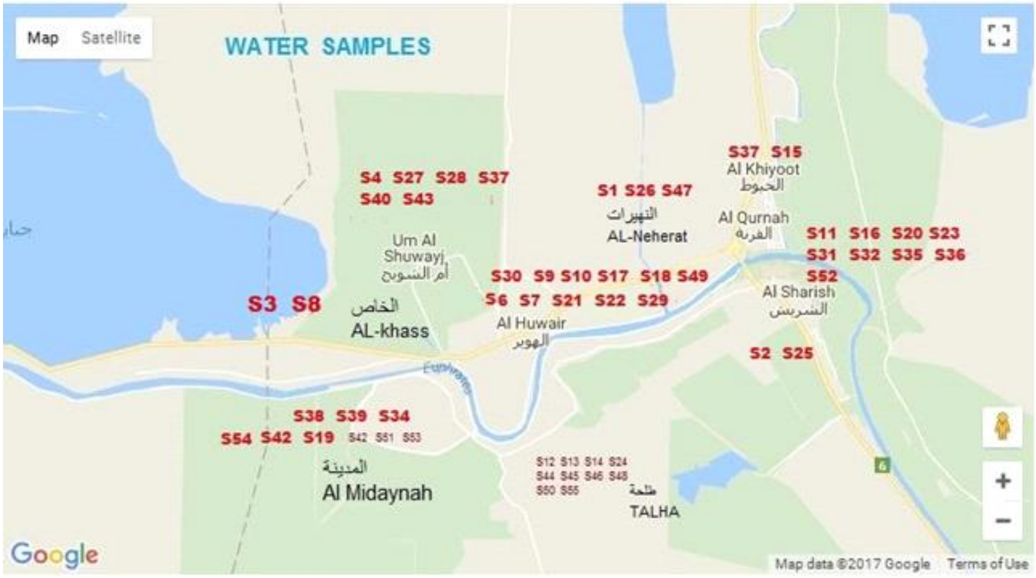

Fig. 2. Basrah Governorate, dots represent the places where samples taken from, numbering in station numbers, Basrah map is from Google earth.

II. MATERIALS AND METHODS

Analytical method:

The Boron concentration can be determined by using Carmine method, which involve combination with carmine or carminic acid in sulphuric acid are followed by photometric measurement. The carmine method is optimum for determination of boron level in the range of 1 – 10 mg/l (13).

Boron content in water samples

A total of 55 water samples were sampled during January, 2017 from area of North Basra Governorate, Iraq. Boron in water and samples were estimated by spectrophotometrically using carmine method. Absorbance was recorded at 585 nm in the UV Spectrophotometer (CECIL –CE2021, England). Regression equation: $C_1 = 0.0367 + 2.351C_{2;}$ divided by 2, the number of 2. is represent the number of millilitres from the water samples. C_1 is the Boron concentration and the C_2 represent the value of absorption; R2 = 95.7% .The Statistical analysis was performed using MINITAB11.

III. RESULTS AND CONCLUSION

The results for Boron concentration in water samples determined in the present study are presented in Table 1 are collected from some areas in North Basrah Governorate, southern Iraq.

Table 1: Boron concentration in water samples from different areas of Basrah Governorate.

Boron Concentration (ppm)	Absorption at 249 nm	Location Name	Location
0.779	0.647	Al Qurna - Al Nahairat (1)	S1
0.588	0.485	Al Qurna - Al Sharash	S2
0.928	0.774	Hawair – Sheikha	S3
0.574	0.473	Al-Huwair - Al-Saddah	S4
0.538	0.442	Al-Qurna – AL- thger	S5
0.958	0.799	Al-Huwair – Huwair Al-sada(1)	S6
0.580	0.478	Al Hawair - Al Aweeja	S7

0.667	0.552	Alhwair – Khamesa	S8
0.607	0.501	Hawair – Aujan	S9
0.670	0.554	Al Huwair - Center (1)	S10
0.914	0.762	Qurna - Hay -AL- Salam	S11
0.530	0.435	Al-Huwair – Huwair Al-sada(2)	S12
0.607	0.501	Al-Hawair - Al-Alwa	S13
0.632	0.522	Al Huwair - River of Ezz (4)	S14
1.089	0.911	Al Hawair - Company Street	S15
0.839	0.698	Qurnah – Humayun	S16
0.516	0.423	AL-Huwair – AL-Ardainea	S17
0.682	0.565	Al Huwair - River of Ezz (5)	S18
0.678	0.561	AL-Midena - Al Sura (2)	S19
0.658	0.544	Qurna – Nasir	S20
0.795	0.661	Al Huwair - River of Ezz (1)	S21
0.764	0.634	Al Huwair - River of Ezz (2)	S22
0.539	0.443	Al Qurna - Center (2)	S23
0.761	0.632	Al Huwair - River of Ezz (3)	S24
0.621	0.522	Qurna – Shaheen	S25
0.838	0.697	Al Qurna - Al Nahairat (2)	S26
0.808	0.672	Alhwair – Al-Mhayit	S27
0.896	0.747	Hawair - Oil Street	S28
0.835	0.695	Al Huwair - Center (2)	S29
0.866	0.721	Alhwair - Haj al-Dakhil	S30
0.599	0.494	Al Qurna - Mazra'a (1)	S31
0.667	0.552	Al Qurna - Center (1)	S32
0.764	0.634	City - Al Sura (1)	S33
0.606	0.500	– FethiyAL-Midena	S34
0.960	0.801	Al Qurna - Maziraa (3)	S35
0.607	0.501	Al Qurna - Maziraa (2)	S36
0.973	0.812	Hawair – AL-kutae	S37
0.527	0.433	AL-Midena – AL-Sada	S38
0.796	0.662	AL-Midena - Al-Awaji (1)	S39
1.01	0.844	Alhwair - Al Bayeb	S40
0.631	0.521	– Market AL-Midena	S41
0.784	0.651	- Al-Awaji (2) AL-Midena	S42
0.835	0.695	Alhwair - Al-Samayd	S43
0.814	0.677	Hawair – Triangle	S44
0.827	0.688	Talha – Center	S45
0.761	0.632	Talha – Rahmaniyah	S46
0.525	0.431	Al Qurna - Al Nahirat (3)	S47
0.775	0.644	Hawair - The Harde	S48
0.671	0.555	AL-HawairAsala	S49
0.788	0.655	Al-Huwair – AL-Trabia	S50
0.666	0.551	Asala AL-Midena	S51
0.486	0.398	AsalaQurna	S52
0.808	0.672	- River Saleh AL-Midena	S53
0.840	0.699	- Antar River AMidena	S54
0.772	0.641	Talha - Ahmed bin Ali	S55

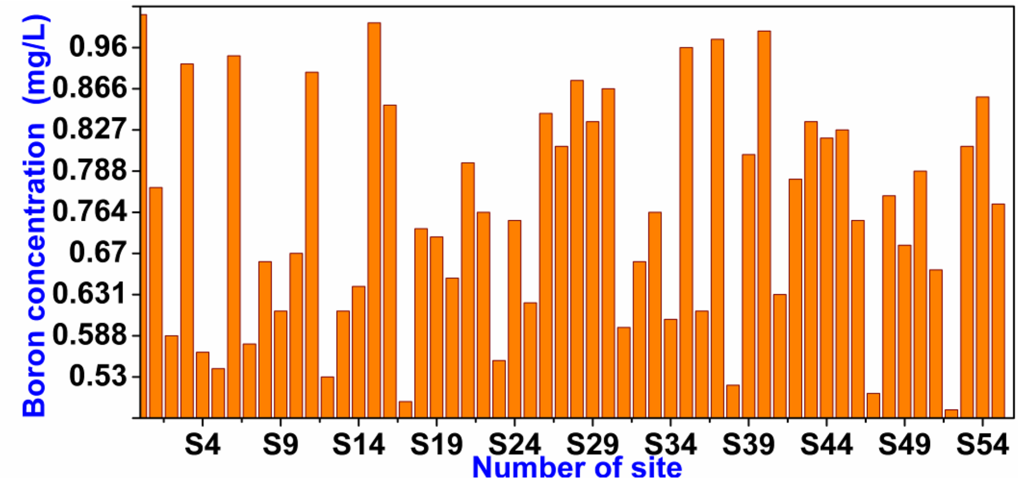

Fig.4 : Boron concentrations in water in North of Basrah Governorate, southern Iraq.

For the measurement of boron concentration level water, table 1 and Fig.4, reflect the fact that, there was some high level of boron concentration in this water higher than the most of public tap and washing surface water in the governorate. The results for these 55 samples categorized into 55 locations, from S1 to S55, shown in Fig. 4. Boron content found maximum 1.089 ppm in Al Hawair - Company Street belt and minimum from 0.525 ppm in Al Qurna - Al Nahirat (3) belt. Out of the 55 water samples 5 samples recorded higher which are beginning from(0.941- 0.973) ppm while the 9 water samples are beginning from(0.808 - 0.896) ppm and th 6 water samples ar beginning from(0.606-0.671)ppm while the 10 water samples are beginning from (0.516 – 0.99) ppm than the prescribed WHO limit (0.5 ppm). The World Health Organization (WHO) in 1993 the WHO established a health-based Guideline of 0.3 mg/L for boron. This value was raised to 0.5 mg/L in 1998 primarily. Furthermore, in 2000 it was decided to leave the guideline at 0.5 mg/L until data from ongoing research becomes available that may change the current view of boron toxicity or boron treatment technology [14,16].The European Union established a value of 1.0 mg/L for boron in 1998 for the quality of water intended for human consumption [17,18]. New Zealand has established a drinking water standard for boron of 1.4 mg/L [19,20].

IV. CONCLUSION

This study is the first boron concentration measurement in water sources that is performed in the area of North of Basrah Governorate (Iraq). In general, well water samples within the investigated areas, are highly mineralized. The correlation analysis revealed the strong positive association between boron and some chemical compounds in water samples. Access to safe soil samples is essential to human well being and is a key public health issue. The maintenance o f good quality y o f water samples were achieved both by protecting the raw soil samples supply and soil water treatment. It is possible to protect the raw waters supply by means of pollution control measures that prevent undesirable constituents from entering the water and by good watershed management practices.

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