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The evaluation and analysing the boron concentration rate in soil of north Basrah city (Iraq) by carmine method

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Abstract . One of the primary goal of the current research is to estimate the concentration of Boron element $^{10}_5\text{B}$ in soil of North of Basrah in Iraq. The evaluation was achieved by analysing the soil samples obtained from 34 locations using carmine method. The estimation range of Boron concentration was between 0.259 ppm to 0.757 ppm corresponding to Al-Huwair, Al-Mhayit and Al-Huwar river EZZ in soil respectively .It can be noticed from the study that all the surface soil samples under the test have a boron ratio within the natural limits for drinking water supplies for the people.

Keywords: North of Basrah, Carminic acid , Boron concentration, Carmine method

1. Introduction:

Boron element is one of the trivalent atoms. It has a three valence electrons and has oxidation state of +3. It can be considered as a mixture of two stable isotopes namely as ^{10}B 19.8% and ^{11}B 80.2% [1]. It can be founded in the nature in water, rocks as well as the soil. It has different concentration in the nature (10 ppm-100 ppm). In the landcrust and in boron-rich areas respectively [2]. The boron appears on the land in many different composite forms such as tourmaline, colemanite ,kernite, borates, ulexite, borax and boric acid [3-6]. Un-dissociated boric acid (H_3BO_3) has 7 at PH, however, it can be formed as a tetrahedral borate anion when it dissociated in water since accepted hydroxyl ions from water [7]. Boron is similar to carbon in its capability to form stable covalently bonded molecular net work .It exists in four major polymorphs; Γ , S , χ and T. Where as Γ , S and T phases are based on B_{12} icosahedra, however χ -phase can be characterized as a rock salt type arrangement of the icosahedra and B_2 atomic pairs. Also the boron can be grown in soil when it had a great amount of free carbonates, high PH and less organic matter [8]. Boric acid, borates and per borates have wide used in detergents, soap, cosmetics, mild antiseptics as well as in glass manufacture [9]. Those matters can cause boron toxicity in environment since they used in flame retardants and for nuclear installations as neutron absorbers. In agricultural can uses a borates as fertilizer, insecticide and herbicide [10-12]. However the boron can be formed as borosilicate in igneous, sedimentary



rocks and metamorphic which are resistant to weathering and not suitable to plant. Fig.1 shows a 3D structure for some types of Boron compounds.



Figure 1. 3D structure for some types of Boron compounds

It is well known that the boron element is insoluble in water and a boric acid can be considered a weak acid. Borox (decahydrate) can be changed to anhydrous at 320 °C and the melting point The melting point for anhydrous borax is above 700 °C and it decomposes at 1575 °C [11].The aim of this article is to achieve and evaluate the complex interactions with flow of soil for the present study area which involve Basrah Governorate south part of Iraq as shown in Figure 2.

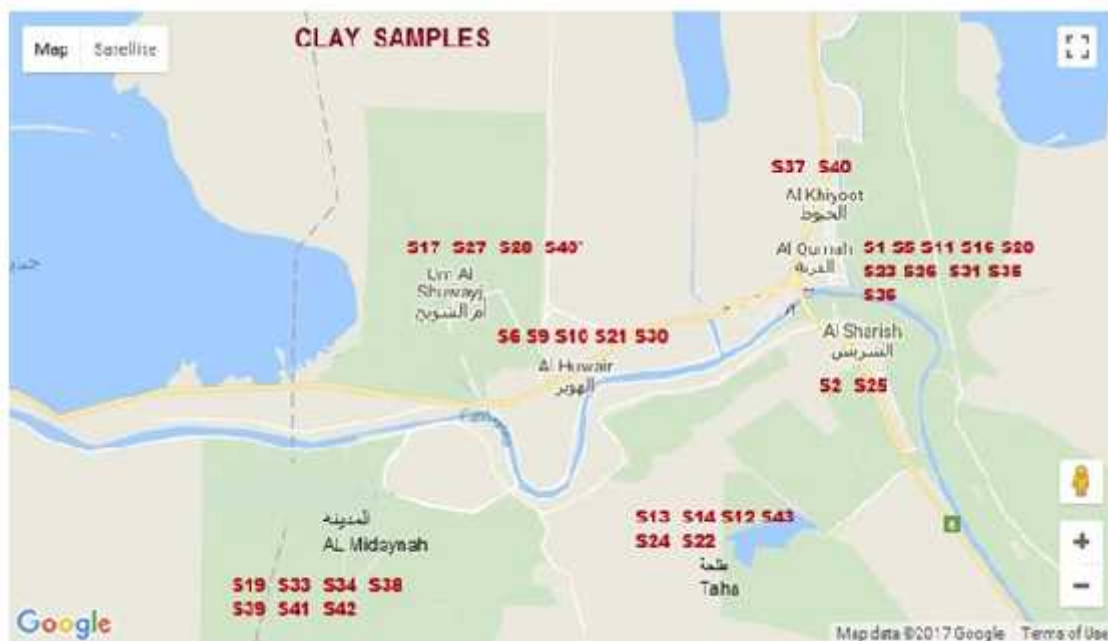


Figure 2: Basrah Governorate, dots represent the places where samples taken from, numbering in station number (S), (Basrah map is from Google earth).

2. Materials and Analytical Methods.

2.1. Analytical method:

The carmine procedure for determining Boron [13-15] is based on the fact that carmine (anthraquinone dye) complexes H_3BO_3 in concentrated H_3BO_4 . This complex forms within 45 min, retains maximum absorbance at 585 nm and is unaffected by the presence of a wide variety of electrolytes. With this procedure, B concentrations ranging from 0.5 to 10 μg of B/ml may be determined. In the presence of boron, a solution of carmine or carminic acid in concentrated sulfuric acid changes from a bright red to a bluish red or blue, depending on the concentration of boron present.

2.2. Soil sampling and Analysis:

The samples were collected from various station in North of Basrah Governorate .The collected samples were dried by air and then all the colds and crumbs were removed by using a 2 mm mesh sieve .After that the samples stored in plastic container.

2.3. A method of Boron Extraction from Soil:

100 g of collected samples were dissolved into 150 mL of distilled water in polyethylene bottles shaken and the mixture which were filtered later through the white paper number 1. The absorbance of standard which obtain by using the spectrophotometer using carmine method ,the absorbance of standard put it in program statistical names of Minitab version11.From this program we are obtain on the regression equation : $C1 = -0.3784 + 2.162C2$. and the correlation factor, $R\text{-seq} = 94.6\%$, where the C1 is represent the Boron concentration (ppm) and the C2 is the absorbance of samples which obtain from the spectrophotometer and then put these values of absorbance samples in this equation divided by 2 and estimated the boron concentration for this value of absorbance samples, this results which can obtain from the program statistical, MINITAB11.

3. Experimental Results.

Figure 3 and table 1 represent the experimental results of boron concentration in soil samples estimated at current study. It can noticed from Fig.3 and table 1 ,there was some high level and it considered within the natural limits for all stations of present study of evaluate the concentration of boron in soil of Basrah city. Fig.3 and Fig. 4 showed the result for the 43 samples corresponding to 43 locations from S1 to S43. Boron content was found maximum ($=0.752$ ppm) and minimum ($=0.259$ ppm) corresponding to Al-Huwair River of EZZ blet and Al-Huwair –Al-Mhayit blet respectively. Out of the 43 soil samples 7 samples recorded higher which begin from(0.622 to 0.699) ppm and the 5 samples which are beginning from (0.518-0.587) ppm and also 5 samples which begin from (0.406-0.498) ppm while the 15 soil samples begin from (0.303- 0.398) ppm are considered within the natural limits. Many organization and Unions established reports about the magnitude of boron for best quality of water intended for human consumption within the range of 1mg/L to 1.4mg/L relating European Union and New Zealand respectively [16-19]. The higher quantity of boron in soil samples may be related to leaching of soil boron as very much quantity of movement boron is represent in the acidic soil in the area under present study. In addition to use of boron compounds as fertilizer, herbicides and insecticide at systematic rang are moved to wastewater irrigation disposal since possibility of boron leaching under soils.

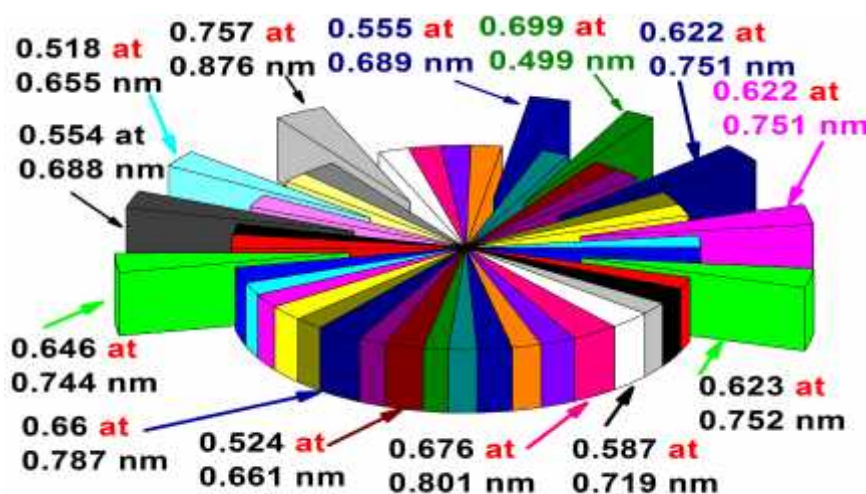


Figure 3. Boron concentrations in soils as a function of absorption at 249 .

Table 1: state the evaluation of boron concentration in soil at different area of Basrah city.

locations	City locations	Absorption at 249 nm	Boron Concentration (ppm)
S1	Al Qurna - Al Nahairat (1)	0.637	0.498
S2	Al Qurna - Al Sharash	0.455	0.302
S3	Hawair – Sheikiha	0.752	0.623
S4	Al-Qurna - the thger	0.432	0.277
S5	Al-Huwair – Huwair Al-sada(1)	0.451	0.298
S6	Alhwair – Khamesa	0.797	0.671
S7	Hawair – Aujan	0.456	0.303
S8	Al Huwair - Center (1)	0.521	0.373
S9	Qurna- Hay Al- Salam	0.751	0.622
S10	Tallha – AL-rahmanya	0.425	0.270
S11	Tallha- Ahmed bin ali	0.487	0.336
S12	Tallha – Bahlah	0.499	0.699
S13	Al Hawair - Company Street	0.487	0.336
S14	Qurnah – Humayun	0.689	0.555
S15	AL-Huwair – AL-Ardainea	0.522	0.407
S16	Tallha – altumar	0.512	0.363
S17	AL-Midena - Albadran	0.551	0.406
S18	Qurna – Nasir	0.521	0.373
S19	Al Huwair - River of Ezz	0.876	0.757
S20	Tallha – abo guraib	0.621	0.481
S21	Al Qurna - Center (2)	0.432	0.277
S22	Tallha-Alneayem	0.655	0.518
S23	Qurna – Shaheen	0.502	0.353
S24	Al Qurna - Al Nahairat (2)	0.688	0.554
S25	Alhwair – Al-Mhayit	0.415	0.259
S26	Hawair - Oil Street	0.529	0.382
S27	Al Huwair - Center (2)	0.744	0.646
S28	Alhwair - Haj al-Dakhil	0.621	0.481
S29	Al Qurna - Mazra'a (1)	0.494	0.344

S30	Al Qurna - Center (1)	0.544	0.398
S31	AL-Midaynaa -Hiader	0.611	0.470
S32	AL-Midena – Fethiya	0.499	0.349
S33	Al Qurna - Maziraa (3)	0.787	0.660
S34	Al Qurna - Maziraa (2)	0.471	0.319
S35	Hawair – AL-kutae	0.661	0.524
S36	AL-Midena – AL-haj Hamdy	0.421	0.265
S37	AL-Midena - AL-wohayyed	0.488	0.338
S38	Alhwair - Al Bayeb	0.599	0.457
S39	– Market AL-Midena	0.501	0.352
S40	AL-midayna – AL-sudan	0.612	0.471
S41	Alhwair - Al-Samayd	0.801	0.676
S42	Hawair – Triangle	0.719	0.587
S43	Talha – Center	0.493	0.343

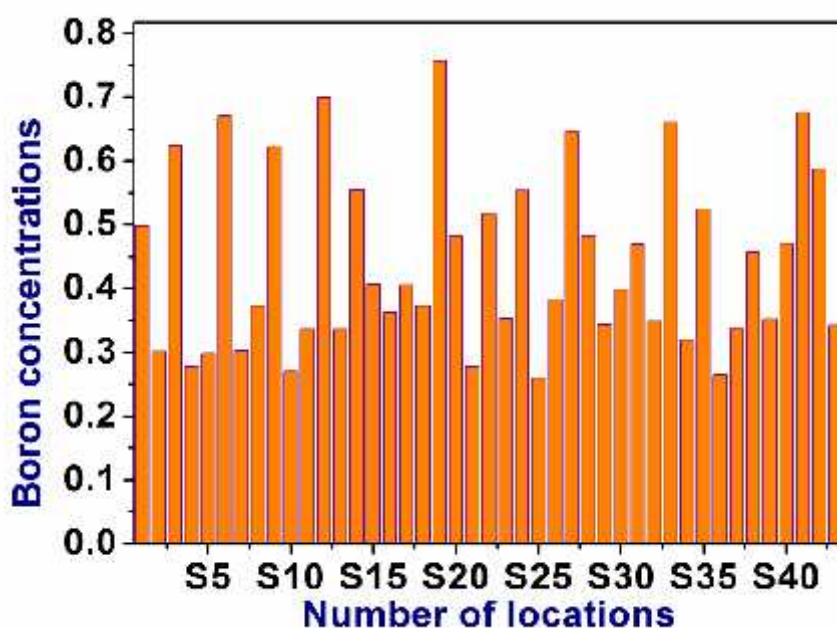


Figure 4. Boron concentrations in soils in North of Basra Governorate.

4. Conclusions:

From the above results at the present study can be withdrawn the following conclusions. The aim of the present study is to evaluate and estimate the concentration of boron $^{10}_5\text{B}$ in soil of some area in north of Basrah city south of Iraq. It is found to Law 1.0 with the variation range (0.259-0.757) ppm. It can be noticed that the concentration of boron is small and within the natural limits in all the samples of the surface soils measurement at areas under the study. The correlation factor, 94.6% of the range between boron of absorbance standard and the samples absorbance in soils. Can be considered that

very good correlation. As well as known that indicates to safe soil is important to human well-being and can be considered as a key public health issue.

5. References

- [1] WHO. World Health Organization. Environmental Health Criteria 204: Boron. Geneva, Switzerland: World Health Organization (as cited in U.S. EPA, 2004). **1998**.
- [2] Woods W.G. , *Environ. Health Perspect.*, **1994** , 710, 25.
- [3] W.G., Woods, *Environ Health Perspective*, **1994**, 102, Supplement 7, 5-11.
- [4] P. Argust, *Biological Trace Element Research*, **1998**, 66 (1-3), 131-143.
- [5] D.S. Kostick, Mineral Yearbook: Boron, United States Geological Survey, **2006**.
- [6] S. Goldberg, D.L. Suarez, P.J. Shouse, *Soil Science*, **2008**, 173 (6), 368-374.
- [7] B.J. Shelp, In: U.C. Gupta, (Ed.), Boron and Its Role in Crop Production(CRC Press, Boca Raton, FL, **1993**), 53-85.
- [8] W.L. Lindsay, In: J. J. Mortvedt, *et al.*, (Eds), Micronutrients in Agriculture, 2nd Edition, (Soil Science Society of America, Madison, Wisconsin, USA, **991**), 89-144.
- [9] WHO, Guidelines for Drinking Water Quality. 3rd Ed., World Health Organisation. Geneva.**2004**.
- [10]R. J. Weir, R.S. Fisher, *Toxicol and Pharmacol*, **1972**, 25, 251-256.
- [11]D. Diaconu, V. Nastase, M.M. Nanau, O. Nechifor, E. Nechifor, J. Preventive Medicine,**2008**,16(1-2) 77-84.
- [12]Th. M. Salman, A. Y. AL-Ahmad, H. A. Badran and and C. A. Emsary, *Physica Scripta* (2015), 90 , 085302 (8pp)
- [13]O. Neil, M. J. Smith, Heclelman P.E.,(Ed.).The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals.13th edition. Merck & Co.Inc.,Whitehouse Station, NJ,**2001**,pp 1326 .
- [14]Chemfinder. com. 2006. Database and Internet Searching. Available online at <http://chemfinder.cambridgesoft.com/>
- [15] J. T. Hatcher , and L.V.Wilcox.. Colorimetric determination of boron using carmine *Anal. Chem.* **22** , (1950) 5 6 7 - 5 6 9 .
- [16] Council of the European Union Council Directive 98/83/EC, November3, 1998 on the quality of water intended for human consumption. **1998**.
- [17] Neelesh S., Mishra D. D., Mishra P. K. *Advances in Applied Science Research*, **2012**, 3 ,335
- [18] New Zealand Ministry of Health Drinking-Water Standards for New Zealand 2000. Wellington Ministry of Health. **2000**.
- [19]Abdul R.H. S. , Master A. A. *Advances in Applied Science Research*, **2012**, 3 ,563.