

Boron concentration in water wells samples of Basrah Governorates using ICP/OES techniques

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Abstract— Intake of boron from food and drinking water may pose a risk to the public health above a certain concentration level. Therefore, knowledge of boron concentration in drinking water and food items is essential. In this context, samples of drinking water were collected from Basrah governorates (Southern of Iraq). The measurements were performed by analyzing the water samples collected from 37 locations using inductively Coupled Plasma (ICP/OES) is an analytical technique used for the detection of trace metals in environmental samples. The Boron concentrations which are obtained ranged from 1.8647 ppm in Khor Al-Zubair to 10.312 ppm in Umm Qasr Al-Hadama in water samples. The results are presented and compared with other studies. The study reveals that's 38 surface water well samples have boron concentration higher than the WHO limit. It may be due to higher leaching of boron during monsoon rains from surface soils beyond the root zone. Thus, there is possibility of severe pollution problem with boron in near future.

Index Terms—Boron, Wells water, ICP/OES.

I. INTRODUCTION

Water quality of wells, important drinking water sources in rural areas is monitored by Public Health Authorities, chemical and microbiological quality of these sources is often inadequate because water is not treated and/or the pollution sources, especially from agriculture and zootehny, are multiple [1].

Boron is a naturally occurring element that is widely distributed in nature in minute concentrations [2]. It is released into the ground water as a result of leaching from rocks containing boron, soil, and volcanic activity [3]. Boron enters into human bodies primarily from fruits, vegetables, and drinking water [4–6]. Occupational exposures from dust of consumer products are other potentially significant sources of boron that may pose a risk to the general public above a certain concentration level [7]. A small amount of boron in drinking water is not harmful because it is regularly excreted in faeces and urine over a period of several days. It is generally believed that low-level boron intake from natural water and food is beneficial for bones, osteoarthritis, osteoporosis, brain function, metabolism of minerals, and hormonal regulation [8]. Boron has two stable isotopes ^{10}B (19.8%) and ^{11}B (80.2%) that are distributed unevenly in the Earth's crust [5].

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 [9–12]. In aqueous solution at $\text{pH} < 7$, it occurs mainly as undissociated boric acid (H_3BO_3) but at higher pH boric acid accepts hydroxyl

ions from water thus forming a tetrahedral borate anion [13]. 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 [14–15].

This work describes the preliminary findings from Boron concentration measurement data collected from water well samples in Basrah Governorates. The general aim is to investigate the complex interactions and exchanges with water, and to estimate how much hazards brought with waters. In fact, the study area is located inside Basra Governorate which is located in the extreme southern part of Iraq, see Fig. 1. Al-Basra Governorate sited at the southern rim of the Gulf, part of the Iraqi Southern Desert in the west and south and relatively short coast on the Gulf. In the northern part of Basra Governorate, Tigris and Euphrates merge forming Shatt-Al Arab river which flows southward to the Gulf.



Fig. 1. Basra Governorate, dots represent the places where samples taken from, numbering in station number (S). Basra map is from Google earth.

II. MATERIAL AND METHOD

In Basra governorate, the samples from 38 stations and locations were collected during April 2014. The collected, 0.25 L, bottles completely filled with water wells and well sealed to avoid any connection with air. The measurements of Boron concentration water were carried out by using ICP/OES method [16].

Inductively coupled plasma/optical emission spectrometry (ICP/OES) is a powerful tool for the determination of metals in a variety of different sample matrices. With this technique, liquid samples are injected into a radiofrequency (RF)-induced argon plasma using one of a variety of nebulizers or sample introduction

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