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Estimation Lead & iron with changes in normal values of elements in Roadways Soil of Samarra City

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Abstract

So far there are no investigation or any study on the soil contamination or measuring the Pollutants levels in soil of Samarra city, the present work is part of project to estimate the heavy metals in the soil and other contamination elements. Soil pollution, in short, is a much bigger and more complicated problem than it might appear. The soil texture varied from Clay Silts to Sandy Silts trending to Gypsy nature because of high calcium Sulphate levels with high levels of calcium carbonate. The risk in this study was the high levels of Lead concentration in all soil samples collected from Samarra City. The highest lead concentration register 1220,4 ppm while the control was just 380,4 ppm. Levels of Calcium Carbonate also registered high concentration. By talking about Calcium Sulphate there is a high levels recorded because the Soil type of Samarra is Gypsum. The Total Iron is very High 2460 ppm opposite low concentration of Bioavailability Fe (62 ppm) for Plant uptake.

Keywords: Estimation, Soil of Samarra, Roadways Soil, Lead, Iron

Introduction

Soil contamination can be defined as the alteration of any substance in the soil such as chemical compound or ions or even natural soil environment. The pollutant could be liquid or solid[1]. different kind of materials gathering to increase the pollution. Plastic, Steel, Electronics equipment, Oil, Chemicals compounds and other things. This would take long time to biodegrade. But the radioactive waste are more clearly illustrate the problem of waste disposal.[2]. Urbanization is one of the biggest reasons that cause land pollution and for long time in the future. Some major accidents or maybe the natural disaster could be enough to cause land pollution.⁽³⁾. Once the soil contaminated the contaminants may end up in water, bind to the

soil, or evaporate into air. Properties of soil affected by the last use of land, present activities, the distance of pollutant sources. The Bioavailability of a contaminants can cause direct effects on plants or animals and definitely the human. This biologically available of contaminants may held by soil particles tightly and how much of it dissolves in water (Solubility). More solubility means more bioavailability of contaminants in soil. This also means more likely to leach the contaminants out of soil. The longer time contaminants remain in soil can became less bioavailability. The soil characteristics also affect the fate of contaminants and if they can be taken by plants or animals. Soil texture and it's acidity, temperature, the organic matter amount, levels of moisture and presence of other chemicals may affect the contaminants behavior [4]. Soil contaminants have significant deleterious consequences to ecosystems. The results could be loosing of some primary food chain organisms. Despite of the lower life forms affected by the chemical metals, the lower pyramid levels of food chain may ingest alien chemicals; which become normally more concentrated [5]. By talking about the Calcium Carbonate most of this minerals found in wide range of soil types. Practical methods analysis can estimate properties of soil which needed to manage the land problems.[6]. If we mention another mineral that would be Sulphur (Sulphate); it's the major plant nutrient, at the same time Sulphate is essential for the growth of crops. Solubility of Calcium Sulphate is at 25C with neutral pH which allow convert anhydrite into dihydrate; CaSO_4 is the least soluble ion with no health effect [7]. In addition irrigation water with poor quality may increase salinity of soil. Salinity became a problem when sodium adsorption ratio accumulate in soil which affect negatively the growth of plants [8]. The iron content varies from fractions to several mg/kg and its concentrate and distribute depend on the soil type. Until the late 1970s; Lead compounds were used in gasoline, a soil could affected by roadways and traffic especially Lead. Polyaromatic hydrocarbons (PAHs) also can be at higher levels in the areas that has traffic as compared to other areas. PAHs can also came from accidental or intentional fires or burning yard wastes [9]. Lead bioavailability in particular medium expressed either in absolute terms (Absolute Bioavailability, ABA) or in relative terms (Relative Bioavailability, RBA). Lead estimates that relative bioavailability in soil compared to water and food is about 60% according to U.S Environmental Protection Agency (U.S EPA) [10]. We can say that the ABA of lead is 0.50 (50%) if there was 100 μg dissolved into drinking water and 50 μg were absorbed into the body. Likewise, ABA of lead for soil would be 0.30 (30%) if a 30 μg were absorbed from 100 μg of lead contained in soil. So if the lead dissolved in water was used as the frame of reference for describing the relative amount of lead absorbed from soil, the RBA of Lead would be 0.30/0.50 (60%) [10].

The USEPA defined the Lead contaminated soil if it contain more than 400 ppm lead in play areas, and greater than 1200 ppm lead in non-play areas[11].

Material and Methods

Sample collection

Samples were collected from six crossroads and one control sample. The first crossroads called (Mready) which it's a big mart on the corner selling Vegetables and Fruits Randomly. The Second Crossroads called (Saha Al-Jos) which it's a work place selling black sand, stones, cement, and other staff for constructions work. The third corner was called (Al-Salman crossroads) which have a gas station in the corner selling Cooking gas used in houses, Kerosene, Gasoline. The fourth place was called (Al-astasharyh Hospital Crossroads) which hospital take the corner. By moving forward to the north the fifth crossroad called (Al-razaq Masjid crossroad) which (Al-razaq Masjid, Fire Center, Bakery, and Samarra Park) taking the four corners. The last crossroad was (Elwah) which is the biggest mart of fruit and vegetables in the city, and other markets around selling the weeds and agricultural materials.

Methods

- 1- Soil Texture was determined by using the ASTM 152h Soil Hydrometer [10].
- 2- pH measured by using McLean method [11].
- 3- Humidity were estimated by the method of Hesse. [12] .
- 4- Electrical Conductivity determined depending on Richards method [13].
- 5- Organic Matter evaluated according to Walkley method. [14]
- 6- Calcium Carbonate evaluated using Drouineau method [15]
- 7- Calcium Sulphate (Sulphur) were estimated depending on Richards method. [16]
- 8- Iron was measured by using DTPA method developed by Lindsay and Norvell (1978) [16] .
- 9- Lead was determined using EPA method 3050B Acid Digestion for Sediments, Sludges and Soils section 7.5. [17]

The collected data were coded and entered into Microsoft excel in order to analyzed by simple descriptive statistics such as (Sum, Means and Standard deviation) and correlation analysis by using the statistical package SPSS version 23 computer software.

Statistical Analysis

The collected data were coded and entered into Microsoft excel in order to analyzed by simple descriptive statistics such as (Sum, Means and Standard deviation) and correlation analysis by using the statistical package SPSS version 23 computer software.

Results and Discussion

Table 1 : Soil Texture

Location\Type	Sand	Silts	Clay
Al-Salman	26	44	30
Saha Al-Jos	42	19	39
Mready	21	49	30
Al-Astasharyh	30	38	32
Al-Razaq	28	32	40
Elwah	33	32	35
Control	32	30	38

This table shows the Soil texture of the samples which are almost gipsy and clay gipsy soils but one (Saha al-Jos) which it's type is sandy clay because there a lot of black sand were always used for constructions. These types are commonly found in Iraq were part of CWANA countries.

Table 2 : Soil Values (Humidity, pH, Organic, EC, CaCo₃, CaSo₄)

Location\ Analyst	Humidity %	pH	CHO %	EC dS\m	CaCo ₃ %	CaSo ₄ ppm
Al-Salman	34,8	8,4	30,6	9,48	29,8	13,1
Saha Al-Jos	46	6,4	16,5	7,92	22,6	16,5
Mready	43,4	8,2	28,4	7,54	31,5	13,3
Al-Astasharyh	18	7,9	20,3	6,41	34,5	16,4
Al-Razaq	36,3	7,2	23,6	5,68	29,1	11,5
Elwah	48	7,6	29,5	8,20	31,2	14,2
Control	58,4	8,6	28,2	3,31	30,5	14,8

This table shows many values of soil such Humidity; which the ability of the soil's to retain water depends on some factors including particle size distribution, organic matter content, mineral colloidal nature and soil granulation arrangement. Humidity were recorded high levels which in most soils but the Hospital crossroads which was low. The humidity shows significant differences in all samples at level 0.05. The power of hydrogen (pH) which shows a statistical significance at level 0.05 in all samples except Al-Salman gas station compared to control. The importance of pH in its effect on nutrient availability in soil, susceptibility of soil elements, natural decay of plant root cells, the exchange capacity of cations such clay or humus as well as biological activity. ⁽¹⁸⁾. By talking about the Organic Matter in the soil that formed by the remains of roots, plant materials and microorganisms in various stages of degradation or formation. The agricultural soils in temperate areas contain 3 – 4 % organic matter, while generally soils of semi-arid areas such as CWANA less than 1% of organic matter. ⁽¹⁹⁾. The Electrical Conductivity can be normal to all crops when it's between 0 and 2 ds/m; when this value increased 2 – 4 ds/m it may affect the growth of plants. But when it goes higher than 4 ds/m only the tolerance plant to salinity can grow in this soil. ⁽²⁰⁾. Carbonate were deposited by lake environment can also originate within organic matters resulting from living organisms. There is relation between pH and carbonate; pH measurement approximately 7,5 to 8,5 indicates the presence of Sodium Carbonate. ⁽²¹⁾. Calcium Sulphate (Gypsum – Containing Soils are common in CWANA countries including Iraq. Gypsum is one of the main problems in irrigated areas that it is the least soluble among the family of Sulphate. ⁽²²⁾. Yet this Ion has no adverse effect on health; as several studies failed to find any association between exposure to high levels and diarrhea or other health issue. ⁽²³⁾.

Table 3 : Fe & Pb Concentrations

Location\Type	Total Fe (ppm)	Bioavailable Fe (ppm)	Lead (ppm)
Al-Salman	1980	62	1220,4
Saha Al-Jos	1170	78	840,5
Mready	2460	84	700,3
Al-Astasharyh	2120	92	670,2
Al-Razaq	1360	67	860,5
Elwah	1220	78	900,8
Control	1680	87	380,4

Table 3 shows the results of total (Fe) were very high compared to bioavailable Fe⁺² ; its main part is the form Fe⁺³ as phosphoprotein, while Fe⁺² considered to be active metabolically. Iron affects various processes which reflected in slowing down the growth of plant and reducing yields. The symptoms of iron toxicity are not specific and differs depending on type, stage and plant development. ⁽²⁴⁾. Usually Iron in soil associated with primary minerals such clay, oxides and hydroxides. The solubility is very low due to soluble iron controlled by amorphous Fe(OH)₃. The Fe⁺³ ions predominate at the expense of Fe⁺² ions depending on soil acidity. ⁽²⁵⁾. The Lead results support the trend that this soils contained a concentrations levels of lead higher than EPA standards of 400 ppm for the opened areas. The excess lead is deposited on the surface of soil specially the main roads resulting from vehicle exhausts and thrash burns. In addition lead tetra ethylate (C₂H₅)₄ Pb added to gasoline to improving combustion activity. ⁽²⁶⁾. The another reason is the addition amount of ethylene chlorite and ethylene bromide to convert Lead in the course of combustion to the favorable material Lead Bromide; which evaporated with car exhausts to air and then resides on soil. After raining the leaching soil take the lead inside the soil. ⁽²⁷⁾.

Conclusions

Finally, and as a result ,the data obtained from this research showed that although total Fe was adequate , labile Fe- a plant available fraction – was insufficient, due to the specify of Fe chemistry in soils. Most results have yet to be duplicated. Also possible contamination sources to plant uptake studies have yet to be resolved. In addition the high concentrate of lead may cause health criteria to plant, animals and Humans.

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