Ecology & Conservation Science: Open Access
ISSN: 2689-4637

Research Article
Volume 3 Issue 1 - September 2023
DOI: 10.19080/ECOA.2023.03.555605

Ecol Conserv Sci

Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya)

Wesam FA Mohamed[1], Hamad M Adess Hasan[2]*, Amany T Sroor[3], Nadia Walley EL-Dine[3], Samia M EL-Bahi[3] and Jemila Mussa Ali[4]

[1]*Faculty of Education, Omar Al- Mukhtar University, Libya*

[2]*Chemistry department, College of science Omar AL-Mukhtar University, Libya*

[3]*Faculty of Women for Arts, Science and Education, Physics Department, Ain Shams University, Libya*

[4]*Physics department, College of science Omar AL-mukhtar University, Libya*

Submission: August 22, 2023; **Published:** September 06, 2023

***Corresponding author:** Hamad M Adess Hasan, Chemistry department, College of science Omar AL-Mukhtar University, Libya. Email id: hamad.dr@omu.edu.ly

Abstract

This study was carried out on forty one samples collected from different locations at Gandula region (Libya). The samples included (soil, rock, plant and water samples) afferent elements were selected in this study including (Na, Ca, K, Cu, Fe, Zn, Mn and Pb). The obtained results showed high levels of Na and Ca in water samples with average concentration of (154.08 and 84.4 ppm), respectively, and the high average concentrations of potassium was recorded in the plant samples (10.83 ppm). On the other side the high concentrations of Cu was recorded in rock samples with average (1.03 ppm). The results also recorded that the high concentrations of iron (Fe) and manganese (Mn) were recorded in soil samples (65.76 and 2.97 ppm), whereas the average values of, Zn and Pb were (1.36 and 0.97 ppm), respectively, in water samples. Levels of heavy metal were lower than the reference doses recommended by USEPA (U.S. Environmental Protection Agency) and JECFA (Joint FAO/WHO Expert Committee on Food Additives).

Keywords: Anthropogenic; Natural Constituents; Gandula region; Fluctuated; Ferromagnesian

Abbreviations: USEPA: U.S. Environmental Protection Agency; JECFA: Joint FAO/WHO Expert Committee on Food Additives; WHO: World Health Organization

Introduction

Heavy metals are produced from a variety of natural and anthropogenic sources, they are indeed an intrinsic natural constituents of our environment [1]. Heavy metals pollution may be produce from direct atmospheric deposition, geologic weathering or through the discharge of agricultural, or industrial waste products [2]. Several anthropogenic ones also contribute to metal concentrations in the environment and industrial beside the mechanical activities which raise natural concentrations causing serious environmental problems [3]. The major concern with the uptake plants of these contaminants from soil and presence in plant produce consumed by humans [4]. This aimed to estimate the level of heavy metals of some samples collected form Gandula region-Libya (Figure 1).

Material and Method

The samples were collected from different locations at Gandula region-Libya. The samples (soils, rocks and plants) were dried in oven at 70 Co for 2 h. The samples grinded and sieved by using a 200 mm mesh sieve, then transferred to 250 ml beaker .A 0.5 g of each samples were taken then in 50 mL Pyrex glass beakers, concentrated sulfuric acid were added in to each of the samples about 5 mL. The beakers containing each of the samples were placed on the heater for about 3h [5]. For the water samples, 5 mL of concentrated hydrogen peroxide was added to get rid of carbon. We moved the beaker from heater, then after cooling filtered by filter paper with added 100 mL water and placed to be measured [6]. The samples will be analysis by using flam

photometer and atomic absorption to measure major elements and heavy metals respectively at central lab of faculty of science of Omer El-Mukthar University, El-Baida, Libya. Flame photometers designed for the determination of sodium (Na) and potassium (K) and calcium (Ca). Atomic absorption (AAS) using to measure (Cu, Fe, Zn, Mn and Pb) [7].

Results and Discussion

The obtained results of sodium (Na), calcium (Ca), and potassium (K) in the studied samples (soil, rock, plant and water) were shown in (Table 1). The results recorded that the concentrations of Na in soil samples were ranged between (2.16-5.95 ppm), while the concentration of Ca were ranged between (0.18-11.38 ppm) and the concentrations of K were ranged between (0.56-1.32 ppm). On the other side concentrations of sodium in the rock samples were ranged between (2.7–3.78 ppm), while the concentrations of calcium were fluctuated in the range of (3.67-5.32 ppm), whereas the potassium concentrations were ranged between (0.22-0.78 ppm), as shown in (Table 1). Also, the results showed that the concentrations of sodium, calcium and potassium in plant samples were ranged as following: (4.33–16.22 ppm), (0.92–9.35) ppm and (4.52–10.83 ppm), respectively, as shown in (Table 1). Meanwhile, the concentrations of the above elements (sodium, calcium and potassium) in water samples were fluctuated in the ranges of (96.48- 354.28 ppm), (56-190 ppm) and (0.15-0.33 ppm) respectively, as shown in (Table 1). The variations of the contents of the studied elements are mainly attributed due to geological composition for the studied area which may be content ores as calcite or dolomite or/and others. In generally the levels are low comparing with permissible limit, The result recorded the highest concentrations of sodium (Na) and calcium (Ca) in water samples comparing to soil, rock, and plant samples, but the concentrations of potassium (K) in plant samples is higher than other samples (soil, rock and plant) [8] as shown in Figures 2-4.

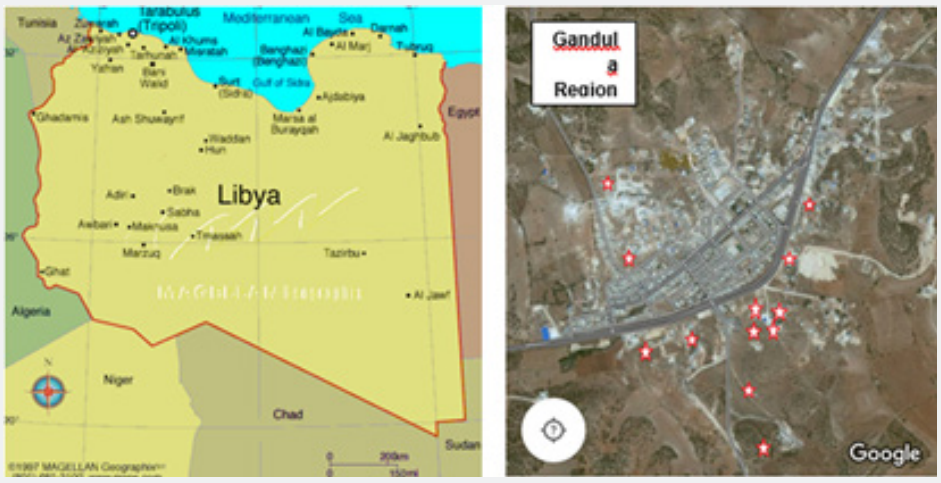

Figure 1: The study area.

The results of heavy metals showed that the concentrations were fluctuated in the following ranges: (0.17- 0.84 ppm), (18.77-99.27 ppm), (0.65- 2.7 ppm), (2.02- 3.66 ppm), and (0.31–0.83 ppm). For the metals of (copper, iron zinc, manganese and lead), respectively. The concentrations of the studied metals in rock samples were ranged as following : (0.73-1.88 ppm), (5.61-11.79 ppm), (0.67-1.97 ppm), (1.07-1.60 ppm), and (0.51-0.96 ppm) for (copper, iron, zinc, manganese and lead), respectively, as sowed in (Table 2). While the concentrations of (Cu, Fe, Zn, Mn and Pb) the plant samples were fluctuated as following : (0.68-0.95) ppm, (1.08-5.41 ppm), (0.70-0.91 ppm), (1.21-2.55 ppm) and (0.55-0.75 ppm), respectively. As shown in (Table 2). On the other side, for water samples the concentrations of the studied heavy metals (Cu, Fe, Zn, Mn and Pb) were ranged as following: (0.62-1.4 ppm), (1.24-5.56 ppm), (0.89-3.07 ppm), (0.48-3.59 ppm) and (0.01-0.10 ppm), respectively. As shown in (Table 2). And the results showed that the average concentrations of studied heavy metals are low comparing with the global composition reveals (Figures 5-7). Most heavy metals are toxic and their accumulation over time in bodies can cause several diseases. Prolonged exposure to heavy metals can lead to physical, neurological and muscular degenerative processes that may lead to Alzheimer's disease and muscular dystrophy [9].

The average concentrations of copper and lead in rock samples are 1.36 ppm and 0.774 ppm higher than average concentrations of other samples composition (soil, plant and water), the highest average concentrations of iron and manganese are 65.761 ppm and 2.975 ppm for all studied samples in soil samples, and

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

there is no indicating a natural case of metal pollution. While high concentrations of zinc presented 1.36 ppm in the water samples. The heavy metal concentrations of Cu, Fe, Zn, Mn and Pb, which consider to be a good indicators for no heavy metals be pollution caused by human activities, are characterized by lower concentrations than the WHO (World Health Organization) [10] have reported soil pollution by ultrabasic rocks, resulting in low concentrations of the previously mentioned elements (Cu, Fe, Zn, Mn and Pb) due to the weathering and dispersion of the parent materials, which these metals are predominant. The average concentrations of soil higher than composition values of Pb, Zn, and Cu in the studied soils can be ascribed to the ferromagnesian minerals of the rocks. In respect to the published mean metal values (Figure 8-9). The soils samples present is higher Fe values than all studied samples, but this is mainly attributed to the mineralization that occurs on the weathered surface of the serpentinites and peridotites, which are considered the parent rocks of the mineralization [11].

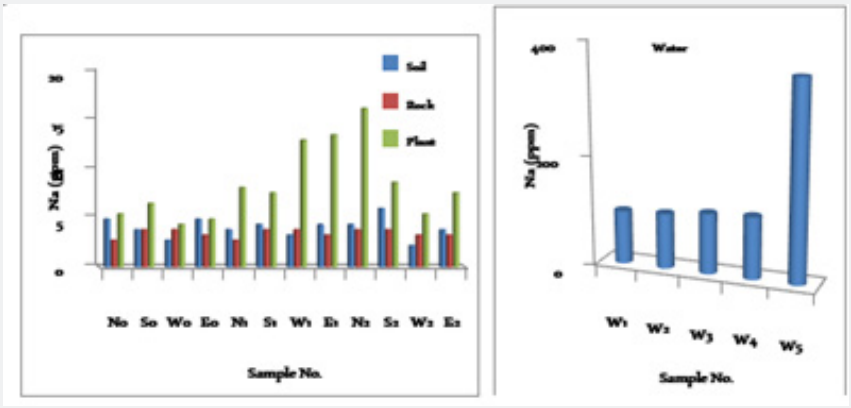

Figure 2: The concentrations of Na (ppm) of the studied samples.

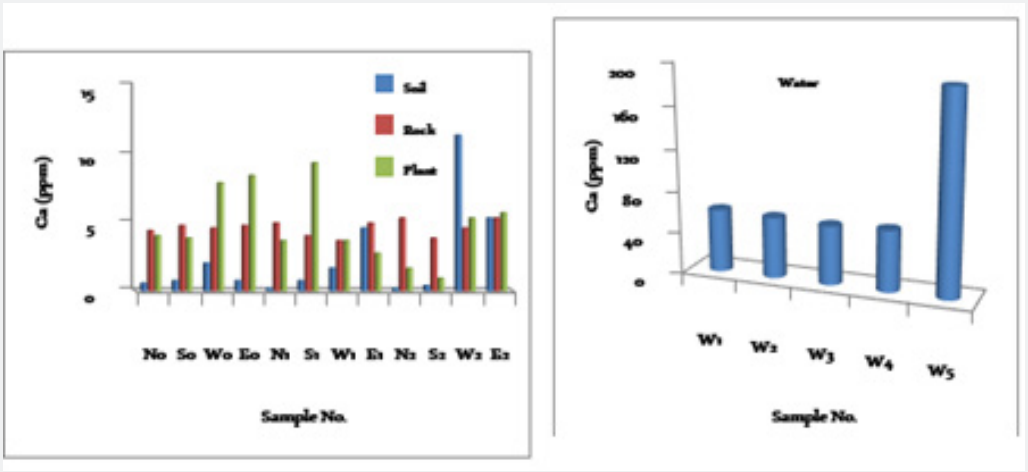

Figure 3: The concentrations of Ca (ppm) of the studied samples.

Conclusion

The aim of study evaluate the levels of heavy metal concentrations for environmental samples in Gandula region-Libya. the contents of the studied major elements in the all samples recorded the high value of Na and Ca in water samples, and high average concentrations of potassium was recorded in the plant samples. On the other side the high concentrations of Cu was recorded in rock samples. The results also recorded that the high concentrations of iron (Fe) and manganese (Mn) were recorded in soil samples, where the values of Zn was estimated in water samples, and the high concentrations of Pb were in plant samples. This study would help to reduce the risk to human health that originates from highway pollution. But, further extensive sampling is necessary to include similar study areas, and further research concerning contamination of environmental.

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

Table 1: The Concentrations of Na, Ca and K (ppm) of all samples.

Type of Sample	Samples	Na	Ca	K
Soil	SN0	4.87	0.55	0.57
	SS0	3.78	0.73	1
	SW0	2.7	2.02	0.96
	SE0	4.87	0.73	1.14
	SN1	3.78	0.18*	0.56*
	SS1	4.33	0.73	1.06
	SW1	3.24	1.65	1.24
	SE1	4.33	4.59	0.96
	SN2	4.32	0.18*	0.94
	SS2	5.95**	0.37	1.32**
	SW2	2.16*	11.38**	0.93
	SE2	3.78	5.32	0.66
	Average	4.01	2.37	9.45
Rock	RN0	2.70*	4.4	0.78**
	RS0	3.78**	4.77	0.65
	RW0	3.78**	4.59	0.48
	RE0	3.24	4.77	0.48
	RN1	2.70*	4.95	0.57
	RS1	3.78**	4.04	0.78
	RW1	3.78**	3.67*	0.65
	RE1	3.24	4.95	0.39
	RN2	3.78**	5.32	0.36
	RS2	3.78**	3.85	0.39
	RW2	3.24	4.59	0.61
	RE2	3.24	5.32**	0.22*
	Average	3.42	4.6	0.63
Plant	PN0	5.41	4.04	4.52*
	PS0	6.488	3.85	7.09
	PW0	4.33*	7.89	10.83**
	PE0	4.87	8.44	5.35
	PN1	8.11	3.67	6.7
	PS1	7.57	9.36**	5.57
	PW1	12.97	3.67	10.57
	PE1	13.51	2.75	10.57
	PN2	16.22**	1.65	10.57
	PS2	8.65	0.92*	10.35
	PW2	5.47	5.32	9.78
	PE2	7.57	5.69	10.04
	Average	8.42	4.77	10.83

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

Water	W1	96.49*	60	0.23
	W2	99.5	58	0.24
	W3	108.55	56*	0.29
	W4	111.56	58	0.33**
	W5	354.28**	190**	0.15*
	Average	154.08	84.4	0.05
*Lowest Value				**Highest Value

Table 2: The concentrations of copper (Cu), iron (Fe), zinc (Zn), manganese (Mn) and lead (Pb) of all samples (ppm).

Type of Sample	Samples	Cu	Fe	Zn	Mn	Pb
Soil	SN0	0.17*	65.23	2.41	3.05	0.31*
	SS0	0.2	77.88	2.3	2.75	0.52
	SW0	0.76	68.04	1.75	3.1	0.59
	SE0	0.84**	62.46	2.70**	3.66**	0.74
	SN1	0.18	84.77	0.74	3.38	0.45
	SS1	0.19	65.44	0.7	2.19	0.41
	SW1	0.84	58.6	0.76	3.57	0.65
	SE1	0.79	65.56	0.79	3.36	0.79
	SN2	0.29	83.12	0.71	3.05	0.41
	SS2	0.61	99.27**	0.78	2.97	0.47
	SW2	0.74	18.77*	0.65*	2.02*	0.71
	SE2	0.76	39.99	0.73	2.6	0.83**
	Average	0.53	65.76	1.25	2.97	0.57
Rock	RN0	1	7.16	0.7	1.26	0.79
	RS0	1.12	7.44	0.79	1.2	0.87
	RW0	1.04	7.63	0.72	1.19	0.78
	RE0	1.09	6.95	0.88	1.19	0.73
	RN1	1.08	7.17	0.71	1.22	0.78
	RS1	0.86	7.71	0.67*	1.24	0.87
	RW1	0.81	6.71	0.68	1.15	0.8
	RE1	0.87	9.63	0.67	1.60**	0.67
	RN2	1.88**	11.79**	1.97**	1.58	0.96**
	RS2	1	5.93	0.68	1.14	0.75
	RW2	0.73*	8	0.68	1.07*	0.78
	RE2	0.9	5.61*	0.68	1.26	0.51*
	Average	1.03	7.64	0.82	1.26	0.77
Plant	PN0	0.76	50.16	0.85	2.44	0.68
	PS0	0.82	55.41**	0.87	2.55**	0.6
	PW0	0.78	20.3	0.83	2.43	0.75**
	PE0	0.75	42.89	0.84	2.38	0.63
	PN1	0.68*	11.92	0.70*	1.5	0.68
	PS1	0.75	26.49	0.82	2.02	0.62
	PW1	0.95**	16.29	0.87	1.56	0.72
	PE1	0.73	6.02	0.83	1.35	0.67

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

	PN2	0.73	1.08*	0.75	1.21*	0.74
	PS2	0.82	46.69	0.91**	2.41	0.66
	PW2	0.78	53.34	0.89	2.42	0.56
	PE2	0.74	22.64	0.85	1.72	0.55*
	Average	0.771	29.43	0.83	2	0.65
Water	W1	0.62*	1.24*	0.95	0.48*	0.04
	W2	0.85	1.41	0.89*	0.72	0.10**
	W3	0.91	1.74	0.94	0.76	0.3
	W4	1.05	1.98	0.95	0.87	0.06
	W5	1.40**	5.56**	3.07**	3.59**	0.01*
	Average	0.97	2.39	1.36	1.28	0.12
*Lowest Value						**Highest Value

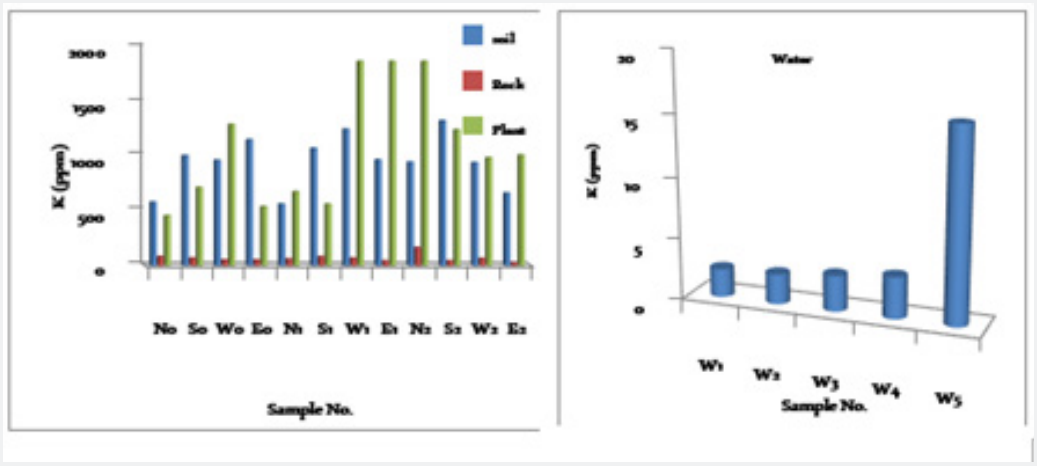

Figure 4: The concentrations of K (ppm) of the studied samples.

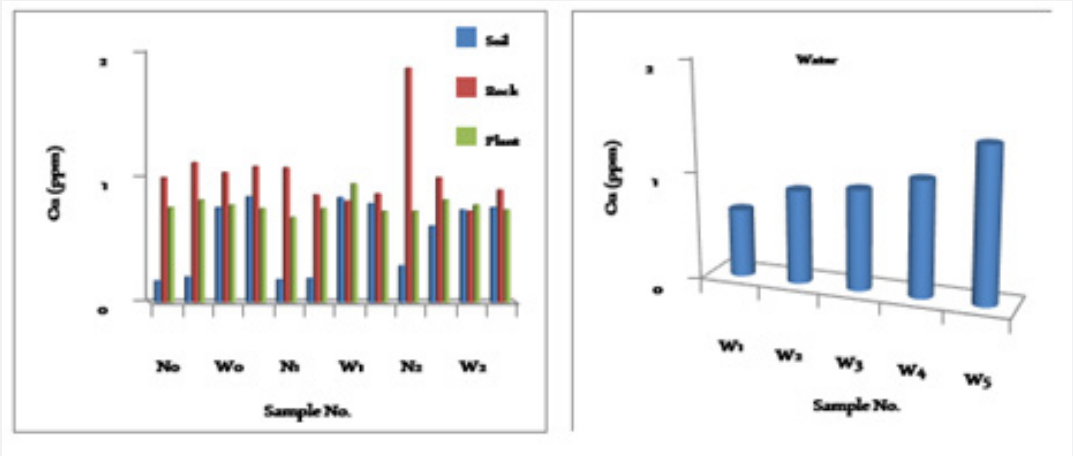

Figure 5: The concentrations of Cu (ppm) of the studied samples.

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

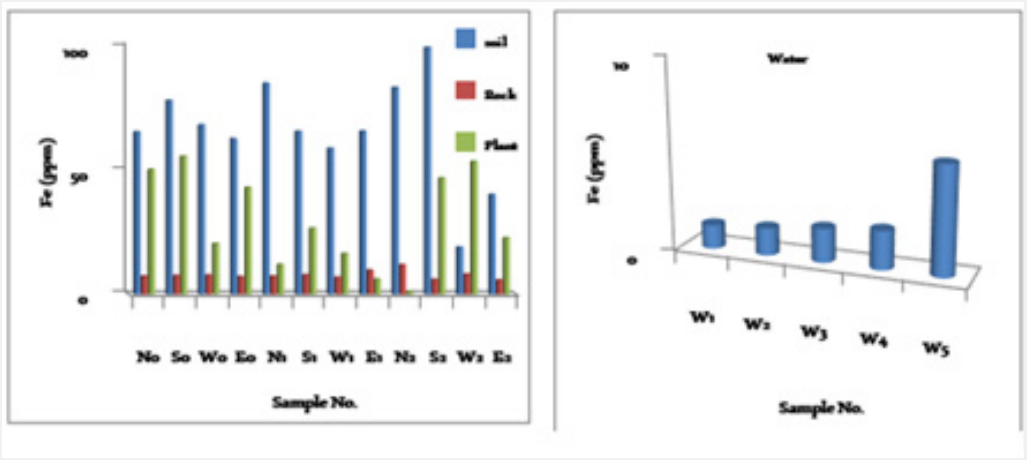

Figure 6: The concentrations of Fe (ppm) of the studied samples.

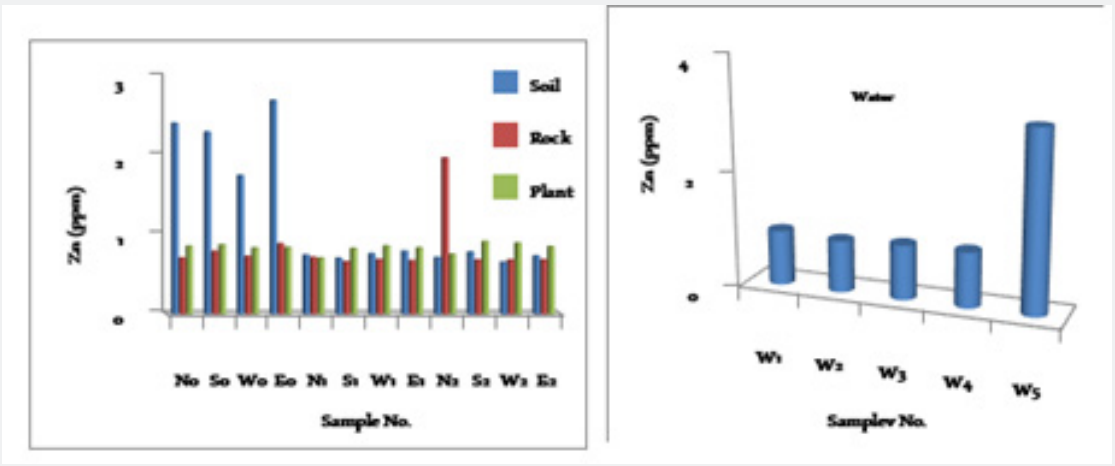

Figure 7: The concentrations of Zn (ppm) of the studied samples.

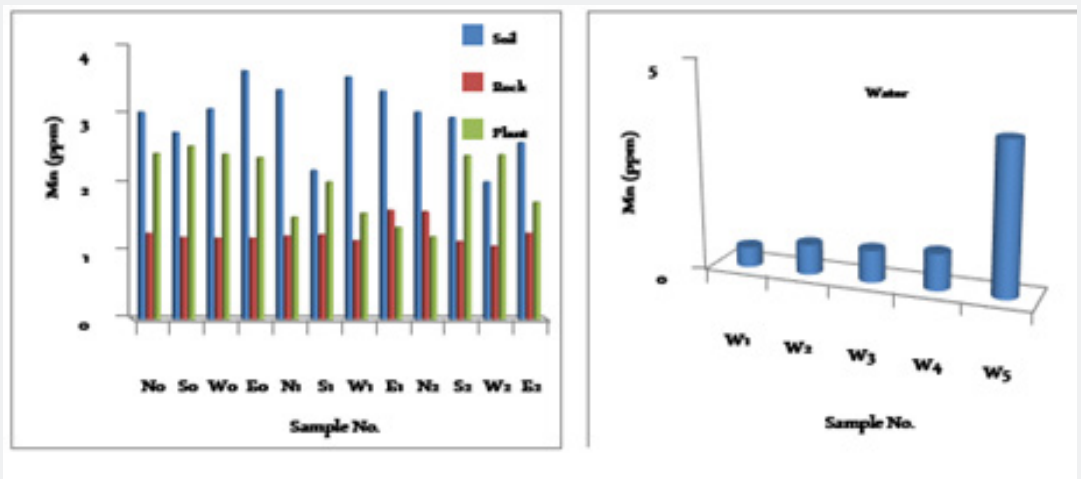

Figure 8: The concentrations of Mn (ppm) of the studied samples.

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605

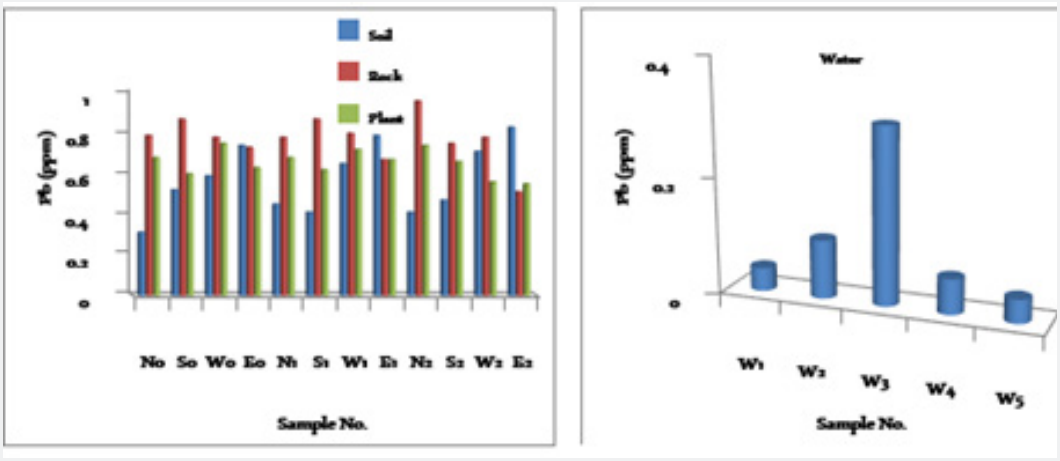

Figure 9: The concentrations of Pb (ppm) of the studied samples.

References

1. Dawson EJ, Macklin MG (1998) Speciation of heavy metals in floodplain and flood sediments: a reconnaissance survey of the Aire Valley, Wet Yorlshire, Great Britain. Environ Geochem Health 20: 67-76.
2. Namminga HN, Wilhm J (1976) Effects of high discharge and oil refinery cleanup operation on heavy metals in water and sediments in skeleton Creek. Proceedings of the Oklahoma Academy of Science 56: 133-138.
3. Camusso M, Vigano L, Baitstrini R (1995) Bioaccumulation of trace metals in rainbow trout. Ecotox Environ Safe 31: 133-141.
4. Bakidere S, Yaman M (2008) Determination of Lead, Cadmium and Copper in Road-Side Soil and Plants in Elazig Turkey. Environ Monit Assess 136: 401-410.
5. Udo EJ, Ogunwale AJ, (1987) Laboratory Manual for the Analysis of the Soils, Plant and Water Samples. Department of Agronomy, University of Ibadan: Ibadan, Nigeria p: 70-76.
6. Kakulu SE, Jacob JO (2006) Comparison of digestion methods for Trace metal Determination in moss samples. Proceeding of the 1st National Conference.
7. García R, Báez AP (2012) Atomic Absorption Spectrometry (AAS), Atomic Absorption Spectroscopy.
8. Pasławski P, Migaszewski ZM (2006) The Quality of Element Determinations in Plant. Polish J Environ Stud 15(2a): 154-164.
9. Baldwin RD, Marshall WJ (1999) Heavy metal poisoning and its laboratory investigation. Ann Clin Biochem 36: 267-300.
10. Skordas K, Kelepertsis A (2005) Soil contamination by toxic metals in the cultivated region of Agia, Thessaly, Greece. Identification of sources of contamination. Environmental Geology 48: 615-624.
11. Vardaki C, Kelepertsis A (1999) Environmental impact of heavy metals (Fe, Ni, Cr, Co) in soils, waters and plants of Triada in Euboea from ultrabasic rocks and nickeliferous mineralization. Environ Geochem Health 21: 211-226.

DOI: 10.19080/ECOA.2023.03.555605

How to cite this article: Wesam FA Mohamed, Hamad M Adess Hasan, Amany T Sroor, Nadia Walley EL-Dine, Samia M EL-B, et al. Estimation The Heavy Metal Contents of (Soil, Rock, Plant and Water) Samples Collected from Gandula Region (Libya). Ecol Conserv Sci. 2023; 3(1): 555605. DOI: 10.19080/ECOA.2023.03.555605