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Measuring the percentage of pollution with heavy metals (nickel, chromium, and lead) in the marine soil at Sabratha Beach

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Abstract : *The results of concentration of nickel (Ni) in the three sites was within the limits allowed by the WHO, and noticed that the soil samples Does not contain Chrome (Cr)in the three studied sites while Lead (Pb) concentration are higher in soil more depth and exceeded the limits allowed.*

The presence of sources of pollution in the area of Sabratha- Libya that proceed from the steam plant for desalination of water, waste water, waste of cars, chemical waste, generators and some small factories, exposure of beaches to pollution and therefore, affect human health, this research was done to measure the pollution of some heavy metals in certain area of the coastal area of lebeda- alkhoms , The study area was divided into three sites and samples were taken with equal distances and three different depths for each region. These samples were analyzed to measure the concentration of Ni, Cr, Pb, elements.

The concentration of heavy metals in the surface soil was less than the concentration in the other depths of all the samples, and the concentration of the metals in the first site (at the wave) was less than in the third site (far from the wave).

Keywords: *heavy metals-Alkhoms-soil-pollution-chemical waste, nickel (Ni), Chrome (Cr), Lead (Pb) , WHO.*

1. INTRODUCTION:

The presence of heavy elements in the environment is dangerous to humans and animals, as the organism needs a certain percentage of these elements, and their concentration exceeding the permissible limits, whether in soil, air, or water, exposes the organism to danger.

Among the human activities that increase the concentration of heavy elements in the environment through activities such as mining, which represents the extraction and extraction of metals from the earth, as well as industry, which represents the manufacture of various products, such as batteries, electronics, and chemical products, and agriculture, which represents the use of fertilizers and pesticides. Waste burning involves the release of heavy metals into the air, which can later be deposited in water and soil.

A study he conducted to measure the concentrations of the elements barium, cobalt, chromium, strontium, and zinc in soil and water near a power plant in northern Greece. The results showed that most of the concentrations were within the permissible limits. In one of the industrial sites in Yugoslavia, contamination was detected in large quantities of the elements lead, strontium, zinc, copper, and cadmium. (7)

There is a study to detect rare elements such as manganese, iron, strontium, and thorium in soil near an airstrip in Africa. The samples were analyzed using an X-ray spectrometer, and the results showed that the soil contains a high percentage of manganese (13).

The accumulation of concentrations of some heavy elements was determined for (229) soil samples on the highway of the Tibetan Plateau. The results showed that there are factors that affect the accumulation of concentrations of copper, zinc, cadmium, and lead. These factors include traffic movement, distance on both sides of the road, and elevation. However, the concentrations of the elements along Road segments within permissible limits (10)

The concentrations of germanium and rare earth elements in surface soil and plants grown in different types of lands were investigated in Freiberg (Germany), where 46- soil samples were collected, and it was found that the total concentrations of germanium ranged between (1 -4.3 mg/g). (5)

There is research to measure lead contamination in the soil in the city of Baghdad, where the results showed that the concentration of lead present in the soil is higher than the natural value of lead, which indicates the presence of pollution in the area due to fertilizers, pesticides, car exhausts, various human activities, and industrial causes. (1)

Another work was completed to evaluate the heavy elements in a portion of the Diyala River water, soil, and agricultural plants. He took 36 samples from each of the soil, plants, and water, and analyzed the samples to measure the concentrations of some heavy elements, such as cadmium, lead, zinc, chromium, manganese, and copper. The results showed that the concentrations of most elements in the surface layer Higher than other layers, as well as the concentration of nickel and lead, exceeding World Health Organization limits due to the movement of these elements through the soil layers (2).

There is a study to measure the concentrations of copper, mercury, zinc, and lead in soil and groundwater in Portugal, conducted by (12)

The obtained values were compared with international values for levels of heavy metals in soil and water. It was found that the highest levels of heavy metals were near the industrial area and sewage outlets, and the concentrations of these elements decreased the farther away from these areas.

Pollutants can exist in different forms in soil. The toxicity of these chemicals depends on the form in which they are found in the environment. There are environmental characteristics, such as climate, that may change the balance in the soil due to the leaching of heavy elements into the soil particles (6).

2. Practical experiments :

Samples, materials and detection methods

Sandy soil samples were collected from the beach of the Sabratha area, Figure (1). This beach is the most crowded in this city and close to the archaeological area. This research was conducted during the period 2023-2024, where the study area was divided into (3) sites at equal and perpendicular distances to the seashore, so that each site has a repeat at a distance of (1) meter from it. The first horizontally after the tide of the second wave, 100 meters from the first location in the middle of the beach). The third was 100 meters from the second location (the end of the beach).

Figure (1) Map showing the study area in the Sabratha beach region - Libya

Soil samples were collected from each site at three depths (0-10) cm, (10-30) cm, and (30-50) cm using a shovel. The samples were placed in nylon bags with data written on them according to the study conducted by (3).
Chemical analyzes were conducted on soil samples as follows:
1- After bringing them from the site, the soil samples were air-dried at laboratory temperature with continuous stirring from time to time for a period of twelve (12) days to get rid of moisture and obtain a dry weight.

2- Each sample was passed through a sieve with a hole capacity of 2 mm.
3- The samples were mixed homogeneously.
4- The samples were stored in plastic containers and nylon bags with the data written on them.
5- The samples were processed before being transported to the laboratory, by weighing 0.25 grams of soil, adding 4 ml of nitric acid and 1 ml of perchloric acid and heating it to 110 degrees Celsius for 2-3 hours, then raising the temperature to 185 degrees Celsius until the solution dries. .
6- Leave the remaining solution to cool, then add 2 ml of 5 mm hydrochloric acid, then heat to 70 degrees Celsius for an hour.
7- Cool the mixture, add 8 milliliters of distilled deionized water, leave for 5 hours, then filter and supplement the filtrate to 50 milliliters with distilled water (2).
8- The samples were transferred to the laboratory to determine the concentrations of nickel, chromium, and lead in the studied area (one sample for each element) using an atomic absorption spectroscopy atomic device.

Figure 2: Spectroscopy Atomic Absorption

3. Results and Discussion:

Table (1) shows the results of the average concentrations of nickel in soil samples in three locations and at different depths: the first location: (1.20.6.4) mg/kg, the second location: 13.21.1.2 mg/kg), and in the third location: (2.0 2.4 4.8 mg/kg) respectively. Table (2) showed that the average concentration of nickel in the three locations: (3.12.11.4 mg/kg) respectively, which is within the permissible limits in the World Health Organization (50) mg (kg) [482] as in Figure (2) As for the element lead, the results as shown in Table (281) showed that its presence in the soil in the three sites and at different depths was 11887 (the first site: 118,693,455.4 mg/kg) and the second site 75.0 mg/kg) and in the third site: (90.8121.498.4 mg/kg), as it was noted from the results that the concentration of lead was high, especially in the deeper soil (30-50 cm), exceeding the permissible limits (100 mg/kg). The average concentration in the three sites studied is: (103.5.96.90.89.1 mg). /kg) respectively, Figure (3) as lead is used in the manufacture of automobile gasoline, where it is added as an organic compound to increase the octane number of gasoline [166]. Also, house dust, food and drink are contaminated with lead and may exceed air pollution [1511]. Also, the source of lead pollution can be Chemical waste comes from human activities, which can be from hospitals, factories, and sewage, as lead dust particles that are more than 5 microns in size are heavy, and most of them are deposited on the ground. Therefore, the soil receives its share of lead pollution (7)

It is noted that the concentration of nickel and lead in general in the surface soil (0-10 cm) is lower than at other depths, as well as the farther away from the shore. (Third site) The rate of concentrations of nickel and lead increases due to the occurrence of leaching of these elements, and thus their transfer occurs through the layers of the earth. The results, as in Table (281), showed that the soil does not contain the element chromium, but within the limits permitted by the World Health Organization.

Table (1) shows the concentrations of nickel, chromium, and lead in the locations of the studied area at different depths in mg/kg.

Soil	Depth	Nickel	Chrome	Lead
Location I	0-10 cm.	2.4	nil	55.4
	10-30 cm.	0.6	nil	93.4
	30-50 cm.	1.2	nil	118.6
	average	1.4	nil	89.1
Location II	0-10 cm.	1.2	nil	75.0
	10-30 cm.	1.8	nil	97.0
	30-50 cm.	3.2	nil	118.8
	average	2.1	nil	96.90
Location III	0-10 cm.	2.0	nil	90.8
	10-30 cm.	2.4	nil	98.4
	30-50 cm.	4.8	nil	121.4
	average	3.1	nil	103.50
WHO		**50**	**100**	**100**

Table (2) shows the concentration rates of nickel, chromium, and lead in the three studied sites in mg/kg

Depth elements	Ni	Cr	Pb
1	1.4	nil	89.1
2	2.1	nil	96.9
3	3.1	nil	103.5

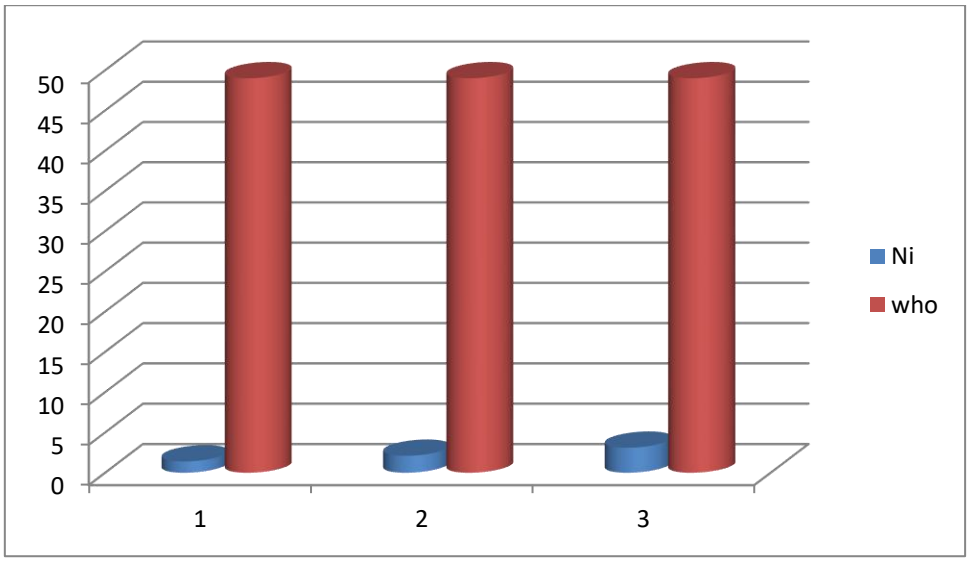

Figure (3) shows the concentrations of nickel in the three studied sites (mg/kg)

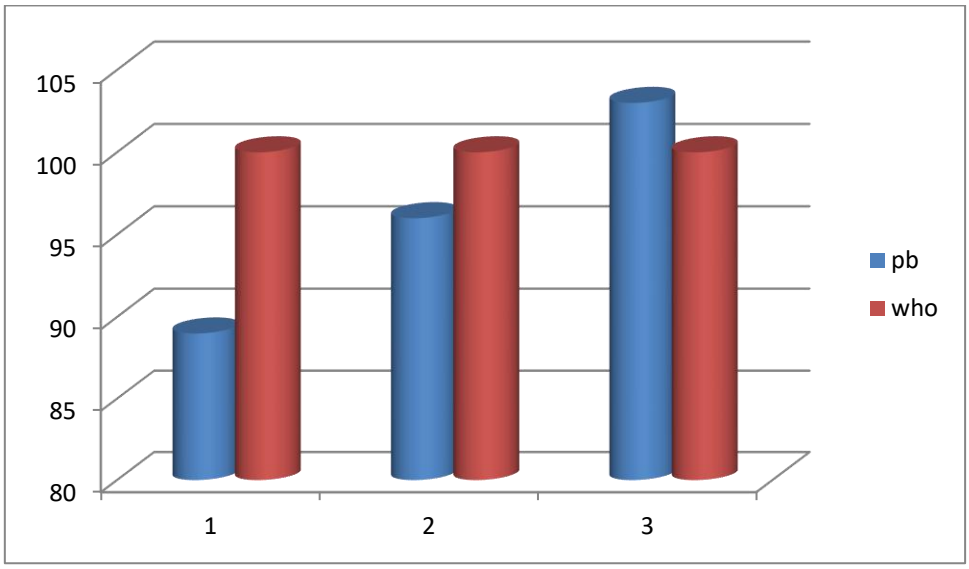

Figure (4) shows the concentrations of lead in the three studied sites (mg/kg)

4. Recommendations :

1- Conduct a continuation of this research with appreciation
2- Reducing environmental pollution, especially soil, by using devices to monitor the fumes rising from the neighboring Mellitah complex and finding solutions for wastewater, by reusing it for other purposes instead of dumping it on the beaches.

3- Expanding the process of conducting a study of the concentrations of other elements in the soil. To know the extent of pollution with heavy metals to find appropriate solutions.

4- Raising awareness of the dangers of pollution with these elements in general and lead in particular, and explaining to them its effects on the health of living organisms, preventing children from playing and tampering with soil contaminated with these elements, and maintaining the cleanliness of the beaches.

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