Determination Some heavy metals in plants (Lepidiumruderale L., AnethumgraveolensL., Apiumgraveolns L.) that were irrigated with groundwater in Basrah Governorate, Al-Zubair District, southern Iraq

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Abstract

This field study was conducted at the University of Basra, Marine Sciences Center, Department of Chemistry and Pollution of the Marine Environment for the year 2020 with the aim of studying the impact of environmental pollution in six sites in Al-Zubair district, Basra Governorate, in the concentrations of heavy metals (nickel Ni- cadmium Cdand leadPb) accumulated in the plant (*Lepidiumruderale L.* and Dill*Anethumgraveolens L.* and celery*Apiumgraveolns L.),*) cultivated in the fields of those sites, in which groundwater was used in the irrigation process, as these agricultural fields depend on groundwater in agriculture. The results of the field study showed that the plants planted in the different sites contained heavy metals in different concentrations and their highest levels were in nickel.(1.83-1.55-1.26) ppm in *Lepidiumruderale L., Anethumgraveolens L. and Apiumgraveolns L.,* respectively, all at site F1. For cadmium it has exceeded the level permitted by the World Health Organization (0.1) ppm,Its highest levels were (2.94-2.89 - 2.80) ppm in *Lepidiumruderale L., Anethumgraveolens L. and Apiumgraveolns* L. at sites F5-F1-F6, respectively. Lead has reached its highest levelppm (7.07 - 6.45 -6.40) in cress plant *Lepidiumruderale L.and Anethumgraveolens L. and celery Apiumgraveolns L* at sites F6-F5-F5, respectively.

Keywords: heavy metals, environmental pollution, agricultural crops, Zubair
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Introduction

Pollution is defined as the undesirable effects that occur in the physical, chemical and biological characteristics of the components of the environment (air - water - soil) that affect the food chain, including plants that in turn affect human health directly or indirectly. Everything that pollutes air and water pollutes the soil Because air and water fill the voids of the soil and permeate its grainsAlso, soil contamination with toxic chemicals may occur as a result of inappropriate agricultural operations, the use of polluted irrigation water, the addition of liquid and solid waste, as well as air pollutants (Zeid, 2001).The elements are heavy, especially since most of the projects were designed without taking into account the conditionsEnvironment)(Hantoush,2004). Most plants in the environment have an important characteristic, which is their ability to store heavy elements in their roots and the ability to control the transfer of parts of the elements to leaves and fruits. Dill is an herb that is also grown in BasrahIt blooms in the spring and is a perennial herb and is eaten as cooked or soft vegetables, and it is a medicinal herb. As for celery, it is grown in Basra in the spring and summer, and it is a biennial herb, which is a medicinal herb and is eaten as a table vegetable

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(Al-Mayah*et al*, 2016) .And due to the lack of available information about the safety of these herbs and the extent to which they contain heavy metals (nickel Ni– leadPb– cadmium Cd) that lead to major problems as cadmium leads to Pyelonephrisist, Oesteomolica and that cadmium is a toxic element that has no function in plants and animals, and when it accumulates causes high pressure Blood and kidney disease, which is difficult to remove with excretion and leads to direct damage to nerve cells. (Shumacher*et al*,1991) .It is represented by lead, which leads to tumors in renal cancer, anemia and joint paralysis (Grath and Smith ,1990). As for nickel, the body needs a small amount of it, and most of it is present in the pancreas and plays an important role in the production of insulin. Its deficiency leads to an imbalance in the liver and causes its accumulation to skin sensitivity, and it is known that it causes cancer and affects the body. Lung and sinus, (Nath ,1986).

Aim of the study

The study aimed to determine the concentrations of some heavy metals in the herbal plants (Rashid - dill - celery) planted in those fields and irrigated with groundwater, which are put on the market for human consumption and to reveal the dangers of environmental pollution due to the proximity of these agricultural fields to facilities, oil fields, plaster plants, the public road, and exhaust waste. Cars, transportation and household waste and their impact on those crops.

materials and methods

study area

The study samples were taken from six sites in Al-Zubayr district within Basra governorate in an organized random manner, where samples were taken from two sites F1 - F2, which are fields close to the oil refinery within 3 km, and samples were taken from two sites F3-F4, which are fields close to the center of Al-Zubair district Residential waste and samples were taken from the two sites F5-F6, which are close to the oil fields and wells in the southern Rumaila and the highway linking Basra and ThiQar, as well as vehicle exhaust and tire friction.

Sample collection

In order to identify the effect of environmental pollution in the six study sites (F1-F2-F3-F4-F5-F6) on the plant (*Lepidiumruderale L.*,*Anethumgraveolens L*. and *Apiumgraveolns L*.) and compare that with the permissible levels and international standards in terms of Plant toxicity and human health, and for the purpose of finding the relationship between environmental pollution and study sites and levels of heavy metals in these plants grown in those agricultural fields, these plants were taken from all study sites, as 54 samples were taken, including no less than 3 samples from each plant, in the same way that It is harvested for the purpose of marketing for human consumption and the heavy element (nickel -lead and cadmium) was estimated.Figure (1-2-3) shows cress, *Lepidiumruderale L*,, *Anethumgraveolens L*. and *Apiumgraveolns L*. respectively.

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Figure No. (1) shows the cress *Lepidiumruderale L.* plant used in the study.

Figure No. (2) shows the Dill*Anethumgraveolens L.* plant used in the study.

Figure No. (3) shows the celery*ApiumgraveolnsL*.plant used in the study.

Determination of heavy metal concentrations (nickelNi - lead Pb and cadmiumCd).

The weight of the dry matter of plants obtained from the field study was found and after drying (70) C^{o} in an electric oven for (24) hours, 0.5 g of each sample was taken after grinding and digested by wet digestion using sulfuric acid and hydrogen peroxide. The heavy metal elements were estimated (Cadmium - nickel - lead) in the acidic extract of these different plant parts by atomic absorption device according to the method mentioned (Chapman and Partt, 1961).

statistical analysis

The experiments were designed and statistically analyzed using the Completely Randomized .(Design (C.R.D.) in the global trials (Al-Sahoki and Muhammad ,1990

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(Al-Rawi,1979) and the comparison between the significant differences in transaction rates was done using Duncan's' New Multiple test as mentioned in
(Steyn *et al*, 1996) .

Results and discussion

The effects of environmental pollution of the study sites on the levels of nickel (Ni)of the plants (Cress, dill, celery) grown there.

It is noted from the results of Table (1) that the levels of nickel were superior in each of the cress plant in the F1 site and reached (1.83) ppm and in dill in the F1 site it reached (1.55) ppm, while the levels of nickel in celery at the F1 site also outperformed, reaching (1.44). ppmWe compared it with the cress, dill and celery plants planted in other sites, respectively, and the reason for this may be due to the differences in the environmental pollution of these sites with the element nickel due to the increase of waste to the soil.The addition of residues rich in toxic and heavy metals, including nickel, led to an increase in the content of soil and plants for these metals. It was noted that the cress, dill and celery were the highest levels in each of them at site F1, which is closer to the oil facility in Zubair.Since these cultivated fields depend on groundwater for irrigation, and this facility dumps the wastes close to these fields and pollute the groundwater in them, it may be a reason for its rise in this site and this is consistent with (Younus,2017).Usually, the nickel content in plants is 0.1-5 ppm of dry matter, and that high concentrations have toxic effects. It was found that toxicity levels ranged between (10-100) ppm (Alloway and Jackson,1991),and when we compared nickel levels in cress, dill and celery with the mentioned toxicity levels, we find that Its levels are within normal limits.

Table No. (1) The effects of environmental pollution for the study sites on the levels of nickel (ppm) in the cress, dill and celery plants grown in them for the year 2020.

Plant	Field sites					
	F1	**F2**	**F3**	**F4**	**F5**	**F6**
Lepidium	1.83 ^{g}	0.22 ^{b}	0.36 ^{c}	0.66 ^{d}	1.23 ^{f}	0.75 ^{e}
Anethum	1.55 $_{e}$	0.52 ^{b}	0.73 ^{c}	1.26 ^{g}	0.69 ^{c}	0.45 ^{a}
Apium	1.44 ^{d}	0.51 ^{a}	0.63 ^{b}	1.10 ^{f}	0.88 ^{e}	0.68 ^{c}

* Averages with similar letters in the horizontal bars do not differ significantly at the 5% probability level according to Duncan's polynomial test.

The effects of the environmental pollution of the study sites on the cadmium (Cd)levels of the plants (Cress, dill and celery) grown there.

It was found from Table No. (2) that the levels of cadmium were superior in each of the dill plant in the location F1 and it reached (2.89) ppm and in the celery plant in the location F6 it reached (2.80) ppm and in the cress plant in the location F5 it was(2.49) ppmCompared with cress plants, dill and celery in other sites, respectively. These differences in cadmium levels may be attributed to the difference in the sources of environmental pollution for these sites, as the F1 site is affected by pollutants emitted from the oil refinery and the open waste without treatment, the F6 site and the F5 site.

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With the remnants of the Rumaila fields and the main road between Basrah and Thi-Qar, and drilling and injection works for oil wells located near those agricultural fields that affect the groundwater used to irrigate those fields (Al-Yasiri ,2019), Therefore, the relationship between cadmium levels in the studied plants was related to the sites from which they were taken, and this relationship shows the extent to which the environment of the studied sites is polluted with cadmium, especially the soil as a medium for the growth of plants.These results are consistent with the findings of (Alloway and Jackson.1991;Al-Ali,19996),that the soil content of cadmium is high, the content of plant parts of this element is also high, and that cadmium is one of the unnecessary elements for plants, but it deserves attention and study because it accumulates in plant tissues in large quantities that lead to toxicity in humans through eating crops and vegetables in quantities that may be dangerous to his health(Chaney,1991) and it has been found (Kabata-Pendias and Pendias,1994) that plant toxicity occurs when their tissues contain cadmium in limits ranging from (5-30) ppmWhen comparing the levels of cadmium from the plants of this study with the levels mentioned above, we find that they did not reach the phytotoxicity limits. Comparing the plants in Table (2) with the permissible limits specified in 1992 by the World Health Organization (WHO)(Petterson and Harris,1995) which amounted to (0.1)ppm of dry matter weightIt reaches us that it exceeded the permissible level in all the studied sites. Perhaps the reason for this is due to the increase in environmental pollution in these sites with cadmium, because they are close to the source of pollution. These results are consistent with the findings of (Alegria*et al*,1991) that factories, public roads and chemical and organic fertilizers are The source of cadmium pollution as well as atmospheric deposits in industrial areas (Al-Nuaimi,1984) .

Table No. (2) The effects of environmental pollution of the study sites on cadmium levels (ppm) in the cress, dill and celery plants grown in them for the year 2020.

Plant	Field sites					
	F1	**F2**	**F3**	**F4**	**F5**	**F6**
Lepidium	1.15a	1.65b	2.11d	1.72c	2.49f	2.45e
Anethum	2.89g	1.38a	2.37e	2.55f	2.25d	1.85c
Apium	2.03b	1.40a	1.44a	2.26d	2.16c	2.80e

* Averages with similar letters in the horizontal bars do not differ significantly at the 5% probability level according to Duncan's polynomial test.

The effects of the environmental pollution of the study sites on the Lead(Pb) levels of the plants (Cress, dill and celery) grown there.

The content of plants from lead is not related to its content in the soil, in contrast to the case of other heavy metals (nickel - cadmium), and the reason for this may be attributed to the increase in the plant's content of lead to the aerobic sedimentation of this element and the result of traffic congestion more than the soil factor and what is added to it From waste containing heavy metals, including lead(Abdel-Sabour, and Aly,2000).We note from the results of Table (3) that the levels of lead were superior in each of the dill plants in the site F5 and reached (7.07) ppm, while the levels of lead in the cress plant in the site F5 exceeded them if they reached (6.45)ppm and in the celery plant the level of lead was the highest value. At site F6, it was (6.40) ppmCompared with the plants of each of the cress, dill and celery,

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respectively, in the other sites. The reason for this may be due to the proximity of the fields in which these plants were planted to the transportation areas and the various motorways, it was found(Braun, and Fluckiger, 1988). that lead pollution can extend to hundreds of meters from the main roads. also pointed out (Abdel-Sabour and Aly,2000)(Abdel-Sabour*et al*,1998),Pollution with lead depends on several factors, including the distance from the external road, the nature of plant surfaces, the duration of pollution, traffic intensity and wind direction. As for the toxicity of plants with lead, each of (Petterson, and Harris,1995) concluded that plant toxicity occurs at lead levels between (30-300) ppm.When comparing the levels of lead in the plants mentioned in Table (3) with its specific and aforementioned toxic levels, we find that the levels of lead in all plants did not reach the toxicity limits because they are less than (30)ppm. It was found from the above that the levels of heavy metals (nickel, cadmium and lead)They differed according to the sites where they are cultivated and their sources of pollution. The levels of heavy metals in the studied plants can be arranged in descending order:nickel< cadmium <lead. The plants planted in sites F1 and F2 were affected by the fallout of oil refineries and oil facility residues in the Shuaiba area of ZubairAnd the various heavy metals it contains. As for the plants planted in the two sites (F3 and F4), they were affected by the remnants of residential areas, sewage waste, and the used groundwater irrigation. These results are consistent with the findings of the researcher.(Chaney,1991) . While the plants planted in sites F5 and F6 were affected by the fallout of the residues of the Rumaila oil fields, oil wells, and the highway linking Basrah and Thi-Qar.And what is emitted from car exhaust due to the continuous passage of cars and tankers and their proximity to the study sites, as well as the addition of fertilizers that play an important role in the accumulation of heavy metals in plant tissues. These are consistent with the study(Abdel-Sabour,1998) of adding plant organic fertilizers to sandy soils led to an increase of nickel, cadmium and lead in plants.

Table No. (3) The effects of the environmental pollution of the study sites on the levels of lead (ppm) in the cress, dill and celery plants grown in them for the year 2020.

Plant	Field sites					
	F1	**F2**	**F3**	**F4**	**F5**	**F6**
Lepidium	3.49b	3.08a	4.18c	6.10e	6.45f	6.12d
Anethum	3.82a	4.05b	4.13c	5.11f	7.07g	6.17e
Apium	3.82c	4.03b	4.10e	4.82b	6.39f	6.40a

* Averages with similar letters in the horizontal bars do not differ significantly at the 5% probability level according to Duncan's polynomial test.

Conclusions

The plants grown in the different sites under study, which were irrigated with groundwater, most of them contained heavy metals, nickel, cadmium and lead in different concentrations. The concentrations exceeded the permissible levels according to the World Health Organization, especially in the site in the southern Rumaila and the highway linking Basra and ThiQar.

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