

***Helianthus annuus L.***

(2012 / 4/ 30                      2012/ 3 /13                      )

*Helianthus*

*annuus L.*

/ (800 ,600 ,400)

/ ( 9 , 6 , 3 )

/ (3)

/ (3)

**Effect of Soil Pollution with Different Cadmium and Lead Concentrations on Carbohydrates, Proteins and some Nutrient Metals in Sunflower (*Helianthus annuus* L.) Plants**

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**ABSTRACT**

This study aimed to investigate the effects of different cadmium and lead concentrations on the carbohydrates, proteins and the nutrient metals concentration in the leaves, stem and root tissues of sunflower *Helianthus annuus* L. plants under wire house conditions. Results showed that soil treated with cadmium (3, 6, 9 mg / kg) and lead (400, 600, 800 mg / kg) resulted in a significant decrease in carbohydrate and protein concentrations in all plant tissues studied with exception of the non significant decrease in the protein concentration in the stem that treated with Cd (3 mg/kg) as compared with the control. A significant decrease in calcium, magnesium and potassium in different plant tissues accompanied with non significant decrease in magnesium concentration in the leaf and stem with Cd (3 mg /kg) treated soil were observed in comparison with the same element concentration in the leaf and stem of the control plants.

**Keywords:** Heavy metal, Proteins, Carbohydrates, Nutrition metals, Sunflower.

.(Andon *et al.*, 2005)

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.(Singh *et al.*, 2011)

.(Majewska *et al.*, 2011)

.(Watanabe *et al.*, 2000)

.(John *et al.*, 2009)

(2)  
 ( Black and Hartge, 1986) (1)  
 (Richard, 1954) (EC)  
 Flame photometer (pH)  
 (Black, 1965)  
 (Jackson, 1958)

:1

		1
3,700	(%)	2
1820	/ (EC)	3
7,800	(pH)	4
( / )		
70	Na <sup>+</sup>	5
119	K <sup>+</sup>	
130	Mg <sup>+2</sup>	
265	Ca <sup>+2</sup>	
80	Cl <sup>-</sup>	
0.0430	Cd <sup>+2</sup>	
0.0160	Pb <sup>+2</sup>	

.....

(100)

:

- =

100 × = (100)

(Cd,Pb)

(4) (20) (23)

:

(9,6,3) (CdSO<sub>4</sub>·8H<sub>2</sub>O) .1 /

(800,600,400) (PbSO<sub>4</sub>) .2 /

*Helianthus annuus* L.

/ (15) 2010/2/1 . Compositae

(10)

(100)

(5)

48

70

<sup>3</sup> (10)

(Herbert *et al.*, 1971)

(Hettich EBA35)

(488)

(Schacterale and

(Lowry *et al.*, 1951)

Pollak, 1973)

(650)

(0.5)

Mg<sup>2+</sup>

Ca<sup>+2</sup>

(Chapman and Partt, 1961)

.(Richard, 1954 )

(Flam Photometer)

K<sup>+</sup>

) ( 1979 , )

Completely Randomized Design (C.R.D)

(1990

.(Duncan's New Multiple Range Test)

.....

(2)

( )

/ (800) (9)

Protochlorophyllide

$\delta$ - aminolevulinic acid dehydratase (ALA-dehydratase)  
reductase

( Andon *et al.*, 2005)

(John *et al.*, 2009)

b a

.(Singh *et al.*, 2011) .

.(Heidari and Sarani, 2011)

(2)

:2

( / )

	/ Pb			/ Cd			
	800	600	400	9	6	3	
	( / )						
1.680 a	1.687f	1.702e	1.748c	1.483j	1.487j	1.800b	1.856a
1.512 b	1.270n	1.540i	1.660g	1.381L	1.444j	1.564h	1.728d
1.286 c	1.200o	1.297n	1.343m	1.048p	1.326m	1.361L	1.428k
	1.494 b			1.433 c			1.670 a

(%5)

(3)

( )

/ (800)

.(Ducic and Polle, 2005)

(Khodaverdiloo *et al.*, 2011)



(Singh *et al.*, 2011)

(John *et al.*, 2009)

lipid Peroxidation protease

(Mihailovc, 2011)

(Khodaverdilloo *et al.*, 2011)

(3)

( / )

:3

	/ Pb			/ Cd			
	800	600	400	9	6	3	
	( / )						
0.857 a	0.739e	0.844d	0.903c	0.563h	0.893d	1.022b	1.036a
0.552b	0.210o	0.238n	0.323L	0.423i	0.655g	0.696f	0.697f
0.428c	0.280m	0.346k	0.407j	0.398k	0.448i	0.548h	0.441i
	0.546 c			0.558 b			0.725 a

(%5)

(4)

/ (800)

/ (9)

Vassilev (2003)

.(Hare and Cress, 1997)

(Sheldon and Menzies, 2004)

.(Kopittke and Menzies, 2006)

(Sepehr *et al.*, 2003)

. (Kopittke and Menzies, 2006)

.( 2000 )

(4)

.....

( / )

:4

	/ Pb			/ Cd			
	800	600	400	9	6	3	
	( / )						
1.329a	1.04e	1.20d	1.46b	1.20d	1.26d	1.50b	1.64a
0.931c	0.78g	0.80g	1.00e	0.80g	0.84g	1.00e	1.30c
1.012b	0.98f	1.00e	1.04e	0.84g	1.00e	1.03e	1.20d
	1.033c			1.052b			1.380a

(%5)

(5)

/ (800)

(9)

.(Maruthi-Sridhar *et al.*, 2005)

(Mihailovc, 2011)

.(Kasim, 2005)

(5)

( / )

:5

	/ Pb			/ Cd			
	800	600	400	9	6	3	
	( / )						
0.42a	0.24f	0.31e	0.44d	0.30e	0.46c	0.59a	0.60a
0.095c	0.03k	0.05j	0.12h	0.04j	0.07i	0.17g	0.19g
0.221b	0.06j	0.12h	0.22f	0.09i	0.13h	0.42d	0.51b
	0.176c			0.252b			0.433a

(%5)

(6)

/ (800 , 600)

.....

(Andon *et al.*, 2005)

. (Heidari and Sarani, 2011)

(6)

( / )

:6

	/ Pb			/ Cd			
	800	600	400	9	6	3	
	( / )						
3.46a	2.46i	3.28e	3.96b	3.16f	3.60d	3.76c	4.00a
2.65c	2.08k	2.40j	2.80g	2.52i	2.72h	2.80g	3.20f
2.81b	2.45i	2.58k	2.90g	2.60h	2.80g	2.96g	3.38e
	2.991b			2.768c			3.527a

(%5)

"

".(1979)

" (1990)

( ) " (2000)

- Andon, V. ; Malgozata, B. ; Nevena, S. ; Zlatko, Z. (2005). Chronic Cd toxicity of bean plants can be partially reduced by supply of ammonium sulphate. *J. Cent. Euro. Agri.* **6**(3), 397-404.
- Black, C. A. (1965). "Methods of Soil Analysis". Part 2. Amer. Soc. Agron. Inc. U.S.A.
- Black, G.R. ; Hartge, C. (1986). Bulk density in Methods of soil structure and migration of colloidal materials in soil. *Soil Sci. Soc. Am. Proc.*, **26**, 297-300.
- Chapman, H.D. ; Partt, P.F.(1961) . "Methods of Analysis for Soil ". Plant and Water. University of Calif. Div. Agric. Sci.
- Ducic, T. ; Polle, A. (2005). Transport and detoxification of manganese and copper in plant. *Braz. J. Plant Physiol.* **17**(1), 103-112.
- Hare, P. D. ; Cress, W.A. (1997). Metabolic implication of stress-induced proline accumulation in plants. *Plant Growth Regul.*, **21**, 79-102.
- Heidari, M. ; Sarani, S. (2011). Effect of lead and cadmium on seed germination, seedling growth and antioxidant enzymes activities of mustard (*Sinapis arvensis* L.). *ARPN. J. Agric. and Biolo. Sci.*, **6** (1), 44-47.
- Herbert, D.; Philips, P.J. ; Strange, R.E. (1971). "In Methods in Microbiology". Norries, J.R. and Robbins, D.W.(eds.) Acad. press, London and New York. 5B. Chap.3.
- Jackson, M. L. (1958). "Soil Chemical Analysis". (ed.). Prentice Hall. Inc.
- John, R. A. ; P. Gadgih, S. ; Sharma, S. (2009). Heavy metal toxicity: effect on plant growth, biochemical parameters and metal accumulation by *Brassica juncea* L. International. *J. Plant Produ.* **3**(3).
- Kasim, W.A. (2005). The correlation between physiological and structural alterations induced by copper and cadmium stress in Broad Beans (*Vicia faba* L.). *Egyp. J. Bio.* **7**, 20- 32.
- Khodaverdillo, H.; Ghorbani Dashtaki, Sh. ; Rezapour, S. (2011). Lead and cadmium accumulation potential and toxicity threshold determined for land cress (*Barbarea verna*) and Spinach (*Spinacia oleracea* L.), *Inter. J. Plant Prod.* **5**(3).
- Kopittke, P.M. ; Menzies, N. M. (2006). Effect of Cu toxicity on growth of Cowpea (*Vigna unguiculata*). *J. Plant Soil.* **279**, 287-296.
- Lowry, O. H.; Rosebrough, N.T.; Farr, A. L.; Randad, R. J. (1951). Protein measurement with folin -phenol reagent. *J. Biol. Chem.* **193**, 257-265.
- Majewska, M.; Kurek, E.; Słomka, A. (2011). Effect of plant growth on total concentrations of zn, pb, and cd, and their distribution between operational fractions in the upper layer of a 100-year-old zinc-lead waste heap. *J. Environ. Stud.* **20**(3), 591-597.

- Maruthi -Sridhar, B. B.; Diehl, S.V.; Han, F.X.; Monts, D. L.; Su, Y. (2005). Anatomical changes due to uptake and accumulation of Zn and Cd in Indian mustard (*Brassica juncea*). *Envi. Expert. J. Bot.* **54**, 131-141.
- Mihailovic, N. (2010). Growth and ion uptake in maize plants exposed to Pb, Cd and Ni depend on  $\text{NO}_3^-/\text{NH}_4^+$  Ratio. *J. Botan. Serbi.* **34**(1), 15-20.
- Richard, I. A. (1954). "Diagnosis and Improvement of Salience and Alkali Soil" . U.S. Dept. Agric. Handbook.
- Schacterale, G.R.; Pollak, R.L. (1973). A simplified methods for the quantitative assay of small amount of protein in biological material. *Anal. Bio. Chem.* **51**, 651-655.
- Sepchr, M.F.; Ghorbanli, M.; Nejad, A. Kh. (2003). Effects of cadmium and salinity on growth, photosynthesis and ionic contents of *Zea mays*. *J. Plant Sci.* **2**(2), 196-201.
- Sheldon, A.; Menzies, N.W. (2004). The effect of copper toxicity on the growth and morphology of Rhodes grass (*Chloris gayana*) in solution culture., *Supr. Soil.* **4**, 1-8.
- Singh, A.; Shekar Kumar, Ch.; Agarwal, A. (2011). Phytotoxicity of cadmium and lead in *Hydrill verticillata* (I.F). *J. Phyt.* **3**(8), 1-4.
- Vassilev, A. (2003). Physiological and agroecological aspects of cadmium interactions with Barley plants: A review, *J. Cent. Euro. Agric.* **4** (1), 65-75.
- Watanabe, T.; Moon, C. S.; Zhang, Z.W.; Shimbo, S.; Nakatsuka, H.; Matsuda-Inoguchi, N.; Higashikawa, K.; Ikeda, M. (2000). Cadmium exposure of women in general populations in Japan during 1991–1997 compared with 1977–1991. *International Archives of Occupational and Environmental Health.* **73**, 26–34.