Advances in Bioresearch
Adv. Biores., Vol 7 (4) July 2016: 194-197
©2016 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
ICV Value 8.21 [2014]

Advances in Bioresearch

ORIGINAL ARTICLE

Study on the Effects of EDTA on the Phytoremediation of Cadmium-Contaminated *Brassica napus* L.

Tayebehalsadat Mirmoeini[a], Leila Pishkar[b]*, Davood Eradatmand Asli[c]
[a]Department of Biology, Islamshahr Branch, Islamic Azad University, Tehran, Iran
[b]Department of Biology, Islamshahr Branch, Islamic Azad University, Tehran, Iran
[c]Department of Agriculture, Payame Noor University , Tehran, Iran
***Corresponding author address:** leilapishkar@gmail.com

ABSTRACT
Heavy metals are considerable soil problem influencing seed germination and plant growth especially in industrial areas. Seed germination plays a pivotal role in the most plant critical stage to abiotic stresses. Brassica napus L plant is negatively influenced by environmental pollution like presence of heavy metals. This report was based on the investigation of the effects of cadmium (Cd) stress at sensitive period of plant life known as seed germination. The effect of Cd stress at the different concentration incubated by different concentration of ethylenediamine-tetraacetic acid (EDTA) as a chelating agent were examined on germination and seedling growth of Brassica napus L plant. The objective was to determine the germination rate and percentage, root length and shoot length. Obtained data revealed that Cd decreased germination rate and percentage, root length and shoot length in Brassica napus L plant, but different trends were observed in in EDTA-incubated plant. In general, EDTA-treated plant provides more level of Cd tolerance in comparison to control one. Overall, it may be deduced that Cd stress caused to reduction in the seed reserves hydrolysis and consequently reduce the germination percentage and seedling growth.
Key words: *Cadmium, EDTA, Germination, Root length, shoot length*

Received 11/01/2016 Accepted 07/07/2016

How to cite this article:
T Mirmoeini, L Pishkar, D Eradatmand Asli. Study on the Effects of EDTA on the Phytoremediation of Cadmium-Contaminated *Brassica napus* L.. Adv. Biores. Vol 7 [4] July 2016: 194-197. DOI: 10.15515/abr.0976-4585.7.4.194197

INTRODUCTION

It has been documented that soil contains almost trace levels of heavy metals. However, overloading consummation of natural and synthetic products accumulated some of heavy metals in certain areas up to normal levels for microorganisms [1, 2]. An excessive concentration of heavy metals can have dangerous impacts on soil fertility, give rise to ecosystem fluctuation and cause a health risk to animals and human beings. Phytoremediation defines the consideration of environmental issues through the application of plants that alleviate the environmental complication without the necessity to excavate the polluted substance and discard of it elsewhere. Phytoremediation is a profitable plant-based way to remediation that concentrates on the capability of plants to accumulate materials from the environment and to metabolize a number of molecules in their tissues. Heavy metals which show toxic capacity are the considerable targets for phytoremediation. Different physiological and molecular aspects of phytoremediation have attracted a great attention in recent years a number of biological and engineering strategies have developed to maximize and enhance phytoremediation. In addition, several field trials affirmed the practicality of plants application for environmental cleanup [3].

The major problem hampering plant remediation effectiveness is that some other metals are motionless in soils and their availability and phytoextraction rate are blocked by corresponding their solubility and diffusion. Chemical improvements were applied to control this issue.

A number of studies reported that chelating agents such as ethylenediamine-tetraacetic acid (EDTA), N-(2-hydroxy-ethyl)-ethylenediaminetriacetic acid (HEDTA) and citric acid (CA) can show the potential of increasing metal mobility, thereby facilitating phytoextraction [4-6]. Various studies showed that EDTA play a pivotal role in deleting heavy metals from polluted soils, although extraction efficiency determined

by many points such as the reactivity of heavy metals in soil, the concentration of EDTA, presence of electrolytes, pH and soil ingredients [7-10].
Much of the previous study on chelate-assisted soil cleaning up and phytoextraction has concentrated on Pb. The aim of the present research was to focus on the capability of EDTA in improving the uptake and phytoextraction of cadmium (Cd) from heavy metal contaminated soils by the application of canola (*Brassica napus* L.) plant designed in laboratory.

MATERIAL AND METHODS

(*Brassica napus* L.) Seeds were used in this report. Seeds were washed with deionized water and suspend in different concentration of EDTA for 24 h, and treated with different concentration of Cd. Petri dish contacting treated seeds incubated in 25°C for 3 weeks and the germination percentage, germination rate, root and shoot length, dry and fresh weight of plant was considered

RESULTS AND DISCUSSION

Germination and seedling growth are considerably most sensitive points in plant life [11]. Acculturation of Cd gives rise to osmotic stress [12] or which result in reduction of seed germination and seedling growth [13, 14]. In this research the germination response of *Brassica napus* L. seeds was significant among different concentration of Cd and EDTA as a chelating agent. The germination percentage and germination rate of *Brassica napus* L. plant was different in varying concentration of Cd and EDTA, so that the highest germination percentage and germination rate were observed in 100µM of EDTA in the absence of Cd heavy metal. On the other hand, Cd caused to more considerable reduction in germination percentage and germination rate when compared to control ones. As shown in Figure 1 and 2 Cd stress gave rise to decrease in germination percentage and germination rate in *Brassica napus* L. plant. It may be attributed that increasing osmotic potential induced by Cd provides inhibiting effects on *Brassica napus* L. plant such as germination and seedling, whereas EDTA in certain concentration can return the germination percentage and germination rate.
Cd stress decreased root and shoot lengths in *Brassica napus* L. plant (Figure 3 and 4). Also it was observed that EDTA treatment led to increase in the root and shoot lengths when the Cd concentration is 100µM. the highest concentration of EDTA (100µM) shows the maximum amount of returning roots shoot lengths. The root and shoot length does not significantly increased in 500µM of Cd. Root and shoot lengths were changed in *Brassica napus* L. plant in a dose dependent manner. Therefore Cd stress at the level of 500µM caused to decrease in root to shoot dry weight ratio and EDTA cannot play a significant role in removing this concentration of Cd, but EDTA (100 µM) increased considerably the root and shoot lengths in an 100µM of Cd concentration. Increasing Cd concentration led to delay in seedling emergence as a result of reducing cell division and plant growth metabolism.

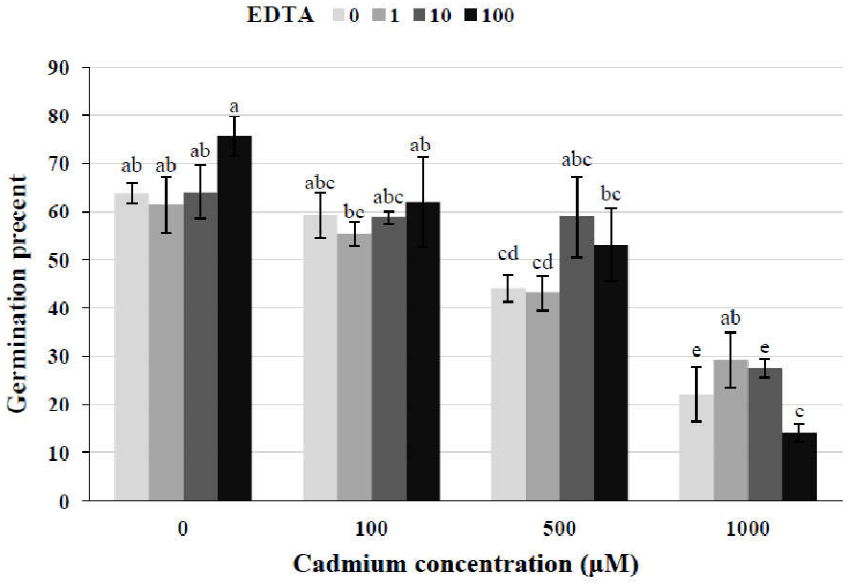

Figure 1. Effect of Cd stress treatments on germination percentage of *Brassica napus* L. plant in the presence of EDTA

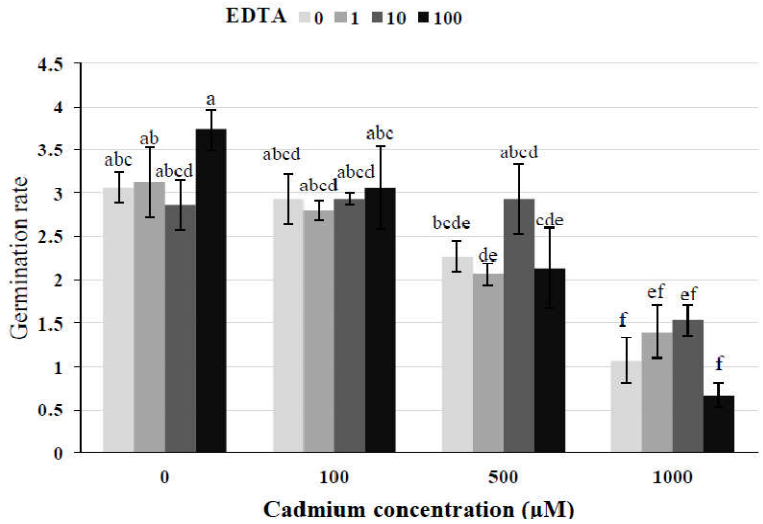

Figure 2. Effect of Cd stress treatments on germination rate of *Brassica napus* L. plant in the presence of EDTA

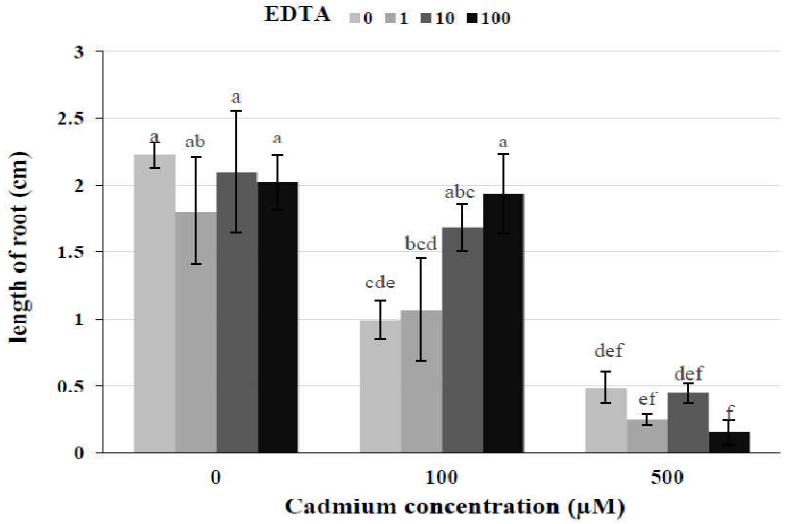

Figure 3. Effect of Cd stress treatments on length of root of *Brassica napus* L. plant in the presence of EDTA

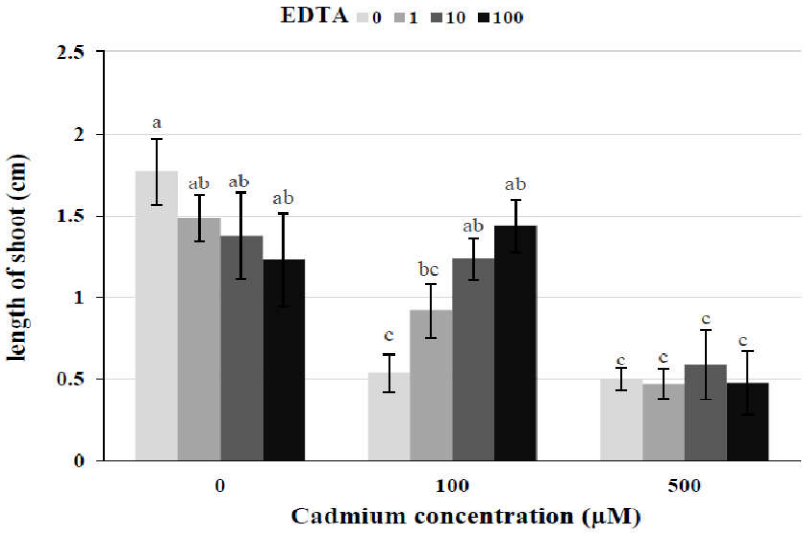

Figure 4. Effect of Cd stress treatments on length of shoot of *Brassica napus* L. plant in the presence of EDTA

CONCLUSION

According obtained data, it may be concluded that Cd stress considerably reduced germination and growth parameters of seedlings of *Brassica napus* L. plant. In general it can be proposed that the effect of Cd on plant growth is a complex issue that involves several mechanisms such as osmotic stress, mineral reduction, physiological and biochemical signaling switching. Cd induces the unique trouble of ion toxicity, because a high concentration of Cd is dangerous for the cells. The toxic effects of Cd can happen at relatively low concentrations, depending on the presence of EDTA as a chelating agent, so the homeostasis of Cd plays a crucial role for the tolerance of organisms.

REFERENCES

1. Chatterjee J., Chatterjee C. (2000): Phytotoxicity of cobalt, chromium and copper in cauliflower. Environ. Pollut., 109: 69–74
2. Kim S.O., Moon S.H., Kim K.W. (2001): Removal of heavy metals from soils using enhanced electro kinetic soil processing. Water Air Soil Pollut., 125: 259–272.
3. Salt DE, Smith RD, Raskin I. (1998). "Phytoremediation". Annu Rev Plant Physiol Plant Mol Biol. 49:643-668.
4. Elless M.P., Blaylock M.J. (2000): Amendment optimization to enhance lead extractability from contaminated soils for phytoremediation. Int. J. Phytoremed., 2: 75–89.
5. Chen H., Cutright T. (2001): EDTA and HEDTA effects on Cd, Cr and Ni uptake by Helianthus annus. Chemosphere, 45: 21–28.
6. Chen Y.X., Lin Q., Luo Y.M., He Y.F., Zhen S.J., Yu Y.L., Tian G.M., Wong M.H. (2003): The role of citric acid on the phytoremediation of heavy metal contaminated soil. Chemosphere, 50: 807–811.
7. Elliott H.A., Brown G.A. (1989): Comparative evaluation of NTA and EDTA for extractive decontamination of Pb-polluted soils. Water Air Soil Pollut., 45: 361–369.
8. Brown G.A., Elliott H.A. (1992): Influence of electrolyteson EDTA extraction of Pb from polluted soil. Water Air Soil Pollut., 62: 157–165.
9. Heil D.M., Samani Z., Hanson A.T., Rudd B. (1999): Remediation of lead contaminated soil by EDTA. I. Batch and column studies. Water Air Soil Pollut.,113: 77–95.
10. Papassiopi N., Tambouris S., Kontopoulos A. (1999). Removal of heavy metals from calcareous contaminated soils by EDTA leaching. Water Air Soil Pollut., 109: 1–15.
11. Ashraf M, McNeilly T, Bradshaw AD. (1986). The response of NaCl andionic content of selected salt tolerant and normal lines of three legume forage species in sand culture. New Phytologist 104: 403-471.
12. Nandawall AS, Godara M, Sheokand DV, Kamboj BS, Kundu MS, Kuhad B, Kumar SK, Sharma S. (2000). Salinity induce changes in plant water status, nodule functioning and ionic distribution in phenotypically different genotypes of Vigna radiata L. Journal of Plant Physiology 156:350-359.
13. Munns R. (2002). Comparative physiology of salt and water stress. Plant, Cell and Environment, 25: 239- 250
14. Hanselin MH, Eggen T. (2005). Salinity tolerance during germination of seashore halophytes and salt tolerant grass cultivars. Seed Science Research 15: 43-50.