EUROPEAN ACADEMIC RESEARCH
Vol. IV, Issue 9/ December 2016

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Effect of bio agent Mycorrhiza fungi and bacteria *(Azotobacter chrococcum)* to reduce heavy metals in rhizospher root of potato

NAEEM SAEED DHEYAB
HAMDIA Z. ALI
WAFAA HADI HASOON
HADI MAHDI ABOUD
DOAA ABAAS
BRAWA HASSEN
Ministry of Science and Technology
Agric. Research Director.
Baghdad, Iraq

Abstract:

The purpose of this article is to evaluate the role of bio agent Mycorrhiza fungi (glomus sp) and bacteria (Azotobacter chrococcum) in the rhizospher which is accumulated by heavy metals. The results showed that in comparison to the soil which not incubated, the heavy metals (Ni , Fe , Mn , Zn , Cu and Co) decrease from (0.325, 86.5 60, 1.493, 0.576, 0.034 and 0.019) to (0.261, 76.460, 1.329, 0.416, 0.015 and 0.017) respectively in spring season the same result obtain in the autumn season, heavy metal decrease from (0.347, 90.16, 1.693, 0.612, 0.054 and 0.048) to (0.2880, 80.06, 1.629, 0.459, 0.036 and 0.047 respectively.

Key words: bio agent, heavy metal, mycorrhiza, azotobacter, potato

INTRODUCTION

Macro and micro nutrient are important for plant growth, health plant and yield production. All plant needs nitrogen for

leaf growth, phosphorus for root formation, stem growth and fruiting, potassium for promoting healthy roots systems and help plants to resist disease (Pimental, 1997). The most heavy metals are (Cd, Cr, Cu, Hg, Pb and Zn). These metals are neutral compound in soil. Some of them are micronutrients necessary for plant growth such as Zn, Cu , Mn , Ni and Co while others have unknown biological function such as Cd , Pb and Hg (gaur and adholeya, 2004). Ecosystems have been contaminated with heavy metals due to various human and natural activates. The source of metals in the soil are divers , including burning of fossil fuels wastes, fertilizers and pesticides. These metals are commonly called heavy metals (Adriano, 1986). It is well known that heavy metals cannot be chemically degraded and broken down to non toxic, many of them are toxic even at very low concentrations sach as Cd, Co , Ni, and Zn, this need to be physically removed or be immobilized (kroop nick and napor, 1994). Application of fertilizers and pesticides for agriculture have contributed to a continuous accumulation of heavy metals in soils (Nouri et al , 2008). Huang and jin, 2008 showed that use of excessive chemical fertilizer and organic manures in the vegetative field and the greenhouse vegetable field contributed to the accumulation of heavy metals in the soils. The presence of heavy metals in some fertilizer at high concentrations are of most concern due to the toxicity and it is ability to accumulate in soils and bioaccumulation in plant and nimals (alloway, 1990). Taylor and Percival, 2001 reported these metals can accumulate in the soil, be taken up by plants and passed on in the food chain to animals and humans. There are several techniques to remove these heavy metals, including chemical precipitation, oxidation or reduction, filtration, ion-exchange, reverse osmosis, membrane technology, evaporation and electrochemical treatment. But most of these techniques become ineffective when the concentrations of heavy metals are

less than 100 mg/L (Ahlamalina and Goyal , 2007). There are many processes involved in phytoremedation of heavy metal (used plant to remove heavy metals) sach as voltaic these metal and release them to atmosphere through leaf surface transformation of metals by enzymes within tissues, accumulation of metal in shoots and breakdown of metals by rhizopheric microorganism (Dixit and et al, 2015). Some studies have shown a positive impact of mycorrhiza fungi to reduce heavy metal contamination from soil. The mechanism of this impact indicated that cell wall of mycorrhizal root plant may chelae that metal ions and mycelia of mycorrhiza in soil filter the excessive metals, some studies supported that mycorrhiza enhance tolerance of host plant by improving the phosphorous absorption (Yi and et al , 2005). Trotta ad et al , 2006 reported that external mycelium of certain mycorrhiza fungi produce a type of protein called glycoprotein (Glomaline) which has heavy metal binding sites .heavy metals accumulated at these binding sites .

The objective of this study was to evaluate heavy metals (Cu , Co , Mn , Fe , Ni and Zn) in rizospher of potato plant after harvesting and investigate the influence mycorrhiza fungi and azotobacter bacteria to reduce accumulation heavy metals in agriculture land.

MATERIAL AND METHODS

Field experiment

The study was conducted in twitha region / south Baghdad. The soil texture varied from sandy loam to clay loam. Potato is the main crop was selected in this study. The field area divided into four block with three replicate each block incubated by mycorrhiza fungi (*glomus sp*), *Azotobacter chrococcum*, both of them and without any biological.

Preparing of bioremediation agent (*Glomus sp* And *Azotobacter chrococcum*)

The inoculum was consisted of Mycorrhiza fungi (*glomus sp*) and bacteria *(Azotobacter chrococcum)* which produced by the bio-fertilizer unit in Al-zafrania station / Agriculture of research centre /ministry of science and technology . the first step was to identify a stock plant that had high abundant spore and other sources of inoculum. The spore, hypha and root infection were extracted by wet saving and decanting method and putting for three minute in solution 1 % sodium hypochlorite to sterilization of inoculums. The mycorrhiza inoculum and Azotobacter broth were mixed with sterile peat moss .

Determined of heavy metals

Total concentration of heavy metals (Cu , Co , Mn , Fe , Ni and Zn) were analyzed using atomic absorption spectrophotometer at the laboratory of soil science department / university of life science / Poland . Acid digestion method used in order to digest soil samples. Soil samples were diluted and analysis by using atomic absorption spectrophotometer.

Statistical analysis

After harvesting potato plant, concentration of heavy metals were measured in rhizospher root zone (mg/g) . Data obtained was analyzed statistically by Genstat program. Means standard errors of the mean and least significant differences were calculated .

RESULT AND DISSOCIATION

Results in table (1) were showed Significant decreases in concentration of heavy metals (Ni , Fe , Mn , Zn , Cu and Co) observed in Rhyzospher root zone of potato inoculated with mix

of bio agent *Glomus sp* and *Azotobacter chrococcum*) in spring season (0.261, 76.460, 1.329, 0.416, 0.015 and 0.017) respectably over non inoculated control (0.325 , 86.5 60, 1.493 , 0.576 , 0.034 and 0.019) .

The same results were showed in autumn season table (2) significant bio agent treatment effects on concentration of heavy metals(Ni , Fe , Mn , Zn , Cu and Co) which recorded decrease in concentration to (0.2880 , 80.06 , 1.629 , 0.459 , 0.036 and 0.047) respectably .over non control treatment which recorded increase concentration of heavy metals to (0.347 , 90.16 , 1.693 , 0.612 , 0.054 and 0.048) .these results indicated that Mycorrhiza fungi (*glomus sp*) and bacteria *(Azotobacter chrococcum)* could have restricted the plant to absorb excessive of heavy metal from soil into the root system . these bio agent also aided the potato plant to hold excessive heavy metal in the shoot system.

Table (1) effect of bio agents to reduce some heavy metal on rhizospher zone of potato plant in spring season

Bioremediation agents	Concentration of heavy metals (mg/g)					
	Ni	Fe	Mn	Zn	Cu	Co
Control	0.325	86.560	1.439	0.576	0.034	0.019
Azotobacter chrococcum	0.275	75.860	1.361	0.412	0.015	0.016
Glomus sp	0.280	75.620	1.379	0.441	0.021	0.016
Mix	0.261	76.460	1.329	0.416	0.015	0.017
LSD 0.05	0.0001	0.1127	0.0139	0.00011	0.00008	0.00064

Table (1) effect of bio agents to reduce some heavy metal on rhizospher zone of potato plant in autumn season

Bioremediation agents	Concentration of heavy metals (mg/g)					
	Ni	Fe	Mn	Zn	Cu	Co
Control	0.3479	90.16	1.693	0.6129	0.054	0.048
Azotobacter chrococcum	0.3018	79.46	1.661	0.4553	0.035	0.046
Glomus sp	0.3067	79.22	1.679	0.4838	0.041	0.046
Mix	0.2880	80.06	1.629	0.4590	0.036	0.047
LSD 0.05	0.0006	0.1127	0.0196	0.0019	0.0002	0.0008

REFERENCES

1. Adriano, D.C. (1986). Trace element in terrestrial environmental, springer, Berlin.
2. Ahluwalia, S.S.; Goyal, D.(2007) Microbial and plant derived biomass for removal of heavy metals from wastewater. Bioresour. Technol., 98, 2243–2257.
3. Alloway, B. J.(1990). Heavy metals in soils .New York wiley .
4. Dixit, R., Wasiullah., Maloviya, D., Pandiyan, K., Singh, V., Soha, A., shulkla, R., singh, B.P., Ruisj., Sharma, P.K., Lade, H and Pual, D (2015). Bioremediation of Heavy Metals from Soil and Aquatic Environment: An Overview of Principles and Criteria of Fundamental Processes .Jornal / sustainability , 7 , p : 2189-2212 .
5. Gaur and A. Adholy (2004).prospects of arbscullare fungi in phytoremendation of heavy metal contaminated soil . current science , vol 86 no 4 , pp .528-534 .
6. Huang,S.W.,& Jin,J.Y.(2008).Status of heavy metals in agricultural soils as affected by different patterns of landuse. Environmental Monitoring and Assessment ,139 (1–3), 317–327. doi :10.1007 / s 10661-007-9838-4.Ju,X.T.,Kou,C.L.,Christie,P.,Dou,Z.X.,&Zh
7. Kroopnick , P.M (1994) Napor abatement cost analysis Methodology for calculating life cycle costs for hydrocarbon vapor extracted during soil venting . In remediation of hazardous waste (eds wise , D.L. and trantolo , D.J.) Marcel Dekker , New York , pp .779790 .
8. Taylor, M .D ., & Percival , H .J . (2001) . Cadmium in soil solutions from a transect of soils away from a fertilizer bin . Environmental Pollution , 113 (1) , 35–40.
9. Trotta, A., Falaschi, P., Cornara, L., Minganti, V., Fusconi, A., Drava, G. and Berta, G. (2006) Arbuscular mycorrhize increase the Arsenic translocation factor in

the As hyper- accumulating fern *Pteris vittate* L. *Chemosphere*, **65**, 74- 81

10. Yi,H., Shu, T and Jian, Y (2005) . The role of arbsculure mycorrhiza on change of heavy metal specintion in rhizospher of maize in wastewater irrigation agriculture soil . Journal of environmental science . vol (17) ,no (2) , p: 276-280 .