INVESTIGATING ROLE OF *PHRAGMITES AUSTRALIS* AS HEAVY METALS POLLUTION INDICATOR IN DEZ RIVER, IRAN

[1]**Farzad Veysanlu**, [2]**S. Mortazavi**, [2]**P. Norozi Fard**
[1]*Assistant Professor, Islamic Azad university, Boroujerd Branch,*
[2]*Assistant Professor, Malayer University, Malayer, Iran*
fveisanloo@gmail.com

Keywords: Bio monitoring; Dez River; Heavy metals; *Phragmites australis*

Introduction

Since riverbed is the main acceptor and storage of different pollutants including heavy metals, the sediments can be regarded as a suitable index to show the environmental condition of studied region. Metal pollutants, especially heavy ones will be biologically enlarged due to the bioaccumulation potential and biological reduction resistance while exposing the organism body; it is considered as a distinguishable feature for the environmental performances of heavy metals as compared to the other toxic pollutants. Since 1980, the usage of plants for the refining and clearing of environment and their roles in restraining and controlling the pollution have been discussed as an effective method in order to conduct soil treatments *in situ.* Their economics and environmental compatibility are two advantages of these methods. It is possible to use plants as monitors for studying the spatial distribution and time changes of accessible metals concentrations. Given that aquatic plants allocate the natural part of every ecosystem, they play crucial roles in purifying the ecosystem and balancing the environment ecologically. High tolerance of these species leads to their appropriateness to purify the polluted soil as compared to the pollutants.Using bio-monitors growing in a specific area results in valuable information on available tensions caused by human activities and significantly, adverse effects made by the mentioned tensions. One of the best species is *Phragmites australis* as a cosmopolitan species with a wide distribution to decrease the accumulation of heavy metals and their impact on water, soil and consequently, food chain. (Bonanno and Lo Giudice., 2010; Bragato *et al.,* 2006).

Methods

Dez River is the second biggest river in Iran as it supplies the drinking water for people and irrigation water for the adjacent industrial and agricultural lands. Since the most plant storage is simultaneous with the peak growing period of *P. australis* considering the phenological stages, samples had been taken from the riverbank and tidal zone at the late November. In every station, three samples of *P. australis* were collected in a 5×2 m^2 plot and samples of sediments were taken from surface layer of plant sample locations in each station with four replicates. To digest the samples, one g dried plant or sediment was first digested by the composition ofratio of 1 to 4 perchloric acid and nitric acid on a heating block at 40 and 140°C for 1 and three hours, respectively (Yap *et al.,* 2002). Concentrations of metals in plant and sediment samples were measured by ContrAA 700 analytic Jena atomic absorption spectrometry.

Finally Enrichment Factor (EF), Bio-accumulation Index and Translocation Factor (TF) were measured.Also, the concentration of metals in surface sediments was compared using Interim sediment quality guideline (ISQG) and mERM-Q value was estimated in order to identify the local priorities for monitoring bio-pollution for further studies.

Results

Underground organs had the higher metal accumulation as compared to the aerial organ due to the bio-access to these elements in the sediments. Underground organs in *P. australis* can accumulate high amounts of metals because of parenchymal tissue with lots of intercellular space filling by air (Bonanno and Lo Giudice, 2010). In present research the metal concentration in the leaf is higher than stem (1<)

since in the plant aerial organs, metals are usually accumulated in the vacuoles of leavesIn general, the following trends were found in terms of four regarded metals:Underground organs >leaves>stems &Zn>Cu>Pb>Cd. Enrichment Factor and mERM-Q values are presented in Table 1.

Table 1. Enrichment Factor (EF) of different metals in sediments (%) and mERM-Q values in various stations

Stations	Enrichment Factor (EF) (%)				mERM-Q
	Cu	Pb	Zn	Cd	
1	25.70	18.60	13.56	4.63	0.076
2	42.59	82.83	42.14	12.96	0.105
3	56.60	50.85	38.68	93.52	0.101
4	35.77	30.05	40.55	56.48	0.095
5	84.03	52.66	55.53	89.81	0.113
6	63.73	19.88	33.27	45.37	0.091

According to the results, the highest values of this factor were given to Zn and Pb, respectively (Table 2).

Table 2. Bio-accumulation and translocation indices values for underground organ to aerial organ

Metals	Bio-accumulation index		Translocation Factor
	Aerial organs	Underground organs	(TF)
Cu	0.472	0.600	0.787
Pb	0.065	0.205	0.317
Zn	0.697	0.481	1.451
Cd	0.910	1.455	0.625

if translocation factor ranged from 0.01 to 1, the plant accumulation and access are moderate. Accordingly, the plant accumulation and access are moderate in relation to Cu, Pb and Cd except Zn. Regarding Zn, this value is greater than 1 (Table 2); thus, the accumulation and access of Zn in this plant was high.

Conclusion

Soil fluid around the roots was the first source for the entry of heavy metals into the plant tissues and in total, the increased heavy metal concentration in the sediments increases the access of desired plant. To this reason, the increase of metal amounts in surface layers of sediments mostly causes the increased accumulation of metals in the underground organs of the studied species, namely *P. australis* as compared to the other plant organs. Underground organs had the highest metal accumulation amount in comparison with the aerial organs; underground organs serve as a super-absorbent of Cd. In addition, although there were obvious differences among heavy metal concentrations in plant organs and sediments, the species *P. australis* regarded as an absorbent and accumulator can be generally proposed in order to decrease heavy metal amounts in the regional sediments. Important relationships of metal concentrations between plant organs and sediments demonstrate that *P. australis* reflects total impact of environmental pollutions. Therefore, the species organs act as a biological index and can be applied as bio-monitors in order to provide quantitative estimates of environment qualities. Finally, it may be claimed that in spite of differences among heavy metal concentrations in the plant organs and sediments, *P.australis* is suggested as a useful plant for the reduction of heavy metals in sediments and as a bio-monitor for biological monitoring plans in order to evaluate the environmental conditions quantitatively with respect to the sediments of studied region.

References

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Proceedings of the 18th International Conference on Heavy Metals in the Environment, 12 to 15 September 2016, Ghent, Belgium