PHYTOREMEDIATION OF Pb-CONTAMINATED SOILS USING VETIVER GRASS

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Introduction

Physical symptoms of rangeland degradation including vegetation and soil quality loss and contamination is accelerating due to overgrazing, mining and land use changes (Hai et al., 2007). Phytoremediation is an economic and non-destructive method to rehabilitate contaminated soils (Blaylock et al., 1997). Phytoremediation costs in terrestrial lands are quite low and could be offset by the co-benefits. Numerous plant species have been suggested for soil remediation in natural ecosystems such as rangelands. However, one main challenge of phytoremediation is the plant of choice for any particular reclamation project. Chrysopogon zizanioides, commonly known as vetiver grass, is tolerate to wide range of soil and climate conditions and successfully used for soil reclamation around the world (Trung, 2000a; Trung, 2008). Furthermore, vetiver grass could provide valuable health and economic benefits to the society. Therefore, this plan species could be considered as a good choice for pb-contaminated soil in rangeland ecosystems. The current study aimed to evaluate the potential of *Chrysopogon zizanioides* grass for phytoremediation of pb mine soils in rangeland ecosystems.

Methods

Soil samples were collected from a contaminated semi-steppe rangeland ecosystem in Lashkardar, Malayer (initial Pb concentration of 600 mg kg^{-1}) in spring 2014. Then, a greenhouse experiment was set up with soil Pb treatment in 4 different levels (0, 300, 600, 1600 mg kg^{-1}) with 4 replication for a 120-days period. At the end of the experiment, soil and plant samples were collected for further analysis of Pb concentration of soil and plant shoot and root. SAS statistical software (V.9.1) were used for statistical analysis.

Results

While soil pb treatments including (0, 300, 600, 1600 mg kg^{-1}) did not show any significant effect on pb concentration at control, 300, and 600 mg kg^{-1} pb treatments, 1600 mg $kg^{-}1$ treatment significantly increased soil pb concentration. Also, pb concentration of plant root and shoot were significantly responded to the treatments ($p \leq 0.05$), particularly at 1600 mg kg^{-1} treatment (Table 1) with the maximum concentration of 242.9 and 242.02 mg kg^{-1} in plant shoot and, respectively. Furthermore, correlation analysis showed a significant strong correlation between pb concentration of plant shoot and root with $r = 0.77$ and $p = 0.0005$.

In addition, it should be mentioned that no necrosis symptoms were observed under all treatments during the experiment.

Table 1. The Summary of ANOVA Analysis and Duncan Multi-comparison Test Results

Variables	P > f	Control	300 treatment	600 treatment	1600 treatment
Soil pb Concentration	0.0022	8.62± 4.09 [b]	27.21± 29.51 [b]	29.55± 16.46 [b]	89.40± 32.50 [a]
Root pb Concentration	<0.0001	-6.95± 4.93 [c]	20.86± 3.77 [c]	73.08± 27.31 [b]	242.02± 37.56 [a]
Shoot pb concentration	0.0009	-12.66± 4.91 [b]	11.48± 12.11 [b]	39.37± 17.69 [b]	242.94± 139.44[a]

Conclusion

In overall, vetiver grass was able to absorb soil pb and tolerate to pb concentration of about 1600 mg kg^{-1} with no necrosis symptoms. Therefore, this plant species could be suggested for soil remediation from pb mine rangeland in Lashkardar, Malayer.

References

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