ENHANCING PHYTOREMEDIATION TECHNIQUE IN CONTAMINATED SOILS USING NOVEL BIOTECHNOLOGY

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Introduction

The contamination with potential toxic elements (PTEs) is ubiquitous problem and persistent unlike other contaminants. The water shortage forced Egyptian farmers to use low quality water in irrigation reso urces impregnated with a variety of contaminants such as potential toxic elements PTEs transferred into fo od chain. Nowadays many techniques such as bioremediation involving phytoremediation of PTEs gained top priorities in many countries. The aim of this work is to evaluate the effects of different remediative am endments used in enhancing phytoremediation technology applied in different soil ecosystems. to minimiz e hazards of pollutants in soil ecosystem.

Methods

Three different contaminated surface soil samples (0-30 cm) were collected; the 1st soil is clay loam from Abou Rawash-Konbera, Giza governorate S1, the 2nd is collected from Kafr El-Sheikh governorate (S2), and the 3rd is clay loam collected from El-Tina plain, Sinai governorate (S3). Zinc equivalent parameter in these soils ranged between 340 -630, mean while the critical value of this parameter should not exceed 250 and the normal value should be less than 100 at least (**Saber, et. al., 2012**).

Phytoremediation was conducted using canola (*Brassica napus*). Before planting, soils were treated with Sulfur fortified with *Thiobacillus thiooxidans* (T1), Sulfur + probentonite (T2), Probentonite incorporated with PR and fortified with phosphate dissolving bacteria (PDB) (T3), Mixture of all materials (T4), beside Control uncultivated soil CU and control Cultivated CC.

Results

The kinetic study showed priority of using Modified Freundlich equation (MFE) equation to describe the kinetic data by having high coefficient of determination R^2 and low standard error compared to other models used. Results indicated that Canola hyper accumulators significantly absorb different pollutants studied from different soil ecosystems compared to control uncultivated soils.

Application of Sulfur fortified with *Thiobacillus thiooxidans* (T1), enhanced the uptake of PTEs by canola plant used represents in decreasing the rate of Cu release (for example) from 0.35 in CC to 0.31

$mgkg^{-1}min^{-1}$, meanwhile, S + Probentonite treatment (T2) decreased the uptake from contaminated soils by fixed different pollutants in complex compound with significant decrease compared to T1.

Data also indicated that T4 was the best treatment in having low rate constant of pollutants release from contaminated soils.

In our results we concluded that although *Thiobacillus thiooxidans* and PDB and enhanced the mode of action of elemental Sulfur and PR in both enhancing the uptake of pollutants by canola and fixation of pollutants in soil ecosystem, application of all treatments (T4) was the best in minimizing the concentration of PTEs in different soil ecosystems.

Table (1) Rate constant *a* of MFE equation, the best fitted model for different pollutants desorbed from contaminated soils after different treatments applied

Treatments	S1			S2			S3		
	Zn	Cu	Ni	Zn	Cu	Ni	Zn	Cu	Ni
UC	0.31	0.47	0.33	0.23	0.18	0.2	0.28	0.29	0.21
CC	0.27	0.35	0.25	0.21	0.16	0.19	0.26	0.27	0.2
T1	0.26	0.31	0.22	0.2	0.15	0.16	0.24	0.21	0.15
T2	0.24	0.28	0.2	0.19	0.13	0.15	0.23	0.22	0.16
T3	0.22	0.23	0.18	0.18	0.11	0.13	0.22	0.2	0.12
T4	0.19	0.21	0.14	0.17	0.1	0.12	0.21	0.19	0.11

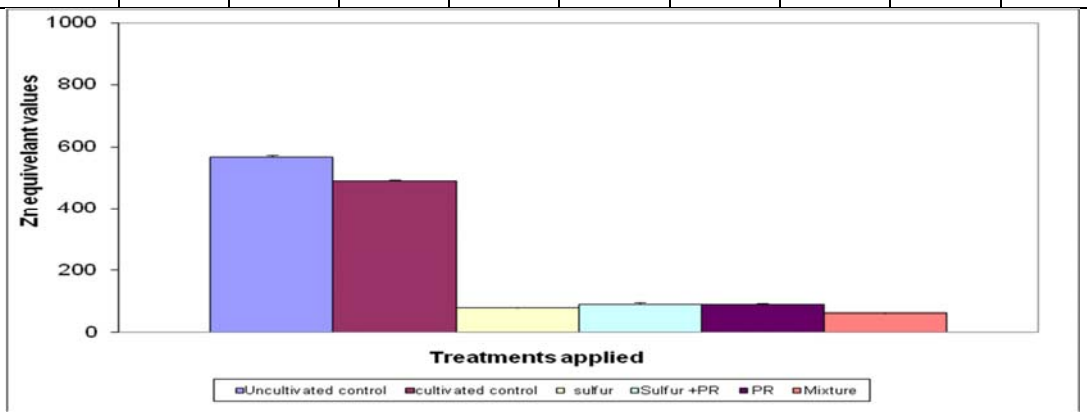

Figure 1 Zn equivalent in Kafr T-Shekh soil as affected by different remediation treatments applied

References

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