BIOREMEDIATION OF SOIL IRRIGATED WITH SEWAGE EFFLUENT BENEFITTING NEW KINETIC TACTICS

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Introduction

Sewage effluent had been extensively manipulated in farming in many sites in Egypt since several decades (Saber et al 2012). The rate at which Potential Toxic Elements (PTEs) are accumulated in the soil ecosystem depends on the physiochemical properties of the soil ecosystem and the relative efficiency of grown plants to uptake PTEs from the soil ecosystem. Contaminated crops by PTEs have been documented in many Egyptian soils irrigated by wastewater. Therefore, the Food and Agriculture Organization and other regulatory bodies of various countries have established the maximum permitted concentrations of heavy metals in foodstuffs or soils. This paper represents different remediative materials could be suitable to be applied under arid and semiarid conditions to minimize hazards of pollutants in soil ecosystem.

Methods

Field experiment was conducted in abo-Rawash, Giza governorate. Sewage soil characterized by Zn equivalent, the parameter of contamination 630, meanwhile it should not be exceed 250 (critical level) pH 8.67, EC 0.2 dS m^{-1}, 2.6% OM (organic matter), and the texture is sandy soil (*typic psamments*) were treated and planted with: - ***Biologically*** *with Acidithiobacillus thiooxidans* - Mycorrhizal (AM [arbuscular mycorrhiza]) Conidia; and Indian Mustard (*Brassica juncea* Czern.), Canola (*Brassica Napus*, L.), *Solanum nigrum* L. (black nightshade). Chemically, soil was treated with probentonite (modified clay mineral prepared in NRC).

Kinetic study was performing on the data of PTEs desorption from both contaminated and remediated soil using both empirical and theoretical models to evaluate the success of remediation.

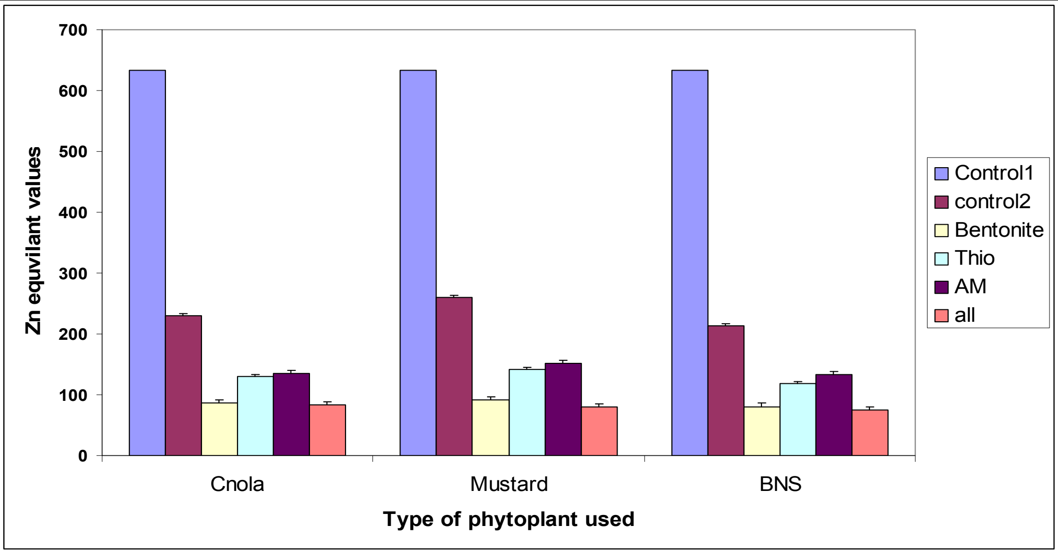
Results

Results indicated that all hyperaccumulators significantly absorb all pollutants from sewage soil ecosystem. The priority of these hyper plants in PTEs could be arranged as: Black Nightshade > Mustard > Canola

Application of *Acidithiobacillus* and Mycorrhizal (AM), both enhanced the uptake of PTEs by different plants used, meanwhile, Probentonite and mixture treatments decreased the uptake from contaminated soils. The kinetic study showed priority of using Elovich equation to describe the kinetic data by having high coefficient of determination R^2 and low standard error compared to other models used. The β constant which is convenient to describe the rate of pollutants desorption from soil indicated that all treatments applied significantly decreased the constant compared to control. Although using of BNS as a hyper accumulator could be the best in having low quantity rate, the teamwork preferred to use Canola for its economic visibility. Although all treatments applied decreased ZN parameter in soil, application of mixture treatment or probentonite in soil were the best treatments to minimize ZE value to the save rate.

Table (1) Rate constant β of Elovich equation for different pollutants desorbed from contaminated soils after different hyperaccumulators plantation

Treatments	Canola			I. Mustard			BNS		
	Zn	Cu	Ni	Zn	Cu	Ni	Zn	Cu	Ni
Control	56.2	11.48	4.26	66.9	4.62	5.3	49.8	8.98	2.56
Probentonite	4.5	7.46	1.34	5.5	1.18	1.07	1.5	1.54	1.01
Thiobasillus	36.0	5.65	2.81	38.7	1.38	2.46	24.1	0.88	1.97
AM	39.4	6.94	1.67	42.5	3.42	2.22	9.92	2.56	1.41
Mixture	13.7	1.2	0.72	25.6	1.21	1.71	16.7	0.98	0.51



I. Mustard: Indian Mustard BNS: Black night shade

Figure (1) Zn equivalent in sewage soil as affected by different remediation treatments applied

References

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