NUMERICAL DATA

Iron Oxide Nanoparticles as Nano-adsorbents: A Possible Way to Reduce Arsenic Phytotoxicity in Indian Mustard Plant (Brassica juncea L.) (2018)

Effect on seed germination indicators in mustard seeds treated with $Fe_{-3}O_4$NPs (500 mg L^{-1}), As (150 µM), $FeSO_4$ (500 mg L^{-1}) or As + Fe_3O_4 NPs

Treatment	Germination %	Germination energy	Germination index	Relative germination rate	Relative heavy metal injury rate
C	100 ± 2.56[a]	1 ± 0.032[a]	28.5 ± 0.997[a]	1 ± 0.032[a]	0
As	17 ± 0.510[c]	0.2 ± 0.005[c]	4.85 ± 0.121[c]	0.17 ± 0.003[c]	0.83 ± 0.023[a]
NPs	94 ± 1.88 [a]	0.95 ± 0.026[a]	26.85 ± 0.805[a]	0.94 ± 0.027[a]	0.06 ± 0.001[c]
As + NPs	72 ± 1.512[b]	0.75 ± 0.016[b]	20.5 ± 0.512[b]	0.72 ± 0.018[b]	0.28 ± 0.007[b]
$FeSO_4$	67 ± 1.407 [b]	0.70 ± 0.014[b]	19.14 ± 0.459[b]	0.67 ± 0.014[b]	0.33 ± 0.009[b]

Source: https://link.springer.com/article/10.1007/s00344-017-9760-0

Effect on shoot–root length in 14-day-old mustard seedlings treated with Fe_3O_4 NPs (500 mg L^{-1}), As (150 µM), $FeSO_4$ (500 mg L^{-1}) or As + Fe_3O_4 NPs

Treatment	Shoot length (cm)	Root length (cm)
C	9 ± 0.279[b]	5.3 ± 0.164[a]
As	4.6 ± 0.105[d]	2.5 ± 0.062[c]
NPs	10 ± 0.35[a]	5.7 ± 0.176[a]
As + NPs	6.6 ± 0.184[c]	4.5 ± 0.135[b]
$FeSO_4$	5.3 ± 0.132[d]	3 ± 0.084[c]

All the experiments were carried out using three biological replicates (n = 3, ± SE). Different letters indicate significant changes ($P < 0.05$) in different treatments

Source: https://link.springer.com/article/10.1007/s00344-017-9760-0

Reduction of soil heavy metal bioavailability by nanoparticles and cellulosic wastes improved the biomass of tree seedlings (2017)

Effect of different levels of nanoparticles (N) and cellulosic wastes (W) levels on maple seedling biomass (g). Mean values – SE in soil contaminated with different concentrations of Pb and Cd. Different letters represent significant differences between treatments within each concentration.

Seedling characteristics	Heavy metal concentration in soil	Control	Treatments						Polluted Soil
			N1	N2	N3	W1	W2	W3	
Leaf biomass	Pb 100	8.94 – 0.29 a	5.85– 0.23 c	6.85– 0.29 bc	7.76 – 0.22 b	6.47– 0.48 bc	6.69– 0.34 bc	7.34– 0.57 bc	3.77– 0.21d
	Pb 200	8.94 – 0.29 a	6.56– 0.49 b	6.67– 0.34 b	7.26 – 0.52 b	4.76– 0.28 c	6.79– 0.45 b	7.95– 0.30 ab	3.77– 0.17 c
	Pb 300	8.94 – 0.29 a	3.76– 0.22 de	5.32– 0.19 c	5.94 – 0.28 c	3.80– 0.29 de	4.88– 0.27 cd	7.18– 0.60 b	3.12– 0.10 e
	Cd 10	8.94 – 0.29 a	5.73– 0.31 cd	7.03– 0.32 b	7.36 – 0.21 b	5.26– 0.13 d	6.47– 0.65 bc	7.30– 0.21 b	3.33– 0.08 e
	Cd 20	8.94 – 0.29 a	4.75– 031 e	5.88– 0.29 d	7.28 – 0.39 b	4.95– 0.30 e	6.25– 0.15 cd	6.88– 0.17 bc	2.99– 0.05 f
	Cd 30	8.94 – 0.29 a	4.28– 0.15 de	5.33– 0.48 cd	7.15 – 0.11 b	3.80– 0.28 ef	5.24– 0.21 cd	6.13– 0.52 c	2.92– 0.01 f
Stem biomass	Pb 100	26.26 – 0.90 a	16.95 – 0.97 d	20.70– 1.03 c	23.50 – 0.39 b	13.37 – 0.61 e	16.74 – 0.53 d	19.07 – 0.39 cd	13.53 – 0.54e
	Pb 200	26.26 – 0.90 a	14.24 – 0.80 d	19.21– 0.98 c	22.42 – 0.53 b	11.46 – 0.33 e	15.24 – 0.51 d	16.63 – 0.57 d	12.23 – 0.37e
	Pb 300	26.26 – 0.90 a	9.09– 0.35 e	13.91– 0.30 c	16.34 – 0.21 b	7.86– 0.39 e	11.81 – 0.60 d	14.26 – 0.63 c	11.27 – 0.18d
	Cd 10	26.26 – 0.90 a	18.80 – 0.12 cd	19.86– 0.37 bc	21.42 – 0.20 b	15.60 – 0.64 e	17.01 – 0.88 de	19.42 – 0.67 bc	11.37 – 0.63 f
	Cd 20	26.26 – 0.90 a	13.97 – 0.43 e	15.77– 0.38 d	19.52 – 0.28 b	11.14 – 0.26 f	13.68 – 0.71 e	17.40 – 0.50 c	9.50– 0.51 g
	Cd 30	26.26 – 0.90 a	9.59– 0.19 cd	10.68– 0.92 cd	13.25 – 0.51 b	6.74– 0.36 f	8.74– 0.30 de	11.34 – 0.68 c	7.70– 0.41 df
Root biomass	Pb 100	20.26 – 0.62 a	14.44 – 0.73 cd	16.54– 0.29 bc	18.11 – 0.30 b	12.56 – 0.81 d	13.28 – 0.41 d	15.68 – 0.72 c	14.60 – 0.49 cd
	Pb 200	20.26 – 0.62 a	13.43 – 0.09 c	16.25– 0.33 b	16.94 – 0.34 b	9.50– 0.54 d	12.83 – 0.35 c	11.03 – 0.31 d	12.90 – 0.32 c
	Pb 300	20.26 – 0.62 a	10.15 – 0.08 c	12.71– 0.17 b	13.79 – 0.12 b	7.74– 0.40 d	7.86– 0.94 d	9.96– 0.89 c	11.97 – 0.21b
	Cd 10	20.26 – 0.62 a	10.57 – 1.10 c	13.07– 0.08 b	14.13 – 0.57 b	8.65– 0.76 d	12.03 – 0.22 bc	13.39 – 0.36 b	5.61– 0.19 e
	Cd 20	20.26 – 0.62 a	7.45– 1.14 c	11.96– 0.09 b	12.57 – 0.27 b	4.34– 0.13 d	5.22– 0.23 d	7.72– 1.14 c	5.12– 0.06 d
	Cd 30	20.26 – 0.62 a	6.33– 0.60 d	8.55– 0.51 c	11.03 – 0.37 b	3.47– 0.35 e	3.88– 0.21 e	6.51– 0.04 d	7.23– 0.17d

The experiment was set up in a completely randomized design. The treatments included: Control (without amendments and heavy metals); 0 (Polluted soil-without amendments); W1, W2, W3 (cellulosic waste levels); N1, N2, N3 (nanoparticle levels). Lead and Cd treatments significantly decreased the height, diameter, leaf, stem, and root biomass of seedlings. There was an increase trend for height, diameter, and biomass (leaf, stem, and root) with increase of amendment level for each heavy metal concentration. For seedling height, W3 and N3 had the best results for all concentration of Pb and Cd, respectively. For seedling diameter, N3 and W3 had the best results for all concentrations of Pb and Cd, respectively. The results of seedling biomass indicated that N3 had the best results for Pb and Cd for all concentrations.

Source: https://onlinelibrary.wiley.com/doi/epdf/10.1002/jpln.201700204

Magnetic ($Fe3O_4$) Nanoparticles Reduce Heavy Metals Uptake and Mitigate Their Toxicity in Wheat Seedling (2017)

Removal efficiency of four different heavy metals (Pb, Zn, Cd and Cu) absorbed by nano-$Fe3O_4$

Heavy Metals	Time	Cd, Zn, Pb and Cu Contents (mg/L)	
		Heavy Metals	Metals + Nano-Fe_3O_4
	1 d	123.43 4.22	1.77 0.53
Cd	2 d	121.6 1.08	1.18 0.2
	5 d	118.27 1.05 [a]	0.44 0.14 [b]
	1 d	68 0.07	5.74 1.61
Zn	2 d	70.42 0.21	1.46 0.26
	5 d	70.61 1.38 [a]	0.98 0.14 [b]
	1 d	126.9 0.62	0.1 0.02
Pb	2 d	130.87 0.47	0.1 0.07
	5 d	129.37 0.81 [a]	0.05 0.01 [b]
	1 d	68.92 0.32	1.51 0.4
Cu	2 d	70.63	0.34 0.08
	5 d	71.01 [a]	0.22 001[b]

The values are presented as the mean± standard deviation (SD). In each line (5 d), values marked with the same letters (a) are not significantly different versus controls (corresponding heavy metal solution without nano-Fe_3O_4) at ($p< 0.05$), while the values marked with the small letters (b) are significantly different versus controls ($p< 0.05$). Treatments: 1 mM (metal) or 1 mM (metal) + 2000 mg/L (nano-Fe_3O_4).

Source:
https://www.researchgate.net/publication/316851018_Magnetic_Fe3O4_Nanoparticles_Reduce_Heavy_Metals_Uptake_and_Mitigate_Their_Toxicity_in_Wheat_Seedling