Citric acid enhanced Phytoextraction of Nickel (Ni) by improving antioxidantsand metal uptake in *Alternanthera Bettzickiana*

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Nickel (Ni) is recognized as most toxic heavy metal that prevails in the environment through anthropogenic activities.. Current study was planned to evaluate the potential of *Alternanthera bettzickiana* in Ni contaminated soils in alone and with combination of citric acid (C.A). Different physiological, morphological and biochemical characteristics of *A.bettzickiana*were observed during the pot scale experiment. Plant cuttings of *A.bettzickiana*were grown in pots filled with 5kg/pot. Nickel Nitrate [$Ni(NO_3)_2$] was used as a source of Ni. Different levels of Ni and citric acid were applied (Ni0,Ni5mM, Ni10mM, C.A 2.5mM, Ni5+C.A2.5mM, Ni10+C.A2.5mM) in alone and with combination soil culture. No visual symptoms of metal toxicity were observed on leaves and roots of plants when exposed to high concentrations of Ni. Results from photosynthetic pigments, antioxidants indicate that the application of C.A reduced metal toxicity and enhanced plant defensive mechanism against Ni stress. Furthermore, Catalase (CAT), peroxidase (POD), superoxide dismutase(SOD) and ascorbate peroxidase (APX), activities were increased in plants with increasing metal concentration in the media. Ni content in different plants was in the order of leaves>stem>roots. Thus, we can conclude that *A.bettzickiana*seems to be valuable for the phytoextraction of Ni contaminated soils.