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Bioaccumulation And Translocation Potential Of Na^+ And K^+ In Native Weeds Grown On Industrially Contaminated Soil

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Abstract: Use of the naturally growing plants to remove the inorganic contaminants from the soil as well as water is a sound technology in the recent years. The study was performed in salinity affected soil to examine the efficacy of bioaccumulation potential of sodium and potassium by 12 naturally grown weeds. The wasteland soil was found having higher bulk density (BD), water holding capacity (WHC), electrical conductivity (EC), organic carbon (OC) and nitrogen, phosphorus and potassium (NPK) than the control (garden) soil. The average values of Na^+ and K^+ were found in plant parts 750 and 1094 µg g^{-1} dry weight respectively. The Na^+/K^+ ratio was found highest in the *B. pertusa* (0.8). Translocation factor (TF) ranged from 0.6 to 1.2 for Na^+ and 0.5 to 0.9 for K^+. Na^+ and K^+ removal from the wasteland soil and waste substrates was most effective with the use of *P. panicum, S. munja, S. spontanum, P. purpureum* and *D. clorata,* because these plants accumulated significant higher amount of Na^+ and K^+ in their tissue. These weed plants found to have a great potential for the phytoremediation of industrial wasteland in the investigated area.
Keywords: Bioaccumulation; enrichment factor; industrial area; phytoremediation; salinity; translocation factor.

Introduction

The environmental stresses trigger a wide range of plant responses, ranging from altered gene expression and cellular metabolism to changes in growth, biomass accumulation, and plant productivity[1-8] and it may also affect the uptake and transport of toxic substances inside the plants. Salinity is a major problem of the soil ecosystem in the arid, semi-arid and coastal regions throughout the world[9-11]. The global range of primary salt-affected soils is about 955 M ha, while secondary salinisation affects about 77 M ha, with 58% of these in irrigated areas. About 21.5 million hectare of land is salt affected in Asia alone and India having 8.6 million hectare out of them. The major ions responsible for salinization of soil are Na^+, K^+, Ca^{2+}, Mg^{2+} and Cl^-. High salinity is one of the most important environmental stresses impeding crop growth and severely reduces agricultural yields and productivity[12]. The soil salinity affects seed germination; alter plants metabolisms through osmotic stress, ion specific effects and oxidative stress[13]. Several reports are available which indicate that many crops have tolerance power towards the salinity e.g. Barley[12] and Chick pea etc.[14]. Sodium ion can compete with K^+ and inhibit transport and metabolic processes depending on K^+. Since Na^+ is frequently present at higher concentrations than K^+ in soils, most plants must have transport systems with high selectivity for K^+ against Na^+. The objective of present study was planned to evaluate the phytoextraction potential of different naturally growing plant species especially weeds for the reclamation of salinity affected wasteland.