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USABILITY OF *TULİPA SP.* IN PHYTOREMEDIATION, AMONG IMPROVEMENT TECHNIQUES USING PLANTS, ITS ROLE IN THE MITIGATION OF ENVIRONMENTAL POLLUTION IN URBAN AREAS, THE SAMPLE OF ERZURUM CITY, TURKEY

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ABSTRACT

This study was conducted with three replicates at six different junctions facing dense motor-vehicle traffic to investigate the usability of ornamental plants in the prevention of environmental pollution in Erzurum in Turkey. *Tulipa sp. (Tulipa* 'Banja Luka', *Tulipa*' Golden Parade', *Tulipa* 'Pink Impression', *Tulipa* 'Margarita', *Tulipa* 'Antarctica', *Tulipa* 'Hakuun', *Tulipa* 'Escape', *Tulipa* 'Darwidesign') plants and soil around their roots were taken on planting (pre-test) and fading (30 days after plantation, post-test) periods, and heavy metal accumulation was investigated in the soil around the roots of the plants and in their leaves and flowers. Eight types of heavy metal (Cr, Mn, Fe, Co, Cu, As, Cd, Pb) contents of the samples (soil, leaf, and flower) were analyzed through Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The mean and standard deviations of the variables were determined conducting the T-test in the SPPSS program and the statistical significance levels of the results obtained were determined using the ANOVA test ($p < 0,01$). Post-test levels of Co, Cr, Fe, and Cd in plant samples (all three parts) were found to be statistically significant ($p<0.01$) at A2 (Havuzbaşı) and A1 (Gez) junction points, which receive the densest traffic. However, Fe, Cr, Cu and Mn ion levels of soil at A4 (University entrance) and Yenişehir junctions, where the traffic density is lower, were found to be not significant in post-tests. The reason for this is thought to be the addition of soil from outer sources when placing bulbs. Considering the increase rate (%) in Cr between pre- and post-tests, it was found that the largest change was seen in flower petals (436%; from 1.25 mg kg^{-1} on planting to 6.70 mg kg^{-1} 30 days later), followed by leaves (505% from 1.94 mg kg^{-1} to 11.74 mg kg^{-1}) and soil (63% from 40 mg kg^{-1} to 65 mg kg^{-1} at pre - and post-tests); these differences are statistically significant. At A1 point, the increase between the measurements of leaves for Mn was found to be 226% (from 29.25 mg kg^{-1} to 95.22 mg kg^{-1}); for Fe in flower petals at A4 point, the increase was 855% (from 866.26 mg kg^{-1} to 8274.56 mg kg^{-1}); Co levels in leaves at A4 point increased by 863% (from 0.43 mg kg^{-1} to 4.14 mg kg^{-1}). This study is the first to be conducted on Tulipa sp. in Turkey. This study is important because it was determined in the study that the plant investigated provides not only aesthetical and visual contributions to landscape architecture, but it also has a possible function of being a hyper-accumulator depending on the rate of heavy metals it contains in its body parts. Usability and functionality of the plant to this aim were also discussed. Struggling with environmental pollution is a heritage to be dropped for the future. Therefore, wise solutions to preventing pollution are vitally important in the respect of economic development, rehabilitation of polluted areas and sustainable use of all the areas for the futures of countries.

Key words: Environmental pollution, phytoremediation, heavy metals, *Tulipa sp.*, Erzurum, Turkey