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“Bioavailability of pharmaceuticals and heavy metals for plants in sludge treatment wetlands”

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ABSTRACT

The objective of this study is to determine the concentration and fraction bioavailable for plants of pharmaceuticals and heavy metals in sludge treatment wetlands (STWs). The level of pollutants in sludge is crucial for its usage for agriculture purposes. The samples of sludge from different depths, plant roots and aerial parts were collected from two domestic STWs of different age (6 and 12 years), and analyzed for organic matter content, nutrition elements, heavy metals and selected pharmaceuticals. Organic matter content decreases with increasing depth from 68.3% to 3.6%, and from 56.3% to 18.3% in 12 and 6 years old STW, respectively. Macronutrients are ranging from 1.6 – 2.1% for P, from 0.08 - 0.72% for S, from 0.2 – 3.7% for N and from 0.5 - 1.2% for K. The micronutrients such as Ca, Mg, Mn and Mo have concentrations within the values reported by other authors and heavy metals (Cu, Ni, Pb, Zn) are under the limits regulated by the European Environmental Agency. Physicochemical parameters, mineralization and stabilization processes are the factors that probably can influence on the tendency of increasing or decreasing the concentrations of heavy metals within the top layer (30 – 40 cm depth from the surface). Analysis of the plant biomass shows a bioaccumulation of these elements predominately in the roots, with the exception of K being concentrated in the aerial parts and rhizomes. Preliminary analysis of pharmaceuticals (caffeine, carbamazepine, clofibric acid, clotrimazol, diclofenac, flutamide, metoprolol, triclocarban and triclosan) in sludge shows concentrations ranged from 1 to over 100 ng/g that are comparable with previously reported concentrations. Bioavailable fraction of pharmaceuticals in the plant samples are still under way and their results will also be reported.