Nonylphenol Translocation in Lettuce from Contaminated Soil Amended with Biochar

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Background/Objectives. Nonylphenol (NP) is one of the organic emerging compounds mainly found in effluents and sludge from wastewater treatment plants. The reuse of such matrices in agriculture results in micro-pollutants potential transport through the soil and trophic chain, with potential risks for the environment and public health. The translocation of these compounds into edible vegetables has recently been investigated.

The pyrolysis of plant residues allows to obtain biochar, which provides the soil for significant amounts of nutrients and organic matter; therefore it is an important agricultural fertilizer. Moreover, some studies highlight biochar as a potential storage matrix of various organic contaminants.

Approach/Activities. In order to assess the potential transport of NP to edible vegetables and the effect of biochar, lettuce was cultivated in pots with contaminated soil (10 mg NP/kg d.w.) and contaminated soil amended with biochar (5% on volume basis). The biochar had been produced by pyrolysis (at 1000-1200°C) from beech and chestnut; the specific surface was about 250 m^2/g. Uncontaminated (blank) pots were also prepared. Soil and lettuce samples were collected and analyzed, after filling the pots and at the end of the experiment (50 days).

A model of pollutant translocation into vegetables (Legind et al., 2011) was also applied, using the experimental data for calibration, validation and predicting purposes.

Results/Lessons Learned. At the end of the test, NP concentration in the contaminated pots (with and without biochar) had significantly lowered (0.2-0.6 mg/kg d.w.). Lettuce grown on contaminated soils exhibited significant NP concentrations (10-100 µg/kg fresh weight), suggesting potential translocation from the contaminated soil. Based on the experimental results, biochar did not bring a significant benefit to NP sequestration in soil. Based on model prediction, a significantly higher percentage of biochar should be added to soil to prevent NP migration, much higher than those commonly used in agriculture.