

Spatial distribution of available heavy metals in relation to land use in suburban cultivated soil of northeast China

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Uptake of heavy metals via soil-crop system is considered as one of the primary pathways of human exposure to environmental heavy metals. Compared to total concentration, available form of heavy metal is reported to possess direct impacts on crop growth. Moreover, soil heavy metal concentrations vary with the land use type on account of the discrepant volumes of heavy metal release. Thus, land use pattern will potentially prompt distribution of cultivated soil heavy metals into certain spatial variation patterns. Black soil region of northeast China is one of few black soil resources in the world. However, rapid urbanization in this region has saddled black soil resources with both quantity and quality loss, and heavy metal pollution is one of soil degradation problems induced by urban sprawl.

To understand impacts from land use on spatial distribution of available heavy metal in cultivated soil, a total of 137 soil samples were collected from a typical rural-urban fringe located in the black soil region. Kriging interpolation was performed to map spatial distribution of available heavy metals, and ordinary least square regression was performed to analyze relationships between concentrations of available heavy metal and influencing factors of land use (residential settlement, industrial land, transportation land and water) along with the corresponding total concentration.

Average concentrations of available As, Hg, Pb and Cd in study area are 0.049mg/kg, 0.122ug/kg, 2.282mg/kg and 0.055mg/kg, respectively. Lanjia residential county in the east is a mutual hotspot for available As, Pb and Cd; Yitong river is a hotspot for available Pb and Hg. OLS regression results indicate that all variables for available As are non-significant; industrial land developed before 2009, transportation land and water are the major influencing factors for available Hg; total concentration of Pb, rural settlement and industrial land developed before 2009 are the major influencing factors for available Pb; available Cd is mainly influenced by total concentration of Cd. Impacts from land use on heavy metal pollution in cultivated soil are prominent.