Geophysical Research Abstracts
Vol. 12, EGU2010-13377, 2010
EGU General Assembly 2010

Can soil drying affect the sorption of pesticides in soil?

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The sorption of pesticides in soils mainly controls their further dispersion into the environment. Sorption is usually related to the physico-chemical properties of molecules but it also depends on the hydrophobic features of soils. However, the hydrophobicity of soils changes with wetting and drying cycles and this can be enhanced with climate change. The objective of this study was to measure by using controlled artificial soils the influence of the hydrophobic characteristic of soils on the retention of a model pesticide.
Artificial soils consisted in silica particles covered by synthetic cationic polymers. Polymers were characterized by the molar ratio of monomers bearing an alkyl chain of 12C. Two polymers were used, with 20 and 80 % ratios, and the same degree of polymerization. In addition, porous and non-porous particles were used to study the accessibility notion and to measure the influence of diffusion on pesticide sorption kinetics. Lindane was chosen as model molecule because its adsorption is supposed mainly due to hydrophobic interactions.
Results on polymers adsorption on silica showed that it was governed by electrostatic interactions, without any dependency of the hydrophobic ratio. Polymers covered the entire surface of porous particles. Kinetic measurements showed that lindane sorption was slowed in porous particles due to the molecular diffusion inside the microporosity. The adsorption of lindane on covered silica particles corresponded to a partition mechanism described by linear isotherms. The slope was determined by the hydrophobic ratio of polymers: the sorption of lindane was highest in the most hydrophobic artificial soil. As a result, modification in soil hydrophobicity, that can happen with climate change, might affect the sorption and the fate of pesticides. However additional experiments are needed to confirm these first results.
Such artificial soils should be used as reference materials to compare the reactivity of pesticides, to identify the main adsorption mechanisms, and to study the effect of modifications in soil physico-chemical properties on the fate of pesticides.