Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11646, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11646
EGU General Assembly 2008

Influence of pH on the toxic effects of 2,4-diclorophenol and 2,4,5-triclorophenol in an agricultural soil.

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Previous studies carried out by our research group regarding the effects of 2,4-diclorophenol (2,4-DCP) and 2,4,5-triclorophenol (2,4,5-TCP) in soils from Galicia (NW Spain) demonstrated that the contaminants behaved in a very variable and unpredictable manner, making it difficult to diagnose contamination of soils with these products. One possible cause of the observed variation may be soil pH, as this affects the degree of dissociation of compounds and thus determines the fraction present as the ionic form, which is thought to be able to penetrate microorganisms and cause their death. In order to investigate the effect of pH on the toxic effects of these compounds, samples of an agricultural soil (pH in KCl 3.88; organic C content, 1.97%) were limed to pH values of 4.98, 5.86 and 6.62. Once the pH stabilized, aliquots of the initial soil (pH not modified) and of the soils at each of the pH levels were contaminated with different amounts of 2,4-DCP (0, 500, 1000 and 2000 mg kg^{-1}) and of 2,4,5-TCP (0, 100, 500 and 1000 mg kg^{-1}). The soils were incubated for three days, and were then analyzed for different properties related to the soil biochemical activity (dehydrogenase and urease activity and microbial biomass-C).

The results obtained demonstrate that for both compounds, the variation in the pH of the soils did not have any effect on urease activity. In contrast, the change in pH did influence the effect of both compounds on the microbial biomass and dehydrogenase activity. The response of both properties as a function of dose of contaminant (2,4 DCP and 2,4,5-TCP) was described by a sigmoidal dose response curve, which enabled estimation of the ED_{50} values. For both properties the ED_{50} values decreased as the pH of the soil increased, and the effect was more intense for TCP than for DCP.

This reflects an increase in the presence of ionic forms of the compounds as the pH increased and therefore also in the toxicity to the soil microbiota. Moreover, the greater effect in the case of 2,4,5-TCP suggests that this compound is dissociated to a greater degree than 2,4-DCP because of the its lower *pK*, close to that of the soil of higher pH.