SOIL AMENDMENT WITH ACTIVATED CHARCOAL CAN REDUCE DIELDRIN UPTAKE BY CUCUMBERS

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Organochlorine pesticides (OCP) were once applied world wide but have been banned meanwhile in most countries because of their ecotoxicity, bioaccumulation and persistence. However, residues can still be present in soils even many years after applications have been stopped and taken up by crop plants. OCP accumulation from bound residues was found to be a particular problem in *Cucurbitaceae* plants. Two soil surveys performed in 2002 and 2005 in Switzerland revealed that OCP residues were taken up by cucumbers grown in soils that have been converted to organic production in the meantime. Even if legal tolerance values are not exceeded, this is a serious economic problem for the farmers affected by contaminated crops, because consumers of organically grown crops are only willing to pay the higher prices for these than for conventional products because they are particularly concerned about health and environmental quality and therefore expect pristine food. One approach to address the problem would be to increase the capacity of affected soils to bind OCP residues in order to prevent their uptake by the crops. In this study, we wanted to test the potential use of activated charcoal (AC) for this purpose. In addition, we wanted to assess the possibility of using OCP sorption in soil by Tenax® beads as a predictor for the phytoavailability of these compounds to cucumbers.
We performed two pot experiments in which the cash crop cucumber (*Cucumis sativus* L.) was grown in soil with bound residues of dieldrin (70 µg/kg), pentachloroaniline (<0.01 µg/kg) and p,p-DDE. The soil was taken from a field under organic farming in which these residues were found in the 2005 survey. In the first experiment, cucumbers were grown for 12 to 13 weeks (until fruits were ripe) in soil into which AC had been mixed at concentrations of 200, 400, and 800 mg/kg and in untreated controls. In the second experiment, Tenax® beads were added to the soil and cucumbers, grown with and without AC amendment (800 mg/kg soil), were harvested after 4, 8, 10, 11, 12, and 13 weeks.
Dieldrin was the only pesticide detected in the sampled cucumbers and extracted from soil by the Tenax beads. Dieldrin concentrations in the cucumbers were significantly reduced in the treatments with 400 and 800 mg/kg AC. Also significantly less dieldrin was sorbed by Tenax from the soil amended with 800 mg/kg AC than from the untreated control soil. More dieldrin was found to be sorbed by Tenax in the last 3-4 weeks of the experiment, particularly in the control soil, but this trend was not significant. The correlation between the amounts of Tenax-sorbed dieldrin and dieldrin accumulation in the cucumber fruits was significant in control soil and 800 mg/kg AC soil. Hence, Tenax appeared to be suited for the assessment of dieldrin solubility in soil and of phytoavailability to cucumbers.

Keywords: Activated charcoal, cucumber, dieldrin, phytoavailability, Tenax