

# A Mini Review on Long-Term Contamination of Tropical Volcanic Soils

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## Abstract

Soils, waterways, aquatic life, and crops all became permanently poisoned as a result. WISORCH, a leaching model based on first-order desorption kinetics, was developed and tested to determine the degree and duration of soil pollution. The SOC/water partitioning coefficient and the organic carbon content of the soil are the input parameters (Koc). It takes into account the current concentrations of chlordecone and drainage water in the soil. The fact that the model worked for andosol indicates that there was no physicochemical or microbiological degradation. Dilution from previous deep tillages renders soil scraping impractical. Liviatio appeared to be the most important strategy for reducing pollution. Koc changed from nitisol to ferralsol and then increased once more in tandem with an increase in SOC content and rainfall.

**Keywords:** Volcanic soils • Chlordecone's • Policy • Soils

## Introduction

From 1972 to 1978, organochlorine insecticide chlordecone (CLD) was used in the French West Indies under the brand name Kepone™ (5% CLD), which was manufactured by Life Science Products Co. (Hopewell, VA), and Curlone™ (5% CLD), which was manufactured by Calliope S.A. (Port-la-Nouvelle, France), from 1982 to 1993. The French Ministry of Agriculture issued a temporary usage permit to Kepone in 1972. It was banned in the United States and stopped being used in 1978. A warning about the risk of CLD contamination of water and soil was published in a 1977 French publication (Snegaroff). A CLD level of more than 9 mg kg<sup>-1</sup> was found in the topsoil of some banana farms a few years after Kepone began to be distributed. There is no evidence that CLD degradation by microorganisms has taken place. *Pseudomonas aeruginosa* strain KO3 and a bacterial pool isolated from Hopewell plant sludge under aerobic conditions were used by Orndorff and Colwell (1980) to achieve apparent de-chlorination into mono- and di-hydro-chlordecone. However, these authors did not describe the initial mono- and di-hydro-chlordecone contents of the CLD. As a result, those values may have been caused by a lack of chlorination during the manufacturing process. Later, three species of *Pseudomonas* were investigated by Georges and Claxton (1988) to determine the degradation of CLD. However, there were no specifics once more. Additionally, peaks corresponding to hydro- and dihydro-chlordecone were observed in the HPLC chromatogram of the CLD solution that had only been inoculated with yeast and glucose. The authors emphasized that CLD's highly chlorinated cage-like structure makes it a poor carbon source for bacteria: Two weeks later, the apparent [1].

## Description

To account for inter-annual chlordecone desorption and the current degree

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of soil contamination, we decided to develop a straightforward CLD leaching model, WISORCH, based on first-order desorption kinetics. Due to delayed decontamination and long-term soil pollution, existing models of pesticide dissipation were unsuitable because they only account for short-term sorption, leaching, and degradation, which would result in significant inaccuracy when applied over years. In WISORCH, we assumed that neither plant capture nor degradation could effectively eliminate CLD from the various volcanic tropical soils found in the French West Indies. Since inter-annual CLD leaching tests were impossible, we validated using a "space for time" method. On the fields, we reenacted the various CLD spreading schedules and compared the simulated soil CLD levels to the actual CLD contents [2].

In the perennial banana cropping systems that are situated on steep slopes, three boreholes with a diameter of 8 cm were utilized to collect samples at 0, 1/4, and 1/2 of the distance between banana trees. The sampling depths of each borehole were 0–10 cm, 10–30 cm, and 50–70 cm, respectively. Composite samples with thicknesses ranging from 0 to 30 cm were made by mixing the first two layers of each topographic position (by volume, half). To account for the impact of tillage on the spatial variability of soil contamination, 20 samples of the 0–30 cm layer were taken from each parcel of the tilled banana cropping system. Each composite sample's carbon (SOC) and CLD contents were calculated. The bulk density of each profile's soil type was also calculated. The obtained relations were used to calculate bulk density from SOC for each composite sample, enabling the gravimetric contents of SOC and CLD to be converted into volumetric contents. We focused our measurements on the layer with a depth of 0–30 cm for two reasons. The crop protection service sampled the same depth at the same time as part of its program survey of soil pollution. This depth is typically used to estimate carbon sequestration. Through a few repetitions, we were able to determine that neither the CLD nor the SOC's contents significantly changed from year to year. Soils were sampled between 2001 and 2005 [3].

Fiberglass wick lysimeters were used to collect drainage leachates at a depth of 65 centimeters. We confirmed that the lysimeter cumulated flow matched the natural cumulated flow of the soil by employing the HYDRUS 1D or 2D models. There was no evidence of solids transfer on filters. Lysimeters were buried beneath and in between the plants for a single-row banana crop NFC on andosol. On nitisol, the double-row banana field BRH5 was placed in three different positions: beneath the banana tree, the small 1.2-meter interrow, and the large 2.4-meter interrow. The sampling and measurement dates for leachate are shown. The apparent Koc\* was used by the WISORCH model to determine the [CLD] w interannual development for various soil types. The application of the DD pattern to the water flow beneath banana feet and the MD pattern to the bare soil were used to account for the [CLD] w in NFC andosol. This shows that when DD or MD were applied to the water flow below

the banana, simulated [CLD] w values for BRH5 nitisol were comparable to those observed on the sample day. Variations in  $K_{oc}^*$  were not brought on by experimental bias. Nitisol's  $K_{oc}^*$  was lower than that of andosol, which has a higher CLD sorption but a lower desorption capability.

Some of our results were expected. Unlike where contaminated water tables first appeared (data not shown), soil contamination only occurred where chlordecone was applied. Because chlordecone has such a low volatility, it is impossible for any pollution that can be detected to travel through the atmosphere. In addition, runoff flow contained less than 3% of the CLD loads in drainage. Inter-parcel contamination remained uncommon as a result. The soil pollution had physical boundaries. Only rapid leaching decontamination and current chlordecone redistribution from the top to the bottom were observed. Drainage was the primary vector of transmission. Since drainage feeds water tables, downstream emergence areas, and rivers, diffuse pollution has long-term effects on water resources. This diffuse pollution could not be reduced by reducing surface pollution [4,5].

## Conclusion

Chlordecone persistence varies from soil type to soil type. The  $K_{oc}$  of nitisol is lower than that of ferralsol or andosol. Nitisol will take a few decades to decontaminate the soil, ferralsol will take several centuries, and andosol will take more than half a millennium. Decontamination could be accelerated by accelerating SOC mineralization, but doing so would have negative effects on agriculture and the environment. Both the values from the model and the values from the experiment backed up the theory that the concentration of chlordecone in water goes up as  $K_{oc}$  goes down. The mapping of contamination risks is

complicated by the lack of a clear link between soil pollution and its capacity to contaminate plants and water. More research is required to comprehend the various organo-mineral matrix behaviors during chlordecone sorption.

## Acknowledgement

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## Conflict of Interest

None.

## References

1. Busto, Y. "Potential of thermal treatment for decontamination of mercury containing wastes from chlor-alkali industry." *J Hazardous Materials* 186 (2011): 114-118.
2. Cachada, Anabela. "Soil and pollution: An introduction to the main issues." *Soil Pollution* (2018):1-28.
3. Cheng, Zhongqi. "Speciation of heavy metals in garden soils: Evidences from selective and sequential chemical leaching." *J Soils Sediments* 11 (2011): 628-638.
4. Cousins, Ian T. "Measuring and modelling the vertical distribution of semi-volatile organic compounds in soils. I: PCB and PAH soil core data." *Chemosphere* 39 (1999): 2507-2518.
5. Crane, Richard A., Michelle Dickinson and Thomas B. Scott. "Nanoscale zero-valent iron particles for the remediation of plutonium and uranium contaminated solutions." *Chemical Eng J* 262 (2015): 319-325.

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