Study of organochlorine pesticides and heavy metals in soils of the Juarez valley: an important agricultural region between Mexico and the USA

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Research Article

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Abstract

The Juarez Valley is an important agricultural region in northern Mexico, conveniently organized into three modules (I to III). For decades, their soils have been exposed to organochlorine pesticides (OCPs) and also have been irrigated with wastewaters, which may contain heavy metals. Nowadays, there is very limited information regarding the presence of OCPs and heavy metals in these soils. Thus, the aim of this study was to diagnose these soils for OCPs and heavy metal content by using gas chromatography coupled with electron micro-capture detector and atomic absorption spectrometry, respectively. The results indicated that 4,4′-dichlorodiphenyldichloroethylene and 4,4′-dichlorodiphenyltrichloroethane were primarily disseminated across the three modules since they were found in 100% and 97% of the analyzed soils, respectively. According to international regulations, none of the determined OCP concentrations are out of the limits. Additionally, the Cu, Zn, Fe, Pb, and Mn were found in all sampled soils from the three modules. The highest concentration of Fe was found in module II (1902.7 ± 332.2 mg kg^{-1}), followed by Mn in module III (392.43 ± 74.43 mg kg^{-1}), Zn in module I (38.36 ± 26.57 mg kg^{-1}), Pb in module II (23.48 ± 6.48 mg kg^{-1}), and Cu in module I (11.04 ± 3.83 mg kg^{-1}) ($p \leq 0.05$). These values did not exceed the limits proposed by international standards. The Cd was detected in most of the analyzed soils and all their values, with an average of 2 mg kg^{-1}, surpassed the Mexican standards (0.35 mg kg^{-1}). This study has mapped the main OCPs and heavy metals in the Juarez Valley and can serve as a starting point to further monitor

the behave of xenobiotics. Since these recalcitrant compounds might be bio-accumulated in biological systems, further analytical methods, as well as remediation techniques, should be developed.

Keywords

Organochlorine pesticides Heavy metals Soil pollution DDT Agricultural soil Cadmium

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Notes

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Publisher's note

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