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BIOSLURRY TREATMENT OF A CLAYISH SOIL POLLUTED WITH LINDANE BY SEQUENTIAL METHANOGENIC-SULFATE REDUCING BIOREACTORS

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Abstract

Lindane is a recalcitrant organochlorine pesticide widely found in soils of Mexico. Slurry bioreactors (SBs) are successfully used for *ex situ* and on site treatment of contaminated soils and sludges (Robles-González et al., 2008). The goal of this research was to assess the effect of solvent (silicone oil, 0 and 20% v/v) on lindane removal from an agricultural soil with high contents of clay and organic matter, using lab scale batch sequential methanogenic-sulfate reducing SBs.

Our matrix was a clayish soil with high contents of organic matter (8%), contaminated with 100 mg lindane/kg. Reactors were operated in a sequential mode (15 d methanogenic followed by 15 sulfate reducing, herein after sequential M-SR). Some units received 20% v/v silicone oil (letter S in the abbreviation) and were operated as triphasic SBs (soil-aqueous phase-solvent). All SBs were supplemented with sucrose (1g/L), bioaugmented with lindane-acclimated inocula, incubated, sampled, and analyzed as described in literature.

The M-SR reactor without silicone oil showed 66% lindane removal efficiency. Unexpectedly, units added with solvent exhibited a lower removal (54%). The second stage (the SR) contributed the most to lindane reduction. Only 4.5% of lindane was removed in the 15-d M stage whereas the SR stage was responsible for 59% disappearance of the pollutant. After 30 d operation chlorobenzene and 1-2 dichlorobenzene were detected in the slurry of control III and M-SR-S. Abiotic removal of lindane was very low (Control I).

Sequential M-SR-S reactors in our work showed performances superior to those reported for partially aerated methanogenic SBs treating the same soil (9.5 and 18% lindane reductions) and only methanogenic SBs (41%). In literature it was found a similar 62% removal of lindane after 60 d treatment of a sandy soil in batch methanogenic SBs, biostimulated with starch. Unexpectedly, our results were lower than those reported for sequential M-SR SB without silicone oil and without sucrose. Since the first stage methanogenic of SB operation contributed very little to lindane removal, it seems that the inclusion of a methanogenic stage in the process is not relevant or required. Lindane removal in control II (live soil and sterile lindane-clastic inoculum) suggested that the native soil microflora had a low-to-moderate capability to degrade lindane. Finally, we found there was no distinct, beneficial effect of silicone oil (solvent) on lindane removal from soil in sequential methanogenic-sulfate reducing SBs.