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"Gheorghe Asachi" Technical University of Iasi, Romania

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COMPARISON OF TRIPHASIC AEROBIC AND ANAEROBIC SLURRY BIOREACTORS FOR THE BIOREMEDIATION OF LINDANE-IMPACTED SOIL

W.E. Varo-Argüello[1], B. Camacho-Perez[1], E. Rios-Leal[2], P. Vázquez-Landaverde[3], M.T. Ponce-Noyola[2], J. Barrera-Cortés[2], N.F. Rindernknecht-Seijas[4], Hèctor M. Poggi-Varaldo[1*]

*[1]Environmental Biotechnology and Renewable Energies R&D Group, Department of Biotechnology & Bioengineering, CINVESTAV-IPN P.O. Box 14-740, 07000, México D.F., México; [2]Department of Biotechnology & Bioengineering, ibídem; [3]CICATA-IPN, Qro., México; [4]ESIQIE-IPN, México; *e-mail: hectorpoggi2001@gmail.com*

Abstract

Lindane is an organochlorine pesticide that has been widely used in Mexico and other countries. Because of its toxicity, persistence and bioaccumulation potential its use has been prohibited or restricted. The use of multiphasic slurry bioreactors for *ad-situ* and *ex-situ* soil bioremediation might improve lindane availability for biological degradation. Stimulation of bioremediation by use of a co-substrate along with bioaugmentation, and electron acceptors other than oxygen, can lead to increased degradation of a variety of xenobiotics. Therefore, we evaluated the effects of co-substrate and final electron acceptor (aerobic and sulfate-reducing) on the removal of lindane in triphasic lab scale slurry bioreactors.

The effect of 2 factors at 2 and 3 levels were evaluated: co-substrate sucrose (1 and 0 g/L; C or no symbol, respectively) and final electron acceptor (O_2, CH_4 and SO^-_4; or aerobic A, methanogenic M and sulfate-reducing SR, respectively). Abiotic controls were run (sterilized soil and inoculum). Bioreactors were implemented and operated as described elsewhere. Lindane and metabolites was analyzed according to literature.

Lindane removal followed the order A>SR>M. Supplementation with sucrose had a positive effect for all the electron acceptors, particularly for the anaerobic regimes.

The ANOVA indicated that there was a significant effect of factor 'electron acceptors' on removal of lindane ($p< 0.0001$). The order of removal A>SR>M was slightly different to that reported by some authors, who found SR>A>>M in experiments with lab scale slurry bioreactors without silicone oil. This was possibly due to the positive effect of silicone oil on oxygen transfer.

Sucrose supplementation had a significant effect on the removal of lindane ($p<0.0004$). Interestingly the increase of lindane removal was lower than expected probably due to the important amount of native soluble and degradable organic matter in the soil (3.6 g soluble BOD/kg).

Some authors obtained 100% removal of lindane in anaerobic slurry bioreactors; their high results could be ascribed to the use of a massive inoculum (8g VSS/L) and coarser texture of their soil.