

Talk

Accelerated soil diuron mineralisation by microbial consortia inoculation and enhancing bioavailability with cyclodextrin.



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ABSTRACT

The deleterious effects of pollution on human health, the functioning of biogeochemical cycles, erosion of biodiversity and more broadly on the entire biosphere, have become a major concern for modern societies. Diuron is considered a "Priority Hazardous Substance". In the case of diuron, biodegradation appears to be the major cause of diuron dissipation, although due to its high persistence, and hence, the likely formation of aged residues, these can be found in many environment such as soil, sediments and water. Especially in the case of diuron, where its principal metabolite, 3,4 dichloroaniline (3,4-DCA) is considered as highly toxic to different organisms.

Agricultural soils possess large and often highly diverse microbial communities that potentially can exhibit many degradative properties, and when these capacities are expressed fully and rapidly, organic chemicals are readily destroyed. To date, all the efforts invested in research on soil bioremediation have been applied to optimizing microbial activity by adding nutrients (bioestimulation), or adding microbial consortia (bioaugmentation). This techniques belong to the green technologies that are used to remove organic contaminants from environments. Another technique used to increase solubility was to add cyclodextrins which increase bioavailability of pollutant.

Different results were found for each of the consortium employed in this study, which were previously isolated using an enrichment technique from five agricultural soils that had been managed with pesticides for more than 10 years (C1,C2,C3,C4,C5). In solution medium, C2 consortium was able to mineralize a 88.6% of the diuron initially added to solution (10 ppm + 450 Bq). In the soil used in slurries conditions, time in days needed to reach a 50% of diuron mineralisation was drastically reduced, except when was inoculated C4. Afterwards, in a more realistic scenario under static conditions was observed 23.2% of global herbicide mineralisation with C1. By last, under static condition when cyclodextrin (CD) was used in combination with bioaugmentation (C1) a 42.2% of the extent of mineralisation was rised.

In conclusion, the combination of bioaugmentation and bioestimulation resulted in a successful strategy to speed up soil diuron biorremediation. CD, provoked a substantial improvement in diuron mineralisation due to the formation of an inclusion complex with diuron, which increased its solubility and hence bioavailability and mineralisation.

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