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Biodegradation of organophosphorus pesticides by soil bacteria

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A number of studies in the 1980s and 1990s showed that crop-protection products, applied to drained fields, could move downwards through the soil profile and to the groundwater. Organophosphorus insecticides (OPs) are used all over the world for crop protection, for other agricultural practices such as sheep dipping and, in aquaculture, for the control of sea lice. Ops besides showing a specific neurotoxicity and have also been related to various modern diseases, including Creutzfeldt–Jakob (CJD) and the Gulf War syndrome. Although OPs are less persistent than Organoclorine pesticides (OCs), they still constitute an environmental risks thus increasing the social concern about their levels in soils, surface waters, and ground waters. Degradation of OPs by microorganisms has been assessed for a few bacterial strains. In the present study the OPs degrading potential of indigenous soil microorganisms was investigated.

Using enrichment cultures in which parathion was the only C and energy sources many bacterial strains were isolated from OPs contaminated and pristine agricultural soils characterized by different physico-chemical properties. More than 40 potential OPs degraders were isolated and grouped in operational taxonomic units (OTU) using analysis of polymorphism showed by the ribosomal internal transcribed spacer (ITS). Partial sequencing of 16S rRNA gene of representative isolates of each OTU revealed that most of them belong to Proteobacteria and Actinobacteria. All the analyzed soils showed the presence of putative OPs degraders: the highest diversity was found in organic cultivated soils, the lowest in chemically cultivated soils.

Degradation of different OPs, characterized by different physical and chemical properties, was obtained by different selected representative strains using SPME GC-MS analysis on water and soil microcosms. The results showed that, after the incubation period, the amount of pesticide residues were in the range 20-80%. Some of the isolates bacterial species are currently unknown as OPs degraders.