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Soil enzymatic activities as potential indicators of organic soil pollution

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The massive quantity of industrial chemicals, fertilizers and pesticides used today represents an increasing environmental hazard. Especially in soil, these toxic compounds may produce negative, irreversible effects on the quality and health; they exert an influence on the microbiota with evident changes in enzyme activity, soil respiration, biomass and microbial counts.

Soil enzymes activities, particularly, have been suggested as suitable indicators of soil quality because: a) they are a measure of the soil microbial activity and therefore they are strictly related to the nutrient cycles and transformation; b) they are sensitive to variations induced by both natural and anthropogenic factors; c) they are easy to measure. Besides, they can be used as biomarkers of degradation and bioremediation processes.

In this study, a sandy clay loam soil was spiked, under laboratory conditions, with phenanthrene (150 ppm) or pentachlorophenol (50 ppm) as representative of PAH and chlorophenols, respectively. A set of enzymatic activities and several biochemical parameters, such as basal respiration, microbial biomass C as well as the routine physical-chemical properties were investigated over one year incubation. The enzymatic activities selected were β-glucosidase, phosphatase, dehydrogenase, urease and arylsulphatase, involved in the main biochemical cycles and microbial activity. The effect of two different rates of compost, 10 and 30 tons ha^{-1}, was also evaluated. A non phenanthrene- or pentachlorophenol-treated soil served as control.

Different responses were observed for the two considered systems. In the presence of phenanthrene, a simultaneous rapid increase of soil respiration, microbial biomass, phosphatase and arylsulphatase activities were measured, thereby suggesting that an

increased microbial growth and a consequent raised activity occurred. The increase of the biological properties was, however, evident only at the beginning of the incubation period, followed by a rapid decline with time. No apparent effects were observed with both the compost amounts.

Also the addition of pentachlorophenol resulted in an increase of the soil respiration and microbial biomass. By contrast, a constant behavior with time was observed for the enzymatic activities, in particular for dehydrogenase, arylsulphatase, and β-glucosidase, which showed lower values in the contaminated system as respect to the control.

In both cases, physical-chemical properties showed not significant differences in the presence/absence of the contaminants.

The temporary and permanent changes measured seem to indicate that soil biological investigations may provide useful information on the effects of pollutants on the metabolic activity of soil, and as such to function as a monitoring tool for evaluating the contamination/decontamination of a soil.

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