Geophysical Research Abstracts
Vol. 15, EGU2013-10631, 2013
EGU General Assembly 2013

The Utility of a Consortium of Microbial Enzymes as an Early Warning Tool for Monitoring Soil Pollution with Heavy Metals

Mohammad Wahsha (1), Claudio Bini (), Flavio Fornasier (), and Mamoon M.D. Al-Rshaidat ()

(2) University of Venice, Environmental Sciences, Venice, Italy (bini@unive.it, +39 412348584), (1) Marine Science Station, University of Jordan, Aqaba Section, Jordan, (3) CRA - Institute for Plant Nutrition, Gorizia section, Italy

Potentially Toxic Substances (PTS) in soils are of increasingly growing concern worldwide. Heavy metals are acting as one of the most serious groups of environmental contaminants, and their release into the environment has strongly increased over the last decades. Heavy metals can cause acute and long-term toxic effects on both human health and the ecosystems around. Toxic effects of heavy metals reach soil biota in general and affect the microbial community biomass and metabolic activities related to such communities. Although all members of the soil biota respond relatively to soil pollution, microbial communities are considered to be the first and most swift responders to such environmental pollutants.

This study focused on the state of the art of developing a consortium of different enzymes and how their collective activities could be used for the assessment and monitoring of soil in response to heavy metal pollution. By measuring microbial community biomass and activity from soil samples from Imperina Valley; an abandoned mine in Italy. Measurements covered heavy metal concentrations; soil physiochemical parameters, and enzymatic activity and biomass of soil's microbial community.

Results showed significant contamination at the sampled sites with different heavy metals ($p \leq 0.05$). With averages above the allowed limits in Italy: 2.12 mg Cd kg$-$ 1, 2.33 mg Cu kg$-$ 1, 9.63 mg Pb kg$-$ 1, 1.23 mg Zn kg$-$ 1 and 3.05 mg Fe kg$-$ 1. Enzymatic activities varied widely among the sampled sites, and were positively correlated with organic matter content.

Strong positive correlation was observed between leucyl aminopeptidase/chitinase, leucyl aminopeptidase/β–glucosidase, and β–glucosidase/chitinase, (0.999), (0.992), and (0.992), respectively. The above enzymes showed positive linear correlation with the organic carbon content of the sampled soils, with alkaline phosphatase showing the most significant correlation (0.726) among all.

This study clearly highlights in situ interactions between different patterns of PTS, represented by different combinations of heavy metals, and enzymatic activity of soil microbial communities'. Showing that changes in the activities of microbial community can precede some detectable changes in soil chemo-physical properties, and strongly supported the utility of using enzymatic activity of soil microbial communities' as an early warning tool for monitoring soil pollution with heavy metals, and demonstrating the type of interactions taking place between heavy metals, soil properties, and enzymatic activities.