RESEARCH PAPER:

Effect of mine spoils on soil and plant enzyme activity of rhizosphere soil

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SUMMARY

A pot culture experiment was conducted in the Department of Environmental Science, Tamil Nadu Agricultural University, Coimbatore to evaluate the role of enzyme activities in metal accumulation in magnesite and coal mine spoils. The activities of soil enzymes like phosphatase, dehydrogenase, amylase, plant peroxidases and plant catalases considerably increased in red soil compared to magnesite and coal mine spoils. The soil and plant enzyme activities were found to be higher in *Amaranthus* sp. grown in red soil (T1) compared to mine spoils. The activities of enzymes in soil and plant increased over time and 45th day sample recorded the highest activity of enzyme, after which it got reduced. The results indicated that enzyme activities of mine spoils decreased in the rhizosphere soil due to the low availability of nutrients in mine spoils compared to red soil.

Key words :
Mine spoils, *Amaranthus* sp., *Brassica* sp., Enzyme activity

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Mining is an anthropogenic activity that changes the soil profile, physical, chemical and biological properties. Soil disturbance caused by mining leads to loss of aggregation, decline in soil organic carbon, loss of soil structure, increased bulk density and reduced porosity (Shukla *et al*., 2003). Phytotransformation refers to the uptake of contaminants from soil and ground water and the subsequent metabolism or transformation by plants. Detoxification mechanisms may transform the parent chemical to nonphytotoxic metabolites stored in plant tissues. A thorough understanding of pathways and end products of enzymatic process will simplify toxicity investigation of *in situ* phytoremediation. Saxena *et al*. (1999) indicated that metals like mercury, selenium, argenic or chromium can be rendered harmless by either enzymatic reduction or by incorporation into toxic organic / metal compounds. These processes occur in nature and can be enhanced by genetic manipulation of plants through introduction of genes coding for enzymes responsible for the underlying biochemical reactions. Some plant ecotypes endemic to heavy metal polluted soils have been shown to contain heavy metal resistant enzyme for example, cell wall acid phosphatase. However, it is unlikely that the development of heavymetal resistant biochemical processes could be a viable heavymetal resistant mechanism (Salt *et al*., 1995).

MATERIALS AND METHODS

A pot culture experiment was conducted to evaluate the role of enzyme activities in metal accumulation in magnesite and coal mine spoils. The experiment was conducted in the Department of Environmental Science, Tamil Nadu Agricultural University, Coimbatore.

Treatment details:

T_1 -Red soil + *Amaranthus* sp., T_2-Red soil + *Brassica* sp., T_3 - Coal mine spoil + *Amaranthus* sp., T_4 - Coal mine spoil + *Brassica* sp., T_5 - Magnesite mine spoil + *Amaranthus* sp., T_6 - Magnesite mine spoil + *Brassica* sp.,

Replication : 3

Design : Factorial Completely Randomized Block Design (FCRD)

The soil and plant samples collected from the pot culture experiment at post germination (five and four days for *Amaranthus* and *Brassica* species, respectively), 45th day and post harvest stage were used for analyzing the enzyme activities. The soil phosphatase, dehydrogenase and amylase enzyme activities were analyzed in soil samples and peroxidase and catalase enzyme activities were analyzed in plant samples. The analysis for the soil and plant enzymes of the mine spoil samples were carried out as per the procedure given as below.