Nuclear microprobe studies of mycorrhizas from environment polluted by heavy metals

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Mycorrhizal symbiosis between plant roots and fungi is beneficial to the plants' adaptation to soils polluted by heavy metals. Apart of its role in the uptake and translocation of nutrients, the mycorrhizal fungi could attenuate the effect of heavy metals on plants. Knowledge of the differences in heavy metal distribution in plant roots could provide useful information for further research on detoxification mechanisms. The sensitivity and quantitative capabilities of micro-PIXE are essential in this type of studies, complementing the results obtained with SEM, TEM and EELS.

Mycorrhizas characterized using conventional and molecular methods were used for micro-PIXE analysis. Specimens of mycorrhizal and non-mycorrhizal roots collected from industrial wastes and control sites were cryo-fixed and freeze-dried. Elemental analysis was performed using the nuclear microprobe at the Materials Research Group, iThemba LABS, South Africa. Analyses using 3.0 MeV protons for heavy metal detection were complemented by measurements using 1.5 MeV protons for the detection of light elements (Mg, Al, Si, P). True elemental maps were obtained using GeoPIXE-I and GeoPIXE-II software, with matrix correction based on proton backscattering results.

Distribution of nutrients and heavy metals in different types of mycorrhizas (ectomycorrhiza, arbuscular mycorrhiza and orchid mycorrhiza) will be presented. The biofiltering effect of mycorrhiza against heavy metals will be discussed.

The results would allow the selection of the most effective mycorrhizas for practical use in polluted areas, as the development of restoration techniques requires extensive knowledge of the function of the mycorrhiza.