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## Solutions and Projections for Sustainable Soil Management

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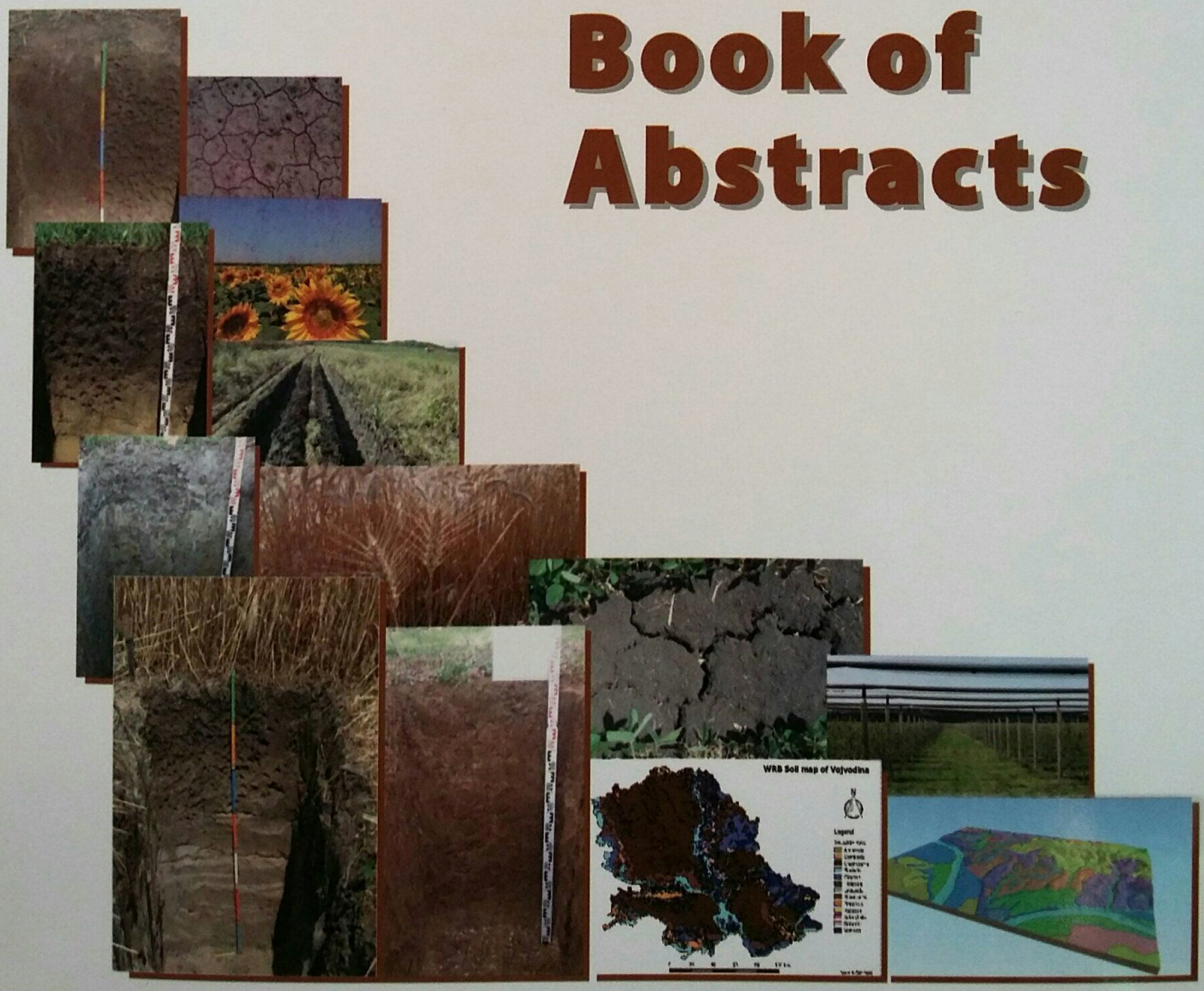
# Book of Abstracts



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# MONITORING OF LIGNIN BIODEGRADATION USING RESPIROMETRIC TEST AND GC×GC-MS

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**INTRODUCTION and OBJECTIVES:** Humic substances have an important role in soil fertility, plant nutrition and the stabilization of soil aggregates. They are divided into three components: humin, humic acids and fulvic acids. In nature, lignocellulose accounts for the major part of biomass and its degradation is one of the main contributors to the formation of humic substances. It is composed of polysaccharides (hemicelluloses and cellulose) and aromatic polymer (lignin). White and brown rot fungi are well known for their essential role in naturally occurring degradation of lignocellulosic biomass, which is enabled by secretion of extracellular ligninolytic enzymes. Composting is an aerobic process during which different waste products are partly mineralized and partly converted to humic substances. It has been claimed that during composting, lignin is the major contributor to the biosynthesis of humic acids. One of the most abundant forms of lignin is Kraft lignin, a byproduct of the alkaline sulfide treatment of lignocelluloses in the paper mill industry. The aim of this work was to investigate the potential of mixed culture of fungi to degrade kraft lignin. Degradation process was monitored with respirometric test to assess the $CO_2$ production and with comprehensive two-dimensional gas chromatography-mass spectrometry (GC×GC-MS), to identify the degradation products.

**MATERIAL and METHOD:** Five different fungal strains isolated from soil were inoculated into liquid mineral medium containing lignin (2.5 g/L) and glucose (1 g/L) as the only sources of carbon. Aerobic biodegradation of lignin was assessed using an open flow 12 chamber Micro-Oxymax respirometer (Columbus Instruments, USA). Degradation was monitored for 30 days, after which the degradation products were extracted with dichloromethane and analysed using GC×CG-MS (Shimadzu, Japan).

**RESULTS and CONCLUSIONS:** High metabolic activity of fungal cells toward lignin was confirmed respirometrically. The $CO_2$ production rate was significantly higher compared to the control sample. Also, oxygen uptake has increased compared to the control sample. The results of GC×GC-MS showed that kraft lignin sample inoculated with fungi contained several aromatic lignin-related compounds that were not present in control sample. The compounds identified in inoculated sample were mostly derivatives of phthalate, p-coumaric and benzoic acid. These results suggest that this fungal consortium can degrade lignin and their activity in the soil should be assessed next.

**KEY WORDS:** lignin, biodegradation, respirometer, GC×GC-MS