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Fate of the explosive TNT in Scots pine (*Pinus sylvestris*)

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Most of German former military sites are covered by woodlands which are dominated by conifers. Many of these areas are diffusively contaminated with explosives, mainly with TNT residues (2,4,6-trinitrotoluene). This causes our question, if coniferous trees may contribute to natural decontamination processes in explosive polluted soils (natural attenuation, dendroremediation). Therefore, three-years-old trees of sand cultivated Scots pine (*Pinus sylvestris*) were subjected to a seven-days pulse application with 45 mg l^{-1} of water solved ^{14}[C]-TNT.

It was shown that Scots pines were able to reduce the content of ^{14}[C]-TNT equivalents (TNTeq) in the planting substrate by transpiration driven tree uptake. Relative mass distribution showed that 96% of ^{14}[C]-TNT equivalents (TNTeq) taken up by pine trees remained in roots reaching concentrations up to 308 mg TNTeq kg^{-1} root dry matter. Only a small percentage was transported to above-ground tree compartments, i.e. wood (3%) and needles (2%). Extractability of TNTeq was low in roots (max. 14%) but higher in wood (31%) and highest in needles (40%). Thus, the bulk of TNTeq was obviously deeply metabolised and non-extractable bound in root tissue. Only low amounts of metabolites were translocated to above-ground tree parts. Extensive TNT metabolisation was verified by radio TLC analysis indicating that residual extractable TNTeq portions contained neither TNT nor known metabolites (e.g. amino-dinitrotoluenes and diamino-nitrotoluenes), but very polar unknown compounds. Distribution analysis of TNT derived radiolabel in non-extracted residues (NER) revealed that among cell wall components (lignin, hemicelluloses, and cellulose) lignin is preferred as final TNT residue deposition compartment.

It is concluded that long living coniferous trees like Scots pine are not only fitted for sustainable dendroremediation of TNT contaminated soils, but all-year transpiration, low nutrition requirement and intrinsing TNT tolerance also qualifies conifers to be superior in TNT remediation compared to deciduous trees.

Keywords: phytoremediation, dendroremediation, explosives, 2,4,6-trinitrotoluene (TNT), conifer, *Pinus sylvestris*, Scots pine

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