Binding of RDX to cell wall components of *Pinus sylvestris* and *Picea glauca* and three-year mineralisation study of tissue-associated RDX residues

Bernd Schoenmuth[1*], Detlef Schenke[2], Tanja Scharnhorst[1], Sandra Combrinck[3], Robert I. McCrindle[3], Jakob O. Mueller[1], Carmen Büttner[1] and Wilfried Pestemer[1]

[1] Humboldt University Berlin, Faculty of Agriculture and Horticulture, Department of Crop- and Animal Sciences, Division Phytomedicine, Lentzeallee 55/57, D-14195 Berlin, Germany

[2] Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants, Institute for Ecological Chemistry, Plant Analysis and Stored Product Protection, Koenigin-Luise-Str. 19, D-14195 Berlin, Germany

[3] Department of Chemistry, Tshwane University of Technology, Private Bag X680, Pretoria 0001, South Africa

*Address correspondence to Bernd Schoenmuth, Lentzeallee 55/57, D-14195 Berlin, Germany.
E-mail: berndschoenmuth@yahoo.de

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Abstract

Contamination of soils with the explosive hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX, Research Department Explosive) as a result of military applications is a large-area problem globally. Since coniferous trees dominate the vegetation of large areas of military land in Central Europe, particularly in Germany, the long-term fate of ^{14}C-RDX in the conifers Scots pine and Dwarf Alberta spruce was studied. Acetic acid was the most effective solvent for the removal of extractable RDX residues from homogenates of RDX-laden tree material (85%, 80-90% and 64-80% for roots, wood and needles, respectively). On average, only a fifth of RDX-derived ^{14}C was bound in non-extractable residues (NER). Within the main cell wall compartments, lignin was the dominant binding site for NER (needles: 32-62%; roots: 38-42%). Hemicellulose (needles: 11-18%; roots: 6-11%) and cellulose (needles: 12-24%; roots: 1-2%) were less involved in binding and a considerable proportion of NER (needles: 15-24%; roots: 59-51%) was indigestible. After three-year incubation in rot chambers, mineralisation of tree-associated ^{14}C-RDX to $^{14}CO_2$ clearly dominated the mass balance in both tree species with 48-83%. 13-33% of ^{14}C-RDX-derived radioactivity remained in an unleachable form and the remobilisation by water leaching was negligible (< 2%).

Keywords: phytoremediation; dendroremediation; hexahydro-1,3,5-trinitro-1,3,5-triazine; *Picea glauca*; *Pinus sylvestris*; cell wall binding; indirect mineralisation