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Influence of rendzina amendment on metal mobility in mining affected immature soil, Ronneburg, Germany

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In the former U mining area of Ronneburg, remains of the more than 40 years lasting mining period still affect the environment even after remediation. Such low-contamination sites are well suited to study phytoremediation approaches combining plants, microbes and soil amendments (Hazen and Tabak, 2005; Ruttens et al., 2006). At the basement area of the heap 'Absetzerhalde Kanigsberg' a test site was designed to study amongst others the effect of rendzina addition (= calcareous topsoil; 20 Vol%) to mining affected soil and its benefits for plant growth. In the recent work, we compared the soil-physical, mineralogical and geochemical parameters of the original mining affected soil (KBS) and the rendzina-treated one (KBR). While the texture was silty-clayey for both materials, the pH($CaCl_2$) was acidic (3.5) for KBS and slightly alkaline (7.2) for KBR. By XRD besides quartz, feldspars and clay minerals, in KBR calcite and dolomite were additionally identified. Both minerals caused higher contents of total carbon (KBS: 0.3 g/kg; KBR: 19.6 g/kg). High bulk contents were determined for Al, Fe, and K for both substrates, while Ca and Mg were higher in KBR. For U 10.5 μ/g were measured in both materials, but sequential extraction (according to Zeien and Brümmer, 1989) revealed a different distribution among the bioavailable fractions (F1+F2). While in KBS a higher proportion of U was retained in the specifically adsorbed fraction (F2), it was mainly in the mobile fraction (F1) for KBR. These results were confirmed to certain extent by U batch elution tests (Solid/Liquid (S/L)=1/10, eluent=H_2O) carried out in time steps of 1 to 21 days, where the U concentration in the eluate was higher for KBR. A similar behaviour was found for Ca, Mg and Sr. A possible explanation might be mobilization by complexation with carbonate-ligands (Elless and Lee, 1998). The eluate concentrations of Al, Cd, Co, Cu, Mn, Ni and Zn were lower for KBR than for KBS. In order to check the transferability of these results to field conditions, soil solution samples were taken *in situ*, resulting in similar observations for Al, Ca, Sr, Co, Ni, Zn, but not Mg, Mn and U. Besides a different S/L ratio, e.g. Eh or reaction time may cause this difference. A closer look on processes behind will be part of future studies. In summary, the addition of rendzina improves the growth conditions for plants with regard to pH and metal mobility, except for U. Thus, this method is well-suited for phytostabilisation approaches aiming on the accumulation of U in plant roots due to higher mobility in soil.
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