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Remediation of per- and polyfluoroalkyl substances (PFASs) contaminated soil and groundwater; evaluating the performance of activated carbon in column tests

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Remediation of sites contaminated with per- and polyfluoroalkyl substances (PFASs) is key to reduce the contamination of drinking water sources and subsequent human exposure. PFAS production and use is increasingly being restricted worldwide with a reduction of point sources; however, legacy plumes are still posing a threat due to the persistence of these chemicals against degradation. One of the most widely studied soil remediation techniques for PFASs is stabilisation, which results in the long-term entrapment of the contaminants with the addition of fixation agents in the subsurface, aiming to prevent their leaching from soil to groundwater. In relation to this, the aim of this study was to identify the leaching behaviour of various PFASs in a treatment scenario using activated carbon. Silt loam soil sampled from central Sweden was used, as well as a mixture of the soil with activated carbon at 0.1% w/w. Spiked artificial groundwater was prepared with a mixture of 21 PFASs, at a total concentration of 1.4 μg mL^{-1}. The sorption of PFASs to the solid phase was investigated using 15 cm-long column experiments under saturated conditions. Uniform packing of the material was validated through non-reactive tracer tests. The desorption behaviour after treatment was also investigated, by switching the inflow from contaminated to clean water after steady state was achieved. Analysis of the compounds was conducted using ultra performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). Results have shown significantly increased sorption in soil amended with activated carbons compared to the untreated soil. Additionally, there was a positive correlation between the length of the perfluorocarbon chain and sorption efficiency. The study is a step towards increasing our understanding on the efficiency and longevity of stabilisation with activated carbons as a remediation strategy for PFAS-contaminated soils and groundwater.