Electrodialytic per- and polyfluoroalkyl substances (PFASs) removal mechanism for contaminated soil - DTU Orbit (26/08/2019)

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Contamination of soils with per- and polyfluoroalkyl substances (PFASs) is a global problem, in particular at fire-fighter training sites due to the usage of PFAS-containing aqueous fire-fighting foams (AFFFs). In this study, an electrodialytic remediation method was applied for the first time to remove PFASs from contaminated soil. The electrodialytic remediation system was evaluated in a laboratory-scale experiment with current densities of 0.19mAcm⁻² and 0.38mAcm⁻² over 21 days, using PFAS-contaminated soil from a fire-fighter training site at Stockholm Arlanda Airport, Sweden. Of the 23 PFASs targeted, significant (p < 0.05) PFAS electromigration towards the anode was observed for C₃-C₇ perfluoroalkylcarboxylates (PFCAs) (PFBA, PFPeA, PFHxA, PFOA) and C₄, C₆, and C₈ perfluorooalkane sulfonates (PFSAs)(PFBS, PFHxS, PFOS) since these PFASs were predominantly negatively charged. In contrast to the electromigration of the charged PFASs, N-methyl perfluorooctane sulfonamide (MeFOSA), perfluorooctane sulfonamidoacetic acid (FOSAA) and ethyl FOSAA (EtFOSAA) showed significant (p < 0.05) transport towards the cathode, which is probably attributed to electro-osmotic flow of these predominantly neutralPFASs. Mass balance calculations showed that for the shortest-chained PFASs (i.e., PFBA, PFPeA, PFHxA,PFBS, and PFHxS), up to 20% was extracted from the soil to the anolyte, which showed that electrodialysis is a possible in-situ remediation technique for PFAS-contaminated soil.

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