Abstract

[Research Title]

Development of Behavior Prediction Methods and Effective Removal Technologies for Perfluorinated Compounds in Soil and Water Systems

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[Abstract]

We developed behavior prediction methods and effective removal technologies for perfluorinated compounds in soil and water systems. In order to determine the distribution and penetration characteristics of PFASs contamination in the vertical direction, a total of five soil boring explorations were conducted in Okinawa and Osaka, and the elution characteristics and content of 35 PFASs including precursors were clarified in a total of 122 m of core samples. Main achievements are described below.

1) We improved the procedure of Higgins & Luthy (2006) and clarified the analysis procedure to obtain a recovery rate of 88~109%. In addition, we clarified the improvement of the TOP Assay method, which has been used for environmental water and sludge, to apply to soil samples, and made it possible to analyze the potential for PFASs generation in soil.

2) We examined a test method to compare the contamination of PFOS and PFOA with the standards when they were included in the Soil Contamination Countermeasures Act. In the vertical distribution, it was shown that long-chain PFASs accumulate in the organic soil layer, PFASs are distributed chromatographically in the vertical direction in the ryukyu limestone layer, and PFHxA and other substances also move horizontally through groundwater.

3) We conducted batch tests and a column tests to clarify the delay coefficients in soil and groundwater. The relationship between soil properties and material transfer parameters was evaluated, and it was found that TOC and ignition loss were positively correlated with the partition coefficient.

4) We collected past cases of PFASs contamination and established a method for evaluating the mass transfer of PFOS and PFOA in groundwater. In the development of a new adsorbent, it was shown that the hydrophobic group of the amphiphilic molecule does not have a double bond, and that the double membrane in the liquid crystal phase is effective in adsorbing PFOS and PFOA.

5) Various solvents such as water, ethanol, methanol, and acetonitrile were added to the actual contaminated soil at different concentrations, and batch shaking tests were performed, and 35 types of

PFASs including precursors were analyzed. Continuous column tests were conducted using actual PFOS-based and PFOA-contaminated soils, and it was shown that 80% acetonitrile was useful for PFOS-based contaminated soils and water was useful for PFOA-contaminated soils. In addition, we have developed a recovery technology to selectively separate and reuse PFOS and PFOA using NF membranes that use charge repulsion.

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