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Bio-Mimetic Foam Fractionation Technology for the Treatment of Per- and PolyFluoroAlkyl Substances (PFAS) in Contaminated Water

Authors : Hugo Carronnier, Wassim Almouallem, Eric Branquet

Abstract : Per- and polyfluoroalkyl Substances (PFAS) are a group of man-made refractory compounds that have been widely used in a variety of industrial and commercial products since the 1940s, leading to contamination of groundwater and surface water systems. They are persistent, bioaccumulative and toxic chemicals. Foam fractionation is a potential remedial technique for treating PFAS-contaminated water, taking advantage of the high surface activity to remove them from the solution by adsorption onto the surface of the air bubbles. Nevertheless, traditional foam fractionation technology developed for PFAS is challenging and found to be ineffective in treating the less surface-active compounds. Different chemicals were the subject of investigation as amendments to achieve better removal. However, most amendments are toxic, expensive and complicated to use. In this situation, patent-pending PFAS technology overcomes these challenges by using rather biological amendments. Results from the first laboratory trial showed remarkable results using a simple and cheap BioFoam Fractionation (BioFF) process based on biomimetics. The study showed that the BioFF process is effective in removing greater than 99% of PFOA (C8), PFOS (C8), PFHpS (C7) and PFHxS (C6) in PFAS-contaminated water. For other PFAS such as PFDA (C10) and 6:2 FTAB, a slightly less stable removal between 94% and 96% was achieved while between 34% and 73% removal efficiency was observed for PFBA (C4), PFBS (C4), PFHxA (C6), and Gen-X. In sum, the advantages of the BioFF presented as a low-waste production, a cost and energy-efficient operation and the use of a biodegradable amendment requiring no separation step after treatment, coupled with these first findings, suggest that the BioFF process is a highly applicable treatment technology for PFAS contaminated water. Additional investigations are currently carried on in order to optimize the process and establish a promising strategy for on-site PFAS remediation.

Keywords : PFAS, treatment, foam fractionation, contaminated amendments
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