Reducing Per-and Polyfluoroalkyl Substances (PFAS) Water Contamination With Mycorrhizal Hydroponics Plants

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Per- and polyfluoroalkyl substances (PFAS), known as "forever chemicals", are one of the most common and dangerous water pollutants, having carcinogenic effects and causing 382,000 global deaths annually. Current methods to purify PFAS-contaminated water can cost millions of dollars and require existing infrastructure, making them difficult to implement in low-income and rural areas without industrial treatment plants. Hydroponics plants colonized by beneficial mycorrhizal fungi present an affordable and sustainable solution to purifying PFAS-contaminated water. In this study, mycorrhizal-inoculated basil and lettuce plants were cultivated in hydroponics systems under controlled conditions. Root samples were stained and analyzed under a light microscope to confirm mycorrhizal presence. PFAS was added to the systems and an LC/QQQ-MS instrument was used to measure the reduction in PFAS concentrations over 72 hours. Results showed that mycorrhizal plants removed 71.1% of PFAS in a water system compared to 59.9% by non-mycorrhizal plants, and t-test (p-value=0.00367) was used to prove statistical significance. Relative health of plants was measured through root length, with results revealing that mycorrhizal plant roots were 2.8 inches longer on average than non-mycorrhizal roots. Further analysis revealed a direct relationship between plant root length and PFAS purification, indicating the suitability of species with naturally longer roots for real-world phytoremediation applications, such as at stormwater detention ponds. This study provided a proof-of-concept of the effectiveness of mycorrhizal hydroponics plants in reducing PFAS contamination in water systems, presenting applications as an inexpensive and large-scale purification system.

Awards Won:
Second Award of $2,000