Combating PFAS Contamination: Developing a Sensor for Detection in Drinking Water

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Per- and polyfluoroalkyl substances (PFAS) are groups of persistent environmental contaminants that have been linked to adverse health effects, including immune system dysfunction and liver damage. Despite their high presence, even in drinking water, regulatory oversight remains limited. Currently, only 30 states have implemented PFAS regulations, among which only 11 have standards for drinking water. This gap is primarily because current detection methods are expensive, laboratory-dependent, and lack the sensitivity and portability required for on-site detection. To address this challenge, this research focuses on the development of a low-cost, portable sensor for trace-level PFAS in drinking water. In this study, an interdigitated, dual gold electrode was microfabricated onto a glass substrate, where a vial cap was attached to the electrode using double sided adhesive. 0.1 uL of a 0.05 mg/uL sorbent suspension was drop-casted onto the electrode. Two sorbent materials, CrMIL-101 and polyaniline, were evaluated for PFAS adsorption efficiency and sensor performance. It was hypothesized that the CrMIL-101 sorbent would have a higher PFAS capture due to its higher surface area and porous framework. Results showed that the sensor produced with the CrMIL-101 has the best performance with 99.61% accuracy, thereby validating the hypothesis and proving the feasibility of producing a cost-effective, onsite detection device. The difference in effectiveness of the CrMIL-101 and the polyaniline indicates the importance of hydrophobicity and electrostatic interaction in PFAS adsorption. Overall, the developed sensor represents a significant advancement in rapid, on-site PFAS detection, which could facilitate regulation implementation, ultimately contributing to reduced PFAS exposure

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