

Polydopamine incorporated Graphene Oxide Membranes for Sustained Charge-based Arsenic Rejection

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Abstract

In this work, a novel graphene oxide (PGO) nanofiltration membrane was prepared to selectively remove both As(V) and As(III) from water. Our novel coating methodology incorporates polymer in GO membrane through in-situ polymerization during membrane formation. The resulting nanofiltration (NF) membrane exhibits high structural stability and >95% long-term arsenic rejection performance. In addition, the membrane maintains performance across a wide pH and pressure range and works in the presence of other heavy metal contaminants. Through the incorporation of polymer, not only has the interlayer spacing of graphene oxide (GO) nanosheets been appropriately regulated but also an improved anti-swelling property has been achieved. The dosage of GO, reaction time with polymer, and mass ratio of polymer to GO have been optimized to achieve a high-performance membrane. Arsenic concentration in ground water is predominantly in ppb levels, and our membrane exhibits excellent arsenic removal performance in varying concentration ranges till 1000 ppb. The resultant PGO membrane has exhibited excellent long-term stability and maintains a steady arsenic rejection which brings down the permeate arsenic concentration always below the specified WHO limit of 10 ppb. Moreover, the rejection mechanism of the PGO membrane is a synergistic effect of charge repulsion and size exclusion which is confirmed by zeta potential and molecular weight cutoff measurements. Results have indicated that PGO could be considered as a promising candidate for simultaneous and selective filtration of As(V) and As(III).

References

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- [2] Siddique TA, Dutta NK, Roy Choudhury N. Nanofiltration for Arsenic Removal: Challenges, Recent Developments, and Perspectives. *Nanomaterials* (Basel). 2020 Jul 6;10(7):1323.

Figures

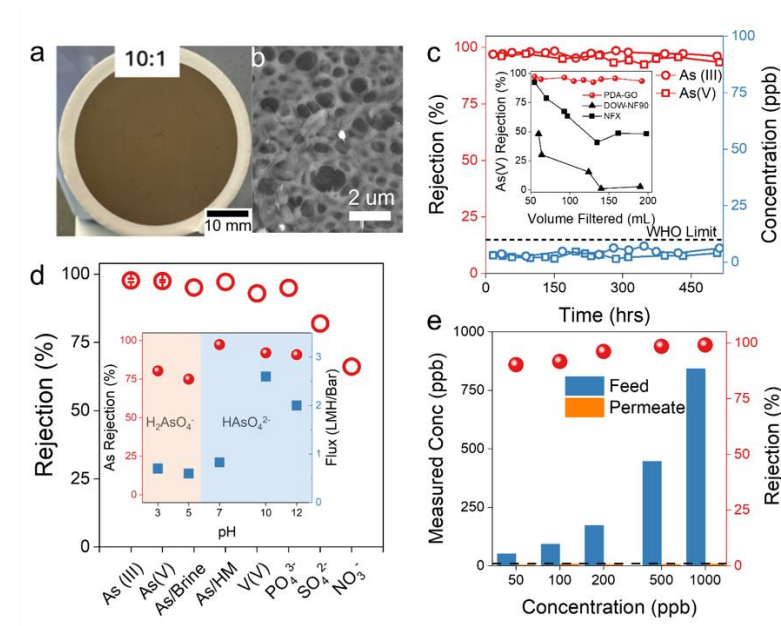


Figure 1: Arsenic rejection performance of PDA/GO membrane. a, Optical image of a 50 nm PDA/GO membrane coated on PES substrate. (Scale bar 10 mm) b, SEM image of the surface of the membrane showing irregular surface structure. (Scale bar 2 μm) c, Long-term (~3 weeks) stability of PDA/GO membranes. d, Rejection of various anions by the PDA/GO membrane. e, Measured concentration and rejection percentage of arsenic at different feed concentrations.