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High-performance synthesis of functionalized graphene oxide nanosheets for water remediation

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Covalent modification of graphene oxide (GO) is a widely exploited strategy to tailor the surface and structure of graphene and enable new applications.[1] In recent years, a plethora of modified GO have been engineered and proposed as specific sorbent materials for water purification from organic and metallic contaminants[2]. However, scale-up methods optimization to produce modified GO is required to guarantee large amount of the targeted materials and reproducible batch purity levels. Here we report a microwave (MW) accelerated synthesis combined with microfiltration (MF) on commercial hollow fiber modules. This procedure enables fast and scalable preparation of highly pure polyethyleneimine (PEI) modified GO nanosheets. Moreover, we demonstrate the suitability of GOPEI as adsorbent of arsenic and lead and organic contaminants from tap water[3]. PEI functionalization turns the surface charge of GO nanosheets form negative (Z_{Pot}= -23.2 mV) to positive values (Z_{Pot}= 14.9 mV) this allowing the removal of anions generally not removed by GO nanosheets. Alongside with the removal kinetic a mechanism insights will be provided.

References

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[2] N. Yousefi, X. Lu, M. Elimelech and N. Tufenkji, Nat. Nanotechnol., 2019, 14, 107–119.
[3] S. Mantovani, S. Khaliha, L. Favaretto, C. Bettini, A. Bianchi, A. Kovtun, M. Zambianchi, M. Gazzano, B. Casentini, V. Palermo, M. Melucci, Chem. Commun., 2021,57, 3765-3768

Figures

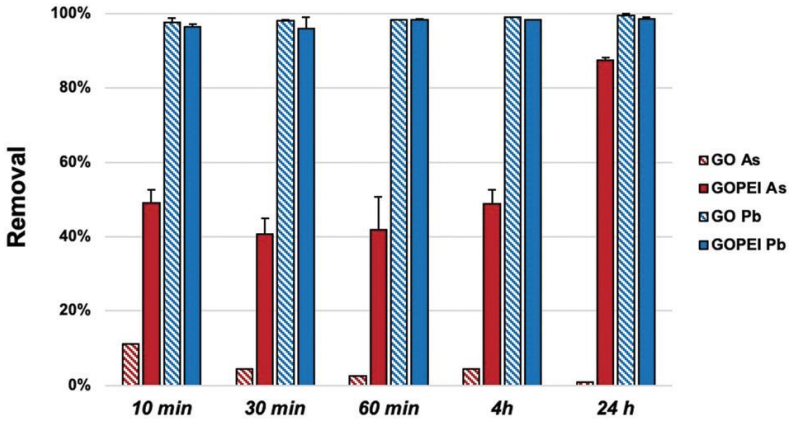

Figure 1: As and Pb adsorption kinetics C_i = 100 µg/L (each), (pH = 7.0). And solid/liquid ratio of 13 mg/30 mL.