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Graphene related materials nanosheets and technologies for drinking water treatment

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Standard Water treatment technologies based on both adsorption and filtration do not allow complete removal of drinking water contaminants. For example, Granular activated carbon (GAC), the benchmark industrials sorbent, fails on metal contaminants and on short chain perfluoroalkyl substances (PFAS), just to mention a few. New materials, approaches and technologies are urgently required to the face the increasing occurrence of Emerging contaminants (EC's) in ground and surface water, ultimately affecting drinking water safety. Graphene-related materials (GRM) have shown great potential in water purification due to the high surface area and multiple interactions pathways with organic molecules. [1] Despite the high number of papers published on GRM promoted adsorption of contaminants, comparison between these materials and standard technologies is not always possible due to the different experimental conditions used. Here we report the comparison of the adsorption properties (kinetics, selectivity, adsorption capacities) of different GRM nanosheets including graphene oxide (GO), reduced GO (rGO), graphene nanoplatelets (GNP) and chemically modified nanosheets.[2][3] A mixture of contaminants of concern (i.e. PFAS, pharmaceuticals and dyes) is considered and the performance are compared to that of GAC through standardized protocol. Molecular dynamic simulations are also exploited for unraveling the interactions driving the adsorption. Finally, in order to overcome secondary contamination, we also describe a scalable and automatized procedure for water purification based on tandem adsorption on GO nanosheets and microfiltration Recovery and reuse of both GO and microfiltration modules is described.[4]

References

[1] S. Khaliha et al., FlatChem, 29 (2021) 100283
[2] S. Khaliha et al., Environmental Science: Water Research & Technology (2023)
[3] S. Khaliha et al., Chemical Communications, 58 (2022) 9766-9769
[4] S. Khaliha et al., Separation and purification technologies, 300 (2022) 121826.

Figures

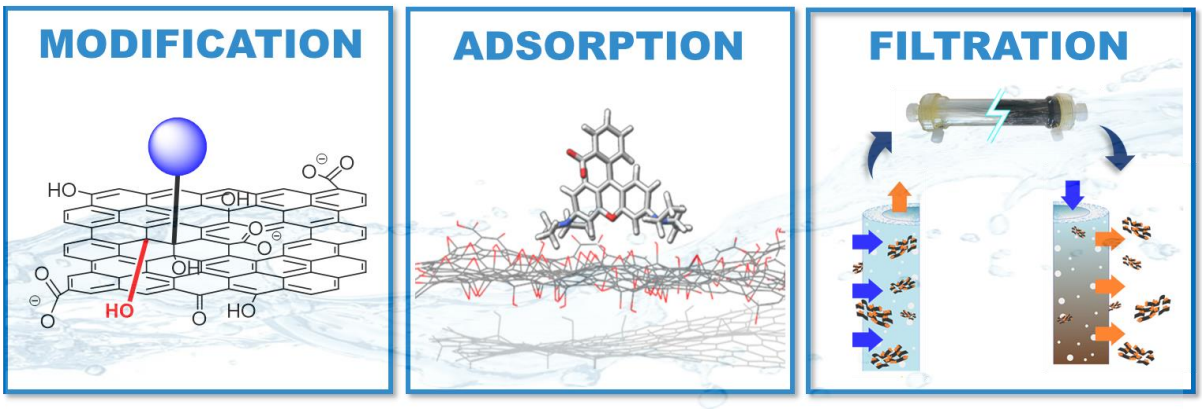

Figure 1: Graphene oxide and modified graphene oxide used as sorbent for drinking water purification.