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Reduced graphene oxide for triazine herbicides adsorption: experimental design and response surface methodology.

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Pristine graphene oxide and its thermally reduced derivatives, rGO, were tested for the removal of triazines (Atraton, Prometryn and Atrazine) from water. The reduction process was optimized by means of Design Of Experiments (DOE) coupled with Response Surface Methodology (RSM), relying on the adsorption efficiency of the material.

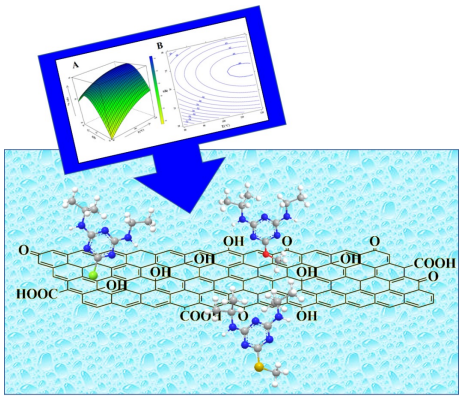

Figure 1. Thermally reduced GO films for the removal of triazines from water: DOE coupled with Response Surface Methodology

The optimal reduction conditions were calculated at a temperature of 110 °C kept for 24 hours; the mildest and simplest reduction protocol was chosen, as it allows the in-air heat treatment with a common laboratory oven.
All the adsorbent materials have been characterized before use, confirming a partial reduction process that, leaving intact most of the oxygenated functionalities on the graphene skeleton, still allow favourable adsorption of pollutants through both hydrogen bonds and $\pi-\pi$ interactions, which result from the large conjugated polyaromatic system.
Triazine analyses were performed by HPLC; the data obtained from the adsorption isotherms were fitted with the Langmuir and Freundlich models, highlighting a slightly different adsorption behaviour of Atraton and Prometryn compared with Atrazine. The maximum adsorption capacity obtained was 4.4 mg/g for Atrazine, 19.4 mg/g for Atraton and 18.4 mg/g for Prometryn, at room temperature.

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