Contribution ID: **462** Type: **Oral Presentation**

Laboratory scale demonstration of cationic organics removal by graphene oxide nanosheets injection in porous media

Monday, 30 May 2022 10:50 (15 minutes)

Graphene oxide nanoparticles (GONPs) are promising materials for the adsorption of a broad set of environmentally relevant contaminants, such as organic aromatic compounds, heavy metals, dye molecules, pharmaceuticals (Iqbal and Abdala, 2013; Zhou et al., 2016). Moreover, thanks to their small size, GONPs can be injected in the subsurface and effectively migrate within groundwater (Beryani et al 2020). Therefore, due to its high sorption capacity and high subsurface mobility, this material has a good potential for being employed as a remediation agent for enhanced in-situ soil washing of secondary sources of groundwater contamination (i.e. the controlled recirculation of a washing GO suspension via injection/extraction wells).

In this study, the capability of GONPs to remove organic contaminants was characterized at the laboratory scale. Methylene blue (MB) was opted as a model molecule representative of these contaminants of concern, which could be absorbed by GONPs in aquatic environments. MB is a common aromatic, water soluble, cationic dye which has been reported as a major pollutant of water resources because of its carcinogenicity and other health adverse effects on aquatic organisms and humans. Additionally, MB removal processes can be representative of other contaminants removal procedures since electrostatic interactions, π-π stacking and hydrogen bonds are the most effective phenomena governing all adsorption processes.

Laboratory tests included batch tests, aimed at assessing the capability of GO to adsorb MB, and column desorption tests, aimed at evaluating the efficacy of GO as a washing agent to remediate MB-contaminated sand columns.

The adsorption experiments demonstrated that GO is highly effective in the rapid adsorption of MB. The results indicated a maximum sorption capacity of 1.6 mgMB/mgGO in moderately alkaline conditions. This is an extremely interesting removal efficiency in view of a technical application in water purification.

The desorption experiments, which were performed injecting a 50 mg/L GO suspension into a sand column artificially contaminated with MB, showed a high potential of GO nanosheets to accelerate the removal of MB from contaminated sand compared with the use of deionized water only. The GO-flushing allowed to recover more than 25.8% of the adsorbed MB after only 3 pore volumes and 42.4% after 10 pore volumes. Only 8.1% and 8.3% of MB was instead recovered after the same water injection times. The results open positive perspectives for the potential application of GO for groundwater reclamation purposes. In particular, a GO-assisted soil flushing can be envisioned. In this way, fast desorption of contaminants strongly adsorbed on the aquifer solid matrix can be promoted, thus allowing for the treatment of secondary sources of contamination.

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Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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