Hierarchical porous adsorbents based on graphene/montmorillonite hybrids and containing high surface area hyper-crosslinked resins

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Porous materials characterized by high specific surface area (SSA) and adsorption capacity have attracted great scientific attention for their potential applications in water and air remediation.

Among microporous materials, hyper-crosslinked resins (HCLR) stand out for their low density and for the possibility of tailoring their porous structure and functionalities, which are pivotal features in order to modulate the material adsorption capacity [1]. Recently, we obtained high surface area HCLR by a very versatile synthetic process based on the bulk polymerization of vinylbenzyl chloride (VBC) and divinylbenzene (DVB) followed by Friedel-Crafts reaction. This procedure was effectively exploited to realize tailored high SSA systems, either by grafting specific organic moieties or embedding functional nanostructured fillers within the resin, with the aim of enhancing their adsorption capacity and selectivity towards organic contaminants [2,3].

Graphene based hydrogels and aerogel, on the other hand, are widely investigated in the field of adsorption because of the possibility to exploit the graphene excellent surface properties [4,5].

In this contribution, we propose reduced graphene oxide (rGO) / montmorillonite (MMT) based macroporous hydrogels and aerogels containing hyper-crosslinked resins for the adsorption of organic pollutants from water and air. Hybrid rGO/MMT hydrogels containing HCLR were obtained by promoting the graphene oxide reduction through a thermal treatment in presence of ascorbic acid and corresponding aerogels were obtained by freeze-drying. Hydrogels and aerogels were tested for the adsorption of model organic contaminants from water and air, respectively. Results demonstrated that tailoring the composition of the hybrid materials allows to enhance the adsorption towards specific class of pollutants. Thus, the engineering of HCLR in rGO/MMT hydrogels and aerogels is a promising strategy to obtain hierarchical porous materials highly effective to sequester organic contaminants from water and air.

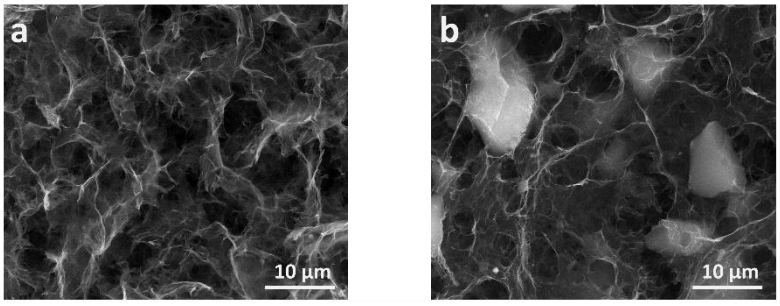

Figure 1. SEM images of rGO/MMT (a) and rGO/MMT/HLCR (b) aerogels.

References:

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