

Development of a highly sorbent material based on Graphene-coated hollow silica microspheres for contaminant removal

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Abstract

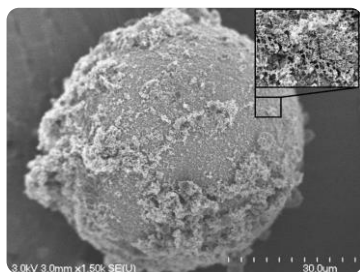
During the last decades, graphene materials showed a tremendous research attention because of their broad and promising applications. Graphene is a two dimensional carbon allotrope, which is a one-atom-thick sheet of carbon atoms in a hexagonal arrangement. It has unique optical, electrical, mechanical, and thermal properties. [1-2] The graphene has an extremely high specific area (theoretical value of $2630 \text{ m}^2 \cdot \text{g}^{-1}$) and a large delocalized π -electron system that can form a strong interaction with organic molecules. Because of these interesting characteristics, graphene can be considered as a good sorbent choice. Using graphene by itself as a high-performance pollutant sorbent might be challenging; it is inconvenient to handle in water base solutions because of the hydrophobic nature of the graphene. This phenomenon reduces drastically the adsorption capacities of the graphene due to the aggregation. Combining graphene with silica microspheres helps to overcome these difficulties. Since the graphene is held on top of the silica microspheres, it gives a good handling and convenience and allows a full expression of the adsorption sites.

Materium Innovations Inc. has recently developed graphene-silica materials based on the coating of hollow silica microspheres with graphene layers using a chemical grafting process or a plasma deposition process (Figure 1). According to preliminary results, Materium graphene-coated silica hollow microparticles shows some good adsorption properties especially with polyphenolic compounds, aromatic compounds, terpenes, proteins and hormones. Indeed, combining hollow silica microspheres with the graphene makes Materium's product a good candidate for the use as a sorbent for contaminant removal.

References

- [1]. Science **2015**, *347*, 1246501.
[2]. Nature **2006**, *442*, 282.

Figures



Silica-graphene composite material (in development)

- ⦿ Particle size : 10 μm , 30 μm , 50 μm , 130 μm , 250 μm
- ⦿ Very low density: 0.08 – 0.3 g/cm^3
- ⦿ High surface area (> 300 m^2/g)
- ⦿ Functionalized with polar or non-polar groups

Application

- ⦿ Adsorption & purification adsorbent

Figure 1: Left: SEM images of a silica-graphene microparticle produced using plasma deposition process, Right: physico-chemical characteristics.