Geophysical Research Abstracts
Vol. 20, EGU2018-2434, 2018
EGU General Assembly 2018

Multifunctional carbon nanotubes-iron oxide-Ag composite for water purification

Bhaskar Bhaduri, Maya Engel, Tamara Polubesova, and Benny Chefetz
Hebrew University of Jerusalem, Soil and Water Sciences, Israel (bhaskar.bhaduri19@gmail.com)

Carbon-based nanomaterials have received much attention due to their variable chemical and biological applications. The introduction of supporting magnetic solids into carbon-based nanoparticles has gained interest due to their easy separation from heterogeneous system. The addition of Ag to the nanoparticle composite provides nanoparticles with both catalytic and antibacterial activity. In this work, we synthesized nanoparticles comprised of single walled carbon nanotubes and Fe3O4 (25 wt. (%)), and enriched with Ag (1.4 wt. (%)) aiming to develop a multifunctional composite, which maintains both high catalytic and antibacterial activities, thus being efficient for water purification. Structure and physico-chemical properties of the prepared composite were evaluated using SEM, BET, FTIR, XPS and TGA. The composite showed high catalytic activity: complete reduction (by NaBH4) of the organic pollutants o-nitrophenol, p-nitrophenol, 2-methyl-p-nitrophenol and organic dye methyl orange occurred in 7, 15, 15 and 20 min, respectively. The composite retained more than 90% of its catalytic activity after three regeneration cycles. The presence of dissolved organic matter, at an environmentally relevant concentration of 5 mg C/L did not affect the catalytic activity of the composite. The presence of dissolved organic matter at 50 mg C/L decreased reduction of p-nitrophenol, 2-methyl-p-nitrophenol, and methyl orange by 10%.
The Ag-enriched composite showed excellent anti-bacterial activity toward both the gram negative Escherichia coli and the gram positive Bacillus subtilis. Bacteria levels in solution were reduced by 4-orders of magnitude in 2 h of exposure to the composite. Toxicity of the composite material was further confirmed by Live/Dead fluorescence staining test.
Our results indicate that the synthesized cost-effective single walled carbon nanotube-Fe3O4-Ag multifunctional composite is highly efficient for water purification from organic pollutants and bacteria.