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Green synthesis of Fe nanoparticles for chromate removal

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Nano-zero valent iron (nZVI) is considered as a powerful reductant for a wide number of pollutants due to their large specific surface area and their high reactivity. A novel green synthesis procedure was used for the one step production of nano zero valent iron particles (nZVI) using raw materials with a high polyphenol content. Plant extracts contain active polyphenol compounds, which reduce the trivalent iron to iron nano-particles by combining extracts with ferric iron salts. This method for producing nZVI is considered the most environmental friendly.

The aim of this research was to examine the extracts of *Camellia sinensis* (green tea, GT), *Syzygium aromaticum* (clove, CL), *Mentha spicata* (spearmint, SM), Punica granatum juice (pomegranate, PG) and Red Wine (RW) as alternative raw materials for the synthesis of stable nZVI dispersions. The most favorable extraction conditions (contact time and volume: mass ratio) were evaluated for each material and mixing conditions of Fe(III) with extracts/juice (volume ratio) were tested in order to improve the reduction of Fe(III) to Fe(0). The maximum reduction to the elemental state Fe(0) was about 35% (22mM) and was obtained using red wine and pomegranate juice in mixing ratio VFe/Vjuice=2/1. Green tea and grind cloves performed similar efficacy in nZVI synthesis with maximum concentration about 18mM. Spearmint extracts were less effective.The nZVI suspensions which were prepared with GT, RW, and PG juice were subsequently examined for the removal of hexavalent chromium from a 0.96 mM solution in batch experiments. It is found that in all tests complete reduction of Cr(VI) was achieved, in less than 5 minutes, when stoichiometric excess of nZVI to Cr(VI), ie nZVI/Cr(VI)>1.5mole/mole was applied.

Biography

Mystrioti Christiana has a bachelor degree in Mining and Metallurgical Engineering, from National Technical University of Athens (NTUA), Greece (2008) and a Master of Science in Environment and Development from NTUA, 2010. Currently, she is a PhD candidate in the School of Mining and Metallurgical Engineering (NTUA). This research is co-financed by (CHARM) LIFE 10 ENV/GR/000601 a project titled “Chromium in Asopos Groundwater System: Remediation Technologies and Measures (CHARM)” aims to contribute significantly to the solution of this complex problem that seriously threats sustainable development of groundwater bodies.

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