AIR-STABLE NANOSCALE ZERO-VALENT IRON PARTICLES: ROLE OF AMINO ACIDS

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Abstract

Nanoscale zero-valent iron (NZVI) particles are advanced remediation agents which are able to rapidly transform many environmental contaminants to harmless products. From the structural and chemical points of view, NZVI particles are $\alpha$-Fe crystallites with sizes ranging between several units to hundred nanometers in diameter. Currently, the suitable stabilization of NZVI particles is a very important practical aspect preventing rapid chemical oxidation of nanoparticles as well as their aggregation in dispersion. Molecules used as stabilizers have to be non-toxic and biodegradable because of the further environmental application of stabilized NZVI particles. Amino acids seem to be suitable candidates for this task. Therefore, our contribution deal with possible stabilization of NZVI particles prepared by wet chemical synthesis in the presence of suitable amino acids. Namely, L-glutamic acid, L-arginine and L-cysteine are chosen in our study. The effect of each employed amino acid on the surface, magnetic and chemical properties of NZVI particles was monitored by $^{57}$Fe Moessbauer spectroscopy, SQUID magnetometry, X-ray powder diffraction, IR absorption spectroscopy, and BET surface area analysis. According to our results, the most perspective air-stable NZVI particles are prepared in the presence of L-glutamic acid. They reveal almost 90% of $\alpha$-Fe (regarding Moessbauer subspectrum area) even three months after the synthesis. Moreover, factors influencing the final outcomes of the synthesis are not only the nature of amino acid, but also the oxidation state of iron in precursor and mutual ratios of reducing agent versus iron salt...

Keywords: Nanoscale zero-valent iron, amino acids, Moessbauer spectroscopy.

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