CHARACTERIZATION OF IRON NANOPARTICLES IN ENVIRONMENTALLY RELEVANT MEDIUM

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Abstract

Production and use of nanomaterials in a variety of industrial, medical and cosmetics applications are increasing every year. Consequently, the risk of nanoparticles release to the environment during all stages of their life cycle is evident. Nanoparticles can significantly differ in physicochemical properties from their counterparts, thus actual safety data sheets cannot be in agreement with reality. In this study, we used a commercially available powder of nanoparticles for water remediation, NANOFER STAR (two and four month old batches) and a powder of hematite nanoparticles; both materials are stable in aerobic conditions. The nanomaterials were suspended in river water (pH 8, 390 µS/cm), artificial river water (pH 8, 550 µS/cm, 5 mg/L humic acid) and in ultra-pure water as a control for one month at laboratory temperature. The artificial river water was prepared as a simple model of river water adding phosphate buffer, sodium chloride and humic acid into ultra-pure water. The analysis by Differential Centrifugal Sedimentation (DCS) and Dynamic Light Scattering (DLS) showed the environmental substances in the river water played a significant role in the nanoparticle behaviour. In general, the nanoparticles were more stable in the ultra-pure water and artificial river water than in the river water. Interestingly, in the river water, the nanoparticles organised into two populations of different particle sizes. The particle size increased in the order: two months old NANOFER STAR, four months old NANOFER STAR, and hematite. It seems that the more stable population of particles are less oxidised as it is expected that the older batch of NANOFER STAR is more oxidised.

Keywords: NANOFER STAR, Hematite, Environmental media, Nanoparticle characterization, DCS, DLS

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