SYNTHESIS OF WATER SOLUBLE MAGNETIC MWCNT-FE COMPOSITES AS A POTENTIAL DIAGNOSTIC TOOL

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Abstract

Various types of multiwall carbon nanotube (MWCNT) based nanosystems were investigated and their potential in medicine as Magnetic Resonance Imaging (MRI) contrast agents and as guided drug delivery systems have been verified. A magnetic iron nanoparticle embedded MWCNTs and the a variety of their easy surface modifications make them very attractive for multimodal applications. MWCNTs filled with three specific amounts of iron were synthesised by means of a floating catalyst chemical vapour deposition (FCCVD) route. Afterwards, three oxidation protocols were explored and verified in order to identify the best one for producing a highly soluble and biocompatible material. Ultracentrifugation was used to sort the resulting MWCNT-iron composite nanostructures by length. A quality of the structures was characterised by scanning electron microscopy (SEM) and high resolution transmission electron microscopy (HRTEM). A thermogravimetrical analysis allowed to estimate the amount of iron in both as prepared and oxidised MWCNT/Fe's. Qualitative and quantitative studies on functionality presence were completed by means of Raman Spectroscopy, Infrared Spectroscopy, respectively. Superconducting Quantum Interference Device (SQUID) and NMR studies allowed to verify the magnetic nature of nanocomposites. A facile solubilisation technique, resulting in particles that remained suspended for months, was performed. The MWCNTs filled with well-defined ellipsoidal shaped iron particles i.e. dimensions and chemical composition were prepared. Significant enhancements in MRI contrast were observed. The MWCNT/Fe before and after functionalization were verified in term of cytotoxic effect. We believe that these results are a good base for further research and might lead to tissue-selective or externally guided, "intelligent", MRI contrast and drug delivery agents.

Keywords: MWCNT, CVD, hydrophilic

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