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Evaluation of the coordination of a phosphonic acid-based ligand to the surface of zerovalent iron nanoparticles

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Iron-based nanoparticles are very popular materials due to their interest for biomedical applications such as magnetic resonance imaging, magnetic hyperthermia, drug delivery or in other areas of nanomedicine. However the potential of these nanoparticles is limited by the poor magnetic properties of iron oxides from which they are made of. Zerovalent iron nanoparticles would be more suited given their higher magnetization properties but the synthesis of stable colloidal solutions in water is very challenging due to dipolar interactions and oxidation. Zerovalent iron nanoparticles, with good control of size and cristallinity, are synthetised in non biological media (organic solvants) and present at their surface different coordinated ligands used as stabilizers. Their transfer into water which is mandatory for biomedical applications requires to master the complexity of their surface chemistry in order to avoid their dissolution or total oxidation in aqueous medium.[1] Few work has been done in this direction and only silica coating was succesfully experimented up-to-now,[2] confirming that aggregation of zerovalent iron nanoparticles could be prevented and their oxidation limited in water. As an alternative to silica coating we present here the potential of a poly(ethylene oxide)-phosphonic acid ligand [3] to coordinate onto the surface of zerovalent iron nanoparticles. The anchoring of this ligand allows to passivate the iron nanoparticles and to impart them with water solubility thus affording a well-suited nanomaterial for biomedical applications. The strategy of the synthesis which takes benefit from coordination chemistry concepts [4] and the characterization of the so-obtained nanomaterial will be detailed.

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Carotenoids determination of citruses agro-industrial waste materials using supercritical extraction technique and high performance liquid chromatography

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The present research concerns the extraction of carotenoids from Citruses - tangerine and orange agro-industrial waste materials carried out in a dynamic supercritical fluid - carbon dioxide (SC-CO2) extraction system. The carotenoids - beta-carotene and lycopene obtained in organic extracts were quantified using a new, rapid, effective and selective developed and validated HPLC method. The effects of operating pressure and temperature, extraction time, flow rate of the SC-CO2, sample size and solvent nature used were investigated. The optimal conditions for extraction were found. The method was developed using RP-18 endcapped LiChroCART 4 x 250 mm, 5 µm column with gradient elution of mobile phase A and B;

The method was validated with respect to system suitability test, specificity, linearity-range, accuracy, precision, limit of detection (LOD) and quantitation (LOQ). The stability of solutions were studied as well.

The calibration curve is linear over a concentration range 6.497– 0.081 µg/mL for beta-carotene (r^2=0.99924) and 18.76 – 0.34 µg/mL for lycopene (r^2=0.99990); The LOD and the LOQ are 0.081 µg/mL and 0.041 µg/mL for beta-carotene, 0.034 µg/mL and 0.085 µg/mL for lycopene, respectively; No interference was observed; The main accuracy is 106.8 % for beta-carotene and 101.4 % for lycopene.

The content of each carotenoid per 1 g of dried agro-industrial waste material varies for beta-carotene 0.445 – 3.972 µg (tangerine peel), 0.833 – 2.455 µg (orange peel) and for lycopene 0.051 – 179.988 µg (tangerine peel), 0.091 – 0.114 µg (orange peel).

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