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Investigation of the ability of direct coating of amino acids to iron oxide nanoparticles

D. T. L. Galhena, N. V. Chandrasekharan, K.M. Nalin de Silva and Rohini M. de Silva*
Department of Chemistry, University of Colombo, Colombo 03

In the last decade, nanotechnology has developed to such an extent that it has become possible to fabricate, characterize and specially tailor the functional properties of nanoparticles for biomedical applications and diagnostics. In the field of biotechnology and biomedicine, preparation and processing of magnetic nanoparticles have been motivated due to their strong magnetic properties and low toxicity. Magnetic iron oxide nanoparticles in particular, has many applications in biological and medical fields such as bio-separation, drug or gene delivery, immobilization of proteins, peptides, amino acids and enzymes, magnetic resonance imaging and thermogenesis to kill tumor cells under an *ac* magnetic field. To explore its bio applications, the development of biocompatible surface is crucial. And also the nature of surface coatings and their subsequent geometric arrangement on the nanoparticle determine its bio-kinetics and bio-distribution in the body**.** Amino acids, which can provide biocompatibility, high solubility and hydrophilic properties, are one of the most promising materials serving as protective layers on iron oxide nanoparticles. Besides their role in proteins, amino acids have many biologically important functions. They often function as chemical messengers in the communications between cells and are important intermediates in various metabolic processes. According to literature there are so many publications on coating of amino acids to iron oxide nanoparticles. Nevertheless, all these studies focused on adding amino acid to a linker which has already been attached to the nanopartcles. In this study we report, functionalization of pre-synthesized iron oxide nanoparticles with amino acids in basic medium as this has many potential bio medical applications. This approach is straight forward and directly immobilizes the amino acid on to the nanoparticle surface without any linker and this type of direct coating has not been previously reported. For this work sixteen amino acids were selected, of which eight amino acids namely, threonine, arginine, valine, glycine, aspartate, glutamate, leucine, tryptophan have been coated. Functionalization of iron oxide nanoparticles surface with amino acids was confirmed through FT-IR spectra. Modifications observed at 1600-1400 cm^{-1} of the COO^- stretching region and at 3200 cm^{-1} of NH stretching region in the IR spectra of the nanoparticles indicate the presence of bound amino acids on to their surface.

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