International Conference & Exihibition on
Analytical and Bioanalytical Techniques 2010
ANANBIOANAL - 2010
Pharmaceutical R & D Summit
doi:10.4172/2155-9872.1000086

Using ATR- FTIR for Detection of Immobilized Biomolecules on Amino Acid Functionalized HAp Nanoparticles

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Surface functionalization nanoparticles (size <100 nm) with bioactive molecules is a rapidly expanding field in current biomaterial research and it should be of great interest to fine-tune the bioactivity of such nanoparticles by surface functionalization using water-soluble biomolecules. Calcium hydroxyapatite or calcium phosphate (HAp, $Ca_{10}(PO_4)_6(OH)_2$) nano-particles which is the main inorganic constituent of the bones and teeth has been used as a model system. In this regard, amino acids were selected as ideal candidates for surface functionalization for production of bioinorganic HAp nanoparticles and bionanocomposites due to their relative low cost, intrinsic biocompatibility and ability to interact with HAp surfaces. This paper highlights, in the first part, synthesis of amino acid-functionalized hydroxyapatite (HAp-AA) nanoparticles with uniform size and having rod-like morphology which was achieved by wet chemical process with $Ca(OH)_2$: H_3PO_4 : amino acid. Fourier transform infrared-attenuated total reflectance (FTIR-ATR) spectroscopy had been used to quantify to determine carboxylate group of the amino acid which was preferentially bound to the surfaces of hydroxyapatite nanoparticles. Variations in the size and shape of the HAp nanoparticles functionalized with different amino acid were consistent with differences in the strength of binding at the HAp surfaces. Second part of the paper describes enzyme immobilization on these functionalized HAp nanoparticles and FTIR-ATR spectroscopy was used for detection of relative proportion of enzyme loading on HAp.