

Abstract

Project Code: TRG5780063

Project Title: Synthesis and Characterization of Amino Acid-Driven Biodegradation of Amino Acid-Incorporated Mesoporous Silica Nanoparticles

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Project Period: 3 years

Abstract

Synthesis of amino acid-incorporated mesoporous silica nanoparticles (aâ-MSNs) is reported. Three amino acids, i.e., glycine, aspartic acid and cysteine, are selected. Amino acid is first conjugated with 3-isocyanatopropyl triethoxysilane before co-condensation with tetraethoxysilane in the presence of hexadecyltrimethylammonium bromide to form aâ-MSNs. Characterization using TEM, FTIR, ²⁹Si CP-NMR and nitrogen sorption are collaborately performed. TEM reveals that incorporated amino acid disturbs pore arrangement of hexagonally ordered aâ-MSNs. Hydrophilic amino acids, like glycine and aspartic acid, leads to the formation of small elongated particles, whereas hydrophobic amino acid, cysteine, yields bigger rod-like particles. Degradation studies in acetate buffer (pH 5.2) and PBS (pH 7.4) shows that aâ-MSNs degrade faster and to the larger extent than that of control MSNs. Type of amino acid designates rate and behavior of particle degradation, as displayed in morphology and size of degraded particles. Degradation degree of aâ-MSNs incubated in trypsin is much higher than solely using buffer, due to trypsin specific cleavage at urea bond. Hydrophilic and nucleophilic side chain of aspartic acid, i.e., carboxylate anion, is responsible for the highest degradation among all samples. These data verify the role of amino acid as degradation promoter, which enable aâ-MSNs benign carrier for biomedical field.

Keywords: Amino acid, mesoporous silica nanoparticles, degradation