

Synthesis of hollow mesoporous silica nanospheres using sacrificial polystyrene templates for drug delivery applications

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Hollow mesoporous silica nanospheres (hmSiO_2 NSs), with large cavity and permeable mesoporous shell, have recently gained increasing attention owing to their application potential in cancer imaging and therapy. In this work, we have reported the synthesis of hmSiO_2 NPs, using polystyrene (PS) nanospheres as sacrificial template, by hydrolysis and condensation of tetraethylorthosilicate (TEOS) in presence of CTAB and subsequent characterizations for structural, morphological and thermal properties. This method involves the synthesis of polystyrene nanospheres as core template followed by in situ deposition of mesoporous silica on the PS spheres and removal of the inner PS core and CTAB on calcination to produce hmSiO_2 NSs. The structural, morphological and thermal properties of hmSiO_2 NSs were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscope (TEM), Fourier transform infrared (FTIR) spectrophotometer, and thermo gravimetric analysis (TGA). TEM analysis confirmed the spherical morphology of hmSiO_2 NSs with diameter in the range of 200–300 nm and wall thickness ~ 100 nm with pore diameter ~ 2 –4 nm. The outer surfaces of hmSiO_2 NSs were further functionalized with polymer and investigated for drug-delivery application by an in vitro method using doxorubicin as a model drug. MTT assays on macrophages cells demonstrated the non-toxic nature of both bare and polymer coated hmSiO_2 NSs. Thus, prepared nanoparticles with high surface area, large pore volume, good chemical and thermal stability, water dispersibility and low toxicity show promising potential for applications in biomedical field including targeted drug delivery in cancer diagnosis and treatment in near future.

Biography:

Mohd Qasim obtained B.Sc. (Hons) in Chemistry, M.Sc. in Physical Chemistry and MTech in Nanotechnology from the Aligarh Muslim University, India. Currently, he is pursuing PhD in Nanoscience and Technology at the School of Engineering Sciences and Technology (SEST), University of Hyderabad, India under the supervision of Dr. Dibakar Das. His research interest mainly covers development of multifunctional nanomaterials and its applications. He published several research papers in refereed Journals and conference proceedings and has presented his research work in various national and international conferences.