Synthesis and Characterizations of Silica Nanoparticles by a New Sol-Gel Method

B. Gorji1*, M.R. Allahgholi Ghasri2, R. Fazaeli1, N. Niksirat1

1Department of Chemistry, Islamic Azad University, South Tehran Branch, Tehran, Iran
2Department of Chemistry, Islamic Azad University, Shahr-e-ray Branch, Tehran, Iran
(Received 14 Dec. 2011; Final version received 23 May. 2012)

Abstract
Silica nanoparticles were synthesized by chemical methods from tetraethylorthosilicate (TEOS), polyethylene glycol 5% and hydrochloric acid 0.001 N. The sol-gel process was applied for the preparation of nano silica gel. This method is hydrolysis and condensation reactions of TEOS as precursor of silica. The optimal synthesis conditions for the preparation of silica nanoparticles were obtained and the produced silica nanoparticles were characterized by x-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The results indicated that the silica nanoparticles were successfully formed. The prepared samples change from amorphous to α-crystallite phase. The XRD analysis indicated the amorphous structure of the synthesized silica nanoparticles while the SEM and TEM images exhibited monodispersedNano sized silica particles with a size about 34 nm. In this study, the soft process of sol-gel reaction is favourable from a view point of energy conservation. Additionally, the advantages of this technique were the purity of products and ability to control nanometer sized internal structure.

Keywords. Silica nanoparticles, Tetraethylorthosilicate, Sol-Gel process, Characterization.

Introduction
Nanoporous materials have stimulated increasing interests due to their extensive applications in the fields of catalysis, drug delivery, chemical sensors, chromatography, microreactor and biological images [1-6]. Nano silica has been proven to be a very promising material due to its low density, good thermal and mechanical stability, and chemical inertia [7-9].

* Corresponding author. Dr. Banafsheh Gorji, Department of Chemistry, Islamic Azad University, South Tehran Branch, Tehran, Iran. Email: banafsheh_gorji@yahoo.com, Tel: +9821- 88830820, Fax:+9821- 88828956.