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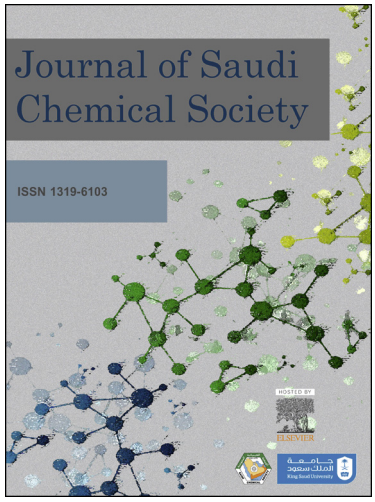

Original article

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Synthesis of Mn_3O_4 nanoparticles via a facile gel formation route and study of its phase and structural transformation with distinct surface morphology upon heat treatment

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Abstract

Mn_3O_4 nanoparticles (NPs) were synthesized from the reduction of $KMnO_4$ with glycerol at 80 °C in aqueous media via a gel formation route. In order to investigate the thermal stability and phase transformation, Mn_3O_4 NPs were subjected to heat treatment from 200 °C to 700 °C. The formation of different MnO_x species observed by X-ray diffraction (XRD) measurements showed temperature dependent phase transformation occurring during the heat treatment process. XRD patterns showed that Mn_3O_4 NPs were formed at a temperature of 80 °C and two new phases Mn_5O_8 and Mn_2O_3 were appeared at 350 °C and 700 °C respectively. The three different oxides having their distinct surface morphologies *viz.*, spherical, rod and cube shape respectively, were observed. Detailed morphological and structural investigations using Field Emission Scanning Electron Microscopy (FESEM), XRD, Thermo Gravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC) revealed the temperature dependent phases, crystal structures, lattice constants, particle sizes and surface morphologies of the MnO_x species.

Keywords: Tetragonal Mn_3O_4, monoclinic Mn_5O_8, cubic Mn_2O_3, structural transition, nanorod.

1. Introduction

Manganese (Mn) oxides have been considered as promising materials due to their wide range of potential technological applications such as catalysts, electrochemical materials, ion-exchanging materials, high-density magnetic storage media, etc. [1-4]. They have also stimulated a special interest due to their high reduction potential with unique oxidative properties. For instance, it has been reported that Mn-oxides can efficiently oxidize many