Journal of Molecular Liquids 220 (2016) 747–754

Contents lists available at ScienceDirect

Journal of Molecular Liquids

journal homepage: www.elsevier.com/locate/molliq

# Photodegradation of organic dye using strontium tungstate spherical-like nanostructures; synthesis and characterization

Hojatollah Hossainian [a], Masoud Salavati-Niasari [a,*], Mehdi Bazarganipour [b]

[a] Institute of Nano Science and Nano Technology, University of Kashan, Kashan, P.O. Box. 87317–51167, Islamic Republic of Iran
[b] Nanotechnology and Advanced Materials Institute, Isfahan University of Technology, Isfahan 84156-83111, Islamic Republic of Iran

ARTICLE INFO

*Article history:*
Received 14 January 2016
Received in revised form 27 April 2016
Accepted 28 April 2016
Available online xxxx

*Keywords:*
Nano
Surfactant
Tungstate
Microscopy
Catalyst

ABSTRACT

Rod-likestrontium tungstate nanostructures have been successfully prepared via the co-precipitation process by using $Sr(Sal)_2$ (Sal = salicylidene) and sodium tungstate dehydrate ($Na_2WO_4 \cdot 2H_2O$) as starting materials. The as-prepared rod-like nanostructures were characterized by X-ray diffraction (XRD), Fourier transform infrared (FT-IR) spectra, Energy Dispersive X-ray microanalysis (EDX), Photoluminescence (PL) spectroscopy, Transmission electron microscopy (TEM), and Scanning Electron Microscopy (SEM). The effect of parameters such as temperature, solvent and surfactant were considered to obtain the best condition. Moreover, adsorption of Rhodamine B (RhB) dye on strontium tungstate nanostructures was investigated and the uptake% was determined to be >80% in 240 min.



## 1. Introduction

Strontium tungstate, one of the Scheelite-type tetragonal metal tungstates, is very motivating for a diversity of requests, suchas photoluminescence, light emitting diodes, solid state Raman lasers, optical fibers, scintillating materials, humidity sensors, and catalysts [1–6]. It belongs to $I4_1/a$ space group with two formula units per primitive cell. Each of W atoms is restricted by four equivalent O atoms creating the $[WO_4]^{2-}$ tetrahedral configuration, and each divalent strontium atom distributes corners with eight adjacent O atoms of $[WO_4]^{2-}$ tetrahedrons [3,4].

It is recognized that the physical properties of nanomaterials are powerfully correlated to their crystallite size and their morphology. Therefore, controlling the size and morphology of nanostructures is yet a main challenge [7–16].

The physical and chemical properties of metal tungstates are related to the construction route. A number of procedures have been progressed over the past decade to increase the applications of metal tungstates prepared by a range of procedures, such as czochralski procedure and pulsed laser deposition [17,18], wet-chemistry methods involving precipitation [19], polymeric precursor [20], solvothermal [21], microwave radiation [22,23] and micro emulsion-mediated approach [24,25]. Herein, we utilize the coprecipitation route to prepare $SrWO_4$ nanostructures. The co-precipitation route is preferred as facile synthetic approach due to its flexibility and simplicity. The coprecipitation route is a good synthesis approach for synthesis of many inorganic powders.

This investigation offers the precipitation synthesis of the $SrWO_4$ nanostructures. The route is novel, inexpensive, attractive, short reaction time, simple, and effective, as contrasted to the conventional ones. The products have small particle size without the requirement of any further calcinations and high purities. To the best of our knowledge, it is the first time that strontium salicylate, $Sr(Sal)_2$, is used as Sr source for the synthesis of $SrWO_4$ and effects of different parameters on the morphology, size and crystallization of strontium tungstate via a coprecipitation method are investigated. The photocatalytic activity of the $SrWO_4$ nanostructures was also evaluated by the degradation of RhB dye in aqueous solution under visible light irradiation for the first time.

## 2. Experimental

### 2.1. Materials and experiments

All the chemicals used in our experiments were of analytical grade, were purchased from Merck and used as received without further purification. The XRD patterns were recorded by a Rigaku D-max C III, X-ray diffractometer using Ni-filtered CuKα radiation. SEM images were obtained on Philips XL-30E SEM equipped with an energy dispersive X-ray spectroscopy. GC-2550TG (Teif Gostar Faraz Company, Iran) were used for all chemical analyses. Fourier transform infrared spectroscopy (FT-IR) was recorded with Shimadzu Varian 4300 spectrophotometer in KBr pellets. EDS analysis was obtained on Philips EM208. Room

* Corresponding author.
*E-mail address:* salavati@kashanu.ac.ir (M. Salavati-Niasari).

http://dx.doi.org/10.1016/j.molliq.2016.04.129
0167-7322/

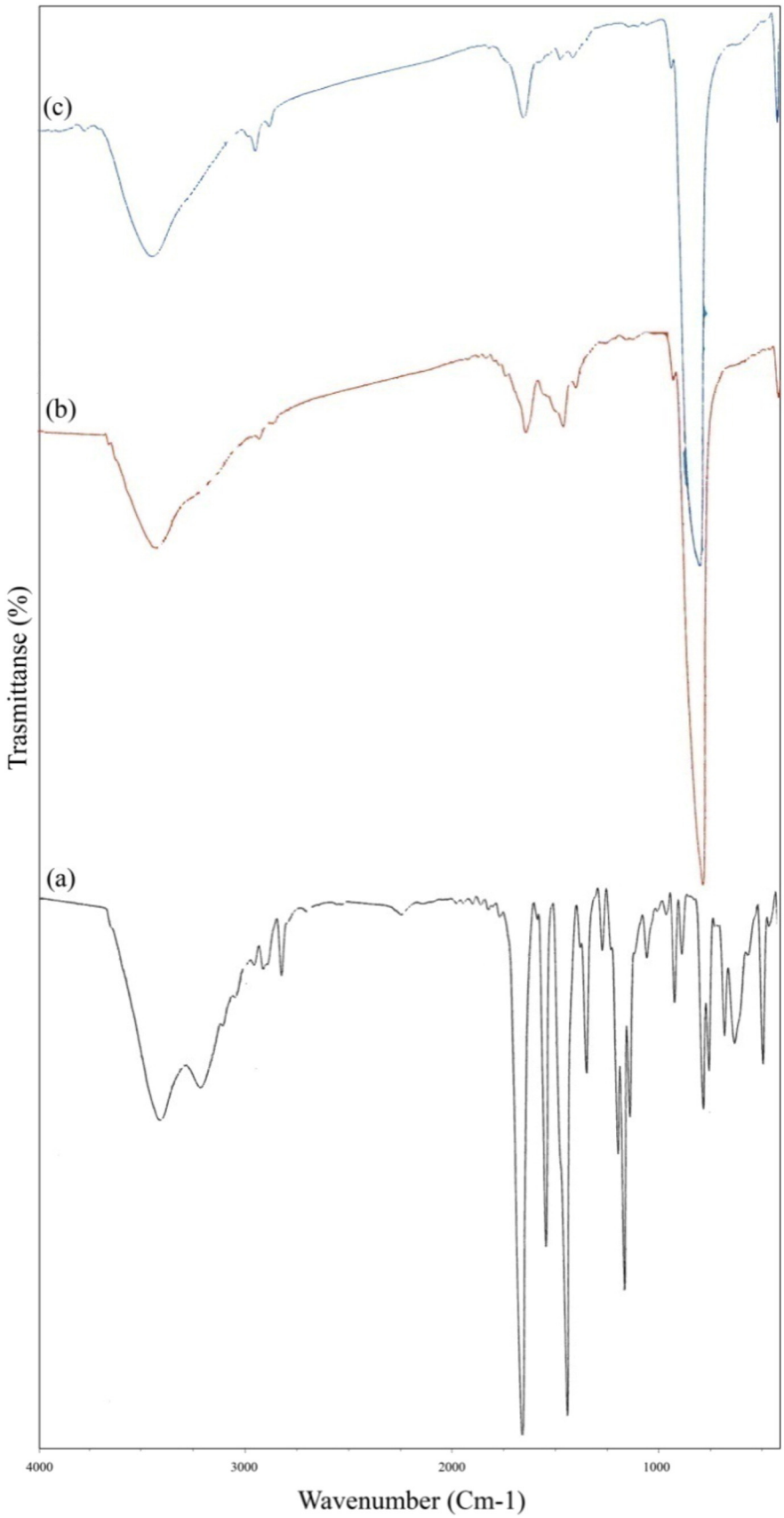


**Fig. 1.** FT-IR spectra of: (a) $Sr(Sal)_2$, (b) $SrWO_4$ (in methanol), (c) SrWO4 (in presence of CTAB).