Materials Letters 223 (2018) 178–181

Contents lists available at ScienceDirect

Materials Letters

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

Featured Letter

pH triggered curcumin release and antioxidant activity of curcumin loaded γ-Fe_2O_3 magnetic nanoparticles

P.B. Patil [a], S.B. Parit [b], P.P. Waifalkar [c], S.P. Patil [d], T.D. Dongale [e], Subasa C. Sahoo [f], P. Kollu [g,h], M.S. Nimbalkar [d], P.S. Patil [c], A.D. Chougale [b,*]

[a] Department of Physics, The New College, Kolhapur, MS, India
[b] Department of Chemistry, The New College, Kolhapur, MS, India
[c] Thin Film Materials Laboratory, Department of Physics, Shivaji University, Kolhapur, MS, India
[d] Department of Botany, Shivaji University, Kolhapur, MS, India
[e] School of Nanoscience and Technology, Shivaji University, Kolhapur, India
[f] Department of Physics, Central University of Kerala, Kasaragod, KL, India
[g] CASEST, School of Physics, University of Hyderabad, Gachibowli, Hyderabad 500046, India
[h] Thin Film Magnetism Group, Cavendish Laboratory, Department of Physics, University of Cambridge, Cambridge CB3 0HE, UK

ARTICLE INFO

Article history:
Received 6 August 2017
Received in revised form 12 March 2018
Accepted 2 April 2018
Available online 3 April 2018

Keywords:
Sol-gel preparation
Nanoparticles
Magnetic properties
Biomedical applications

ABSTRACT

Curcumin is a proven antioxidant and anti-cancerous compound found in *Curcuma longa*. However, the low solubility of curcumin limits its usefulness in therapeutics. To make curcumin more bioavailable, we have functionalized γ-Fe_2O_3 magnetic nanoparticles (MNPs) with curcumin through the biodegradable polymer chitosan. The MNPs were characterized by X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, Field Emission Scanning Electron Microscopy (FESEM), Transvers Electron Microscopy (TEM), BET (Brunauer–Emmett–Teller) and a Vibrating sample magnetometer (VSM). The antioxidant potential of curcumin loaded on chitosan coated MNPs (CMNPs) was subsequently investigated using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and investigated for its pH triggered curcumin releasing capacity. CMNPs showed pH responsive curcumin release and release at pH 6.0 (~40%) was more than at pH 7.4 (~20%) after 6 days. Nanoformulated CMNPs possesses good antioxidant activity with pH triggered curcumin releasing capacity and of high potential value for biomedical use.

1. Introduction

Antioxidants which reduce oxidative stress are highly sought after as a type of preventive medicine against several diseases such as diabetes, cancer, cardiovascular and neurodegenerative diseases [1]. Curcumin derived from *Curcuma longa* L. (Zingiberaceae) is well-known for antioxidant, hypoglycemic, anti-inflammatory and anti-cancer activities [2]. It is well documented that curcumin is a strong antioxidant as compare to Vitamin C and E [3]. Being a strong antioxidant curcumin inhibits lipid peroxidation and also demonstrates free radical-scavenging activity both in vitro as well as in vivo [4].

In spite of its interesting properties, there are limitations on the therapeutic use of curcumin because of its low bioavailability due to low aqueous solubility, high decomposition rate at neutral pH, and a susceptibility to photochemical degradation [5]. The problem of low bioavailability can be overcome by using advanced drug delivery systems [6]. Loading the drug on magnetic nanoparticles (MNPs) can increase the bioavailability of the drug to allow the controlled release of the drug at the site of action, thereby reducing undesirable side effects [7]. It is reported that the nanoformulations of curcumin are effective in oxidative stress and cancer therapy [8]. In this work chitosan, which is a pH-sensitive polymer due to protonation–deprotonation of a large number of amino groups present in it, is coated on MNPs to load curcumin [9,10]. Curcumin release at different pH and the antioxidant activity of curcumin loaded MNPs have also been evaluated. .

2. Experimental

As reported in our previous work a modified sol-gel method was adopted for synthesis of chitosan coated γ-Fe_2O_3 MNPs [10]. For curcumin loading, 1 mg/ml chitosan coated MNPs and 2.5 mg

* Corresponding author.
E-mail address: ashokdchougale@gmail.com (A.D. Chougale).

https://doi.org/10.1016/j.matlet.2018.04.008
0167-577X/