Journal of King Saud University – Science xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Journal of King Saud University – Science

journal homepage: www.sciencedirect.com

Short communication

Phyto-biologic bimetallic nanoparticles bearing antibacterial activity against human pathogens

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ARTICLE INFO

Article history:
Received 17 August 2017
Accepted 23 January 2018
Available online xxxx

Keywords:
Annona squamosa L.
Bimetallic nanoparticles
Antibacterial activity
Human pathogens

ABSTRACT

Use of nanomaterials as antimicrobial agents is gaining tremendous importance. In the present investigation, bimetallic nanoparticles were synthesized using an aqueous extract of *Annona squamosa* L. Initial confirmation was attenuated with a change in color of the reaction mixture and further confirmation was achieved with UV–Visible spectrophotometry which displayed absorbance peak between 500 and 700 nm. The possible role of phyto-components present in aqueous extract to mediate and stabilize nanoparticles was studied using Fourier transform infrared (FTIR) analysis which predicted the presence of hydroxyl, carboxyl and amide functional groups. The X-ray diffraction (XRD) analysis revealed the crystalline nature of bimetallic nanoparticles. The morphological characteristics of bimetallic nanoparticles were studied using Transmission electron microscopy (TEM) which depicted the polydispersity of nanoparticles with myriad size and shapes. The antibacterial activity was assessed with well diffusion, minimal inhibitory concentration. The bimetallic nanoparticles were effective against tested human pathogens and *Bacillus subtilis* (MTCC 121) followed by *Staphylococcus aureus* (MTCC 7443), *Escherichia coli* (MTCC 7410) and *Salmonella typhi* (MTCC 7407). The obtained preliminary investigation is interesting for future studies to elucidate the mechanism of synthesis and the possible mode of action of bimetallic nanoparticles against the test pathogens.

1. Introduction

The intersection of nano-science has led to a new era of nano-revolution (Björnmalm et al., 2016). The field of nanotechnology deals with the particles maneuvering at nano-scale which tends to possess unique physicochemical properties which render different applicative properties (Lin et al., 2014). Nanoparticles are defined as particles bearing size less than 100 nm. These nanoparticles are considered to be particles of the century owing to its extraordinary properties compared to its bulk material (Syed et al., 2017a). The use of nanoparticles in different fields are constantly being explored (Kavitha et al., 2013). Some of the predominant applications of nanoparticles are in textile industries, used in biosensing, targeted drug delivery, nano-agroparticles in agriculture, development of dressing materials and their application as potent antimicrobial agents (Baker and Satish, 2012). Use of nanomaterials as antimicrobial agents has envisioned significant progress in recent years (Baker et al., 2016). The paucity of potent antibiotics has led to a new era of drug resistance (Fair and Tor, 2014). Ever since the first antibiotic was introduced, there is a parallel mode of resistance being developed among the microbial pathogens (Davies and Davies, 2010). In recent decades, there has been rapid expansion of drug resistant bacteria which has posed a serious threat to all form of lives (Ventola, 2015). Hence scientific communities are engaged in developing potent antimicrobial agent with multiple modes of actions (Baker and Satish, 2012). The use of nanoparticles as antimicrobial agents can be

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Peer review under responsibility of King Saud University.

ELSEVIER Production and hosting by Elsevier

https://doi.org/10.1016/j.jksus.2018.01.008
1018-3647/