NANO EXPRESS

OPEN ACCESS

RECEIVED
25 March 2020

REVISED
22 December 2020

ACCEPTED FOR PUBLICATION
7 January 2021

PUBLISHED
18 January 2021

PAPER

Biocompatibility assessment of silver chloride nanoparticles derived from *Padina gymnospora* and its therapeutic potential

Gopalan Rajagopal[1], Nanthagopal Manivannan[2], Mahalingam Sundararajan[3], Arumugam Ganesh Kumar[4], Samuthirarajan Senthilkumar[5], Narayanasamy Mathivanan[2] and Sakkanan Ilango[1]

[1] Post Graduate and Research Department of Zoology, Ayya Nadar Janaki Ammal College, Sivakasi, Virudhunagar District, Tamilnadu, 626124-India
[2] Centre for Advanced Studies in Botany, Unit of Biocontrol and Metabolites, University of Madras, Guindy Campus, Chennai, 600025-India
[3] Department of Ophthalomology, School of Medicine, University of Missouri, Columbia, MO, 65212-United States of America
[4] Department of Environmental Science, Virudhunagar Hindu Nadars' Senthikumara Nadar College, Virudhunagar, 626001-India
[5] College of Biological Chemical Science and Engineering, Jiaxing University, jiaxing, 31400–People's Republic of China

E-mail: silangosakkanan@gmail.com

Keywords: silver chloride nanoparticles, breast cancer, *Aedes aegypti*, antimicrobial, larvicidal, cytotoxicity, flow cytometry

Abstract

The objective of the present work was to improve the biological activity of *Padina gymnospora*. In the current study, silver chloride nanoparticles have been synthesized using the aqueous extract of *Padina gymnospora* and further characterized by ultraviolet-visible spectroscopy, Fourier-transform infrared spectroscopy, x-ray powder diffraction, scanning electron microscopy, energy dispersive spectroscopy, transmission electron microscopy and atomic force microscope. Further, the hemolytic activity and eco-toxicity of silver chloride nanoparticles analyzed. The synthesized silver chloride nanoparticles were found to be mono-dispersed and spherical with an average size of 11.5–32.86 nm. The particles showed an anticancer effect in a dose-dependent manner against breast cancer cell line (MCF-7 cell lines) ($IC_{50} = 31.37\ \mu g\ ml^{-1}$). In addition, it showed the larvicidal activity against *Aedes aegypti* at a lower dose ($3.92\ \mu g\ ml^{-1}$) than that of the aqueous extract ($13.01\ \mu g\ ml^{-1}$). Nanoparticles also exhibited greater antimicrobial activity for both bacterial and fungal pathogens. The synthesized silver chloride nanoparticles showed a maximum zone of inhibition, i.e., 31 mm for *Candida albicans* followed and 27 mm for vancomycin resistance *Enterococcus faecalis*.The results suggest the possible use of synthesized silver nanoparticles with *P. gymnospora* as therapeutic agent for breast cancer, dengue vector control and as antimicrobial agent.

1. Introduction

Evolving nano-based therapeutics has received substantial attention over the last two decades [1]. The fusion of silver nanoparticles with natural resources is looked at as an eco-friendly and cost-effective approach that bounces progression over the other Physico-chemical methods [2–5]. Nanotechnology, a rapidly growing field which involves the production and use of nanomaterials in various research areas [6–8]. At the present time, researchers are aimed to design the synthesis of nanoparticles for various applications which includes therapeutics and diagnostics purposes, based on their cellular mechanisms and the advanced technology in nanomaterials [1]. Silver ions have the capability to inhibit the bacterial multiplication, by binding and denaturing bacterial DNA, thus affecting the ribosomal subunit protein and some enzymes important for bacterial cell growth by penetrating the cells [6, 9, 10]. Silver nanoparticles, the most striking metal nanoparticles which have anti-tumour efficacy [11–13], antimicrobial [14–16], and adjuvanticity [7]. In biomedical and clinical research studies, the preparation of nanoparticles with the desired properties has become a topic of considerable importance for researchers in order to achieve biocompatibility, biosafety and substantial drug localization to the cells [17–19].