



# Phytogenic Synthesis of Ag Bionano-Antibiotics Against ESKAPE Drug Resistant Communities in Krasnoyarsk, Siberia

Baker Syed<sup>1,2</sup> · Svetlana V. Prudnikova<sup>3</sup> · Olga V. Perianova<sup>1</sup> · Sergey M. Zharkov<sup>2,4</sup> · Andrey Kuzmin<sup>5</sup> · Raghuraj Singh Chouhan<sup>6</sup> · Nadezhda K. Potkina<sup>1</sup> · Olga Y. Khohlova<sup>1</sup> · Tatiana I. Lobova<sup>1</sup> · Manoj Singh<sup>7</sup>

Received: 8 January 2019

© Springer Science+Business Media, LLC, part of Springer Nature 2019

## Abstract

The present study reports synthesis of silver nano-antibiotics from aqueous extract of *H. dissectum*. The nano-antibiotics were characterized using UV–visible spectra which displayed maximum absorbance at 430 nm. The role of phytocomponents as reducing agent and stabilization of silver nano-antibiotics was depicted with Fourier-transform infrared spectroscopy which revealed presence of hydroxyl and carboxyl groups associated with silver nano-antibiotics. The crystalline nature was studied with X-ray diffraction which showed Bragg's intensities at  $2\theta$  angle which denoted (101), (111), (200), (220), (311) planes. The morphological characteristics were studied using Transmission Electron Microscopy to reveal the size ranging from 5 to 50 nm. The bactericidal activity of nano-antibiotics was studied via well diffusion and minimal inhibitory concentration assay against members of drug-resistant communities bearing resistant to more than ten standard antibiotics. Nano-antibiotics displayed highest activity against *Ps. aeruginosa* strain 55 and *Methicillin-resistant Staphylococcus aureus* with 16 mm zone of inhibition followed by *Kl. pneumoniae* strain 104 and *E. coli* strain 55. Moderate activity was observed against *Ac. baumannii* strains with 12 mm zone of inhibition. The obtained results envision the role of plant mediated nano-antibiotics as one of the best suited alternatives towards combating drug resistant pathogens.

**Keywords** *Heracleum dissectum* · Silver nano-antibiotics · ESKAPE · Antimicrobial-resistant · Krasnoyarsk · Siberia

## Introduction

The emergence of antibiotic resistant era has resulted owing to the expansion of multi drug resistant pathogens [1]. The proliferation of antimicrobial resistance has tempered the global economy by influencing health and biomedical sectors [2]. According to the latest survey,

fatality ratio owing to drug-resistant pathogens is increasing especially in hospital-acquired infections [3, 4]. The recent studies report that 70% of hospital acquired infections are caused by pathogenic bacteria which are resistant to one or more antibiotics [5–7]. Especially, ESKAPE pathogens which includes *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter*

✉ Baker Syed  
sb.nano41@gmail.com

<sup>1</sup> Department of Microbiology, Krasnoyarsk State Medical University named after Prof. VF. Voyno-Yasenetskiy, Partizana-Zheleznyaka Street, 1, Krasnoyarsk, Siberia, Russian Federation 660022

<sup>2</sup> Siberian Federal University, Svobodnyy pr., 79, Krasnoyarsk, Siberia, Russian Federation 660041

<sup>3</sup> School of Fundamental Biology and Biotechnology, Siberian Federal University, Krasnoyarsk, Russian Federation

<sup>4</sup> Federal Research Center KSC SB RAS, Kirensky Institute of Physics, Akademgorodok 50, Bld. 38, Krasnoyarsk, Russian Federation 660036

<sup>5</sup> School of Petroleum and Natural Gas Engineering, Siberian Federal University, Krasnoyarsk, Russian Federation

<sup>6</sup> Department of Environmental Sciences, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia

<sup>7</sup> Department of Biotechnology, M. M. Engineering College, Maharishi Markandeshwar University (MMU), Mullana, Ambala, India

