Biosynthesis of Silver Nanoparticles from Aqueous Leaf Extract of Synedrella nodiflora under Sunlight Irradiation and Screening of its Antibacterial Activity

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ABSTRACT

The field of nanotechnology and nanoscience is the most currently an area of intense scientific interest for researchers in modern materials science. However there are many chemical as well as physical methods, green synthesis of nanomaterials is the most emerging method of synthesis. We report the synthesis of antibacterial silver nanoparticles (AgNPs) using aqueous leaf extract of medicinal herb Synedrella nodiflora (L.) Gaertn (Family: Asteraceae) at direct sunlight and monitored by UV-Vis spectroscopy. Both leaf extract and resulting AgNPs is subjected to antibacterial study against five pathogenic bacterial strains such as Bacillus megaterium, Staphylococcus aureus, Listeria monocytogenes, Pseudomonas aeruginosa and Salmonella typhimurium. AgNPs exhibited higher antibacterial efficacy than leaf extract and found to be more effective against B. megaterium and S. aureus.

KEYWORDS: Synedrella nodiflora; Asteraceae; Aqueous leaf extract; Ag-nanoparticles; Antibacterial activity.

Introduction

Nanomaterials synthesis and their characterization is an emerging growing field of nanotechnology from the past two decades, due to their numerous applications in science and technology including physics, chemistry, biology and medicine for mankind. With the development of several chemical-synthetic techniques, the concern for environmental contaminations is also heightened as the chemical synthesis protocols need some toxic chemicals for synthesis (Song and Kim, 2008). Most of the physical methods deal with enormous consumption of energy to maintain the high pressure and temperature employed in the synthesis procedures. In the present scenario, synthesis of nanoparticles through biological methods is a good alternative over the chemical and the physical methods as they are both environment friendly and economic and tremendous interest in the biomedical applications of nanoparticles (NPs) (Rout et al., 2012; Zaheer and Rafiuddin, 2013). Their applications is not only limited to the preliminary research stage but also in clinical stages. In particular, silver nanoparticles (AgNPs) are increasingly being investigated as tools for antibacterial and antifungal (Rout et al., 2012), anti-inflammatory (Singh et al., 2007), radio imaging, retinal neovascularization (Bhattacharya and Mukherjee, 2008; Kalishwaralal et al., 2010), antiviral, antioxidant (Hakkim et al., 2007) and novel cancer therapeutics, capitalizing on their unique properties to enhance potential therapeutic efficacy (Bhattacharya and Mukherjee, 2008; Kalishwaralal et al., 2010). Notably silver oxide nanoparticles exhibit antitumor properties in transplanted Pliss lymphosarcoma tumor models when administered by intravenous injection in the form of aqueous dispersions (Rutberg et al., 2008). Perhaps to inhibit the function, AgNPs can interact with sulfur-containing compounds as well as with phosphorus-containing compounds like DNA inside the bacterial membranes (Zaheer and Rafiuddin, 2013). The diameters of AgNPs are normally smaller than 100 nm and contain 20-15000 silver atoms (Lok et al., 2007; Simi and Abraham 2007). When cells or tissue are being exposed to AgNPs, the active surface of AgNPs would be significantly large compared to silver compounds, and thereby exhibiting remarkably unusual physicochemical properties and biological activities (Yen et al., 2009).

The biological activity of the synthesized nanoparticles always depends on the starting capping agent for stabilization of the nanoparticles and also with its concentration. There are several matrixes for the biosynthesis of AgNPs has been reported till date using microorganisms include bacteria (Hebbalalu et al., 2013),