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Green Synthesized Cobalt Nanoparticles using Asparagus racemosus Root Extract & Evaluation of Antibacterial activity

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Abstract

The balance between economic development and environmental damage is also evident in the problem of pollution and waste management. Increased economic activity, mainly in industrial countries, has seen a rise in pollution generated from waste including sewage, trash, and litter. Particularly, the textile industry produces a significant amount of liquid effluent pollutants due to the vast amounts of water used in fabric processing. Dyes are a major class of synthetic organic compounds used in many industries (textile, pharmaceutical, rubber, etc.). Nearly 50,000 tons of dyes are discharged into the environment annually. This has resulted in significant water pollution worldwide. The reduction of these dye compounds from industrial wastewater has been achieved using chemical, physical, and biological methods. However, these approaches are time-consuming, costly, and pose disposal problems. Currently, photocatalytic degradation by nanoparticles is attracting significant attention. In photocatalytic degradation, the pollutants are degraded under UV-visible light irradiation in the presence of catalysts. Compared to the conventional methods, this technique is inexpensive and does not form any polycyclic products. In this review, we focus on different green-synthesized NPs such as Au, Ag, Pt, Pd, ZnO, CuO, α-Fe2O3, TiO2, CeO2, SnO2, and NiO together with and their applications in photocatalytic activities.

Introduction

Nanotechnology is one of the modern technologies which create waves in the present research era. It provides an alternative to the potentially hazardous chemical additives and leads to more eco-friendly synthesis methods of nanomaterials. Many attractive nanodevices are effectively used in the biomedical field for the improved cancer detection, diagnosis and treatment. Metal nanoparticles are very important nanomaterials due to their outstanding physical, chemical, electrical, magnetic, optical and biological properties. Silver has long been recognized as having restrictive action on microbes present in medical and industrial processes. Silver nanoparticles (SNPs) exhibit enhanced properties based on their size and morphology. SNPs are also called as nanosilver; possess different properties compared to the bulk material due to its extremely smaller size and large surface area. Nanosilver exhibits a high extinction coefficient, high surface plasmon resonance and superior anti-microbial properties. It is a popular additive in many health products due to its unique ability to fight with infectious diseases, slow down the growth of bacterium, mould and germs. All these properties make nanosilver, the new "wonder-drug" of the nanotechnology world. Silver nanoparticles have found huge applications in the field of high sensitivity bio-molecular detection and diagnostics, antimicrobials and therapeutics, catalysis and microelectronics. The most important application of silver and silver nanoparticles is in medical industry such as topical ointments to prevent infection against burn and open wounds.

Materials and Methods

Annona reticulata leaves were collected from the botanical garden in the Osmania university science college, Hyderabad. Materials used for the synthesis of silver nanoparticles are silver nitrate (AgNO3 AR grade, Merck Company-purchased from India), Yeast extract, Tryptophan and bacterial grade Agar-agar (purchased from HiMedia laboratories, Mumbai, India).The Bacterial test strains that were used are Escherichia coli, Staphylococcus aureus, Micrococcus luteus and Pseudomonas putida (from IMTECH, Chandigarh).

Discussion

Plant materials are the best source for preparation of NPs in green synthesis apporaches. In this study, the authors exposed the equivalent potential of the Annona reticulata to expand the scope of non-toxic biological systems for the biogenic synthesis of SNPs. Here, eco-friendly, SNPs was successfully synthesized from potent medicinal plant Annona reticulata fresh leaf extracts. The synthesized particles were characterized by spectroscopic and microscopic analysis and its potential activity was measured. The SNPs were shown superior antibacterial activity against gram-positive bacteria Staphylococcus aureus and Micrococcus luteus and less against Escherichia coli, as well as Pseudomonas putida bacteria. Maximum zone of inhibition was observed for Staphylococcus aureus bacteria. The cell wall properties of Gram positive bacteria and gram negative bacteria is different, in gram positive bacteria outer membrane is absent and no lipids linked peptidoglycan, more inhibition occurs compare to gram negative bacteria.

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