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Title: **Synthesis, Characterization and Morphological Studies of Transition Metal Nanoparticles**

Keywords: Nanoparticles, Antibacterial activity, Sensor, LSPR, Silver nanoparticles

ABSTRACT

Biomediated silver nanoparticles were synthesized with the aid of an eco-friendly biomaterial, namely, aqueous *Callistemon viminalis* extract. A simple and highly selective colorimetric sensor for Cu^{2+} is fabricated in this work, based on the Cu^{2+} ions induced self-aggregation of silver nanoparticles. In this new design, silver nanoparticles are first functionalized with *Callistemon viminalis* molecules on their surface. Furthermore, the biomediated silver nanoparticles without any surface modification were used for the heavy metal ion sensor in aqueous media and under the optimized conditions, good linear relationships (R^2 = 0.998) were obtained in the range of 400-10 µM. Therefore, a facile and low-cost colorimetric sensor for visual detection of Cu^{2+} ion was developed without requirement of any instrument.

The present study focus on the synthesis of citrate stabilized silver nanoparticles and their use as nanocatalyst for dye degradation and the by-products. The results show that the highly crystalline silver nanoparticles structures with an average grain size of 6.71±1.4 nm are obtained. The absorption spectra of silver nanoparticles present the existence of single absorption region (strong visible-light at ~400 nm). The catalytic activity of as-synthesized nanoparticles was tested by measuring the degradation of organic pollutant dyes Methylene blue and Rhodamine B. And it is found that both the dyes are efficiently degraded and nanoparticles have better photocatalytic efficiency. The reduction reaction follows pseudo-first order kinetics with a reaction rate constant of 0.018 min^{-1} and 0.186 min^{-1} for methylene blue and rhodamine B,

respectively. The experimental results indicate the capability of using synthesized silver nanoparticles for degradation of organic dyes.

The present study focuses on the use of aqueous extract of *Callistemon viminalis* (bottlebrush) leaves for the synthesis of silver nanoparticles. The extract was used as a bioreductant and the polyphenols and flavanoids present in extract are responsible for the reduction of Ag^{+} ions to zero valent silver nanoparticles. TEM image analysis showed wide size distribution having dimer nanoparticles of hexagonal-triangular, square-triangular, spherical-triangular, spherical-spherical square-spherical morphologies. The antibacterial activity of extract reduced silver nanoparticles against four strains viz. *E. coli* (MTCC-739), *S. aureus* (MTCC-737), *K. pneumoniae* (MTCC-109) and *S. typhimurium* (MTCC-98) was evaluated by calculation of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). The results show that synthesized nanoparticles could inhibit the growth of various bacteria tested.

Using this QUC-AuNP probe, the quantitative determination of Fe^{3+} in environmental, and pharmaceutical samples could be achieved by the naked eye and spectrophotometric methods. Sensitive response and pronounced color change of the QUC-AuNPs in the presence of Fe^{3+} were optimized at pH 6, 30 ˚C. The absorption intensity ratio (A700/A510) linearly correlated to the Fe^{3+} concentration in the linear range of 0–200 µM. The limits of detection were 15, and 60.0 nM for lab water and iron supplement tablets, respectively. Owing to its facile and sensitive nature, this assay method for Fe^{3+} ions can be applied to the analysis of food materials, drinking water and pharmaceutical samples.