

Amino acid-functionalized silver nanoparticles as green catalyst for methylene blue reduction

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Background: Synthesis of environmental friendly nanogreen catalyst due to their very high efficiency and recyclability in color removal from dyes in textile wastewaters needs urgent attention as these wastewaters are toxic for the aquatic life and they obstruct the penetration of sunlight.

Methods: Thus, highly stable and homogeneously dispersed amino acid functionalized silver nanoparticles of ≈ 10 nm diameter, λ_{\max} ranging 420 to 430 nm is prepared on AgNO₃ solution addition to gum of Azadirachta indica solution at 373.15 K. This facile synthesis is in aqueous phase, without involvement of any toxic chemicals making it a green approach. The amino acids were selected based on their polarity. The synthesized nanoparticles were characterized by UV-Vis, FTIR spectroscopy, HR-TEM, XRD and SEM, while the ¹H-NMR confirmed functionalization of silver nanoparticles (ANP) by the amino acids. The functionalized nanoparticles were used as catalyst for the reduction of methylene blue dye in presence of Sn(II) in aqueous, anionic and cationic micellar media.

Results: The rate of reduction of dye was determined by measuring the decrease in absorbance of the dye at 660 nm, spectrophotometrically. The rate of reduction follows K_{cationic} > K_{anionic} > K_{water} order and the polarity and -R group of amino acids played a major role for showing this catalytic activity. After 12 min and in absence of the ANP, only 2%, 3% and 6% of the dye reduction was completed in aqueous, anionic and cationic micellar media respectively while, in presence of ANP functionalized by polar neutral amino acid with non-polar -R group, the reduction completed to 84%, 95% and 98% respectively.

Short Conclusions: The ANP functionalized with polar neutral amino acid having non-polar -R group, increased the rate of reduction of the dye by 94, 3205 and 6370 folds in aqueous, anionic and cationic micellar media respectively. Also, the rate of reduction of the dye increased by three folds when the micellar media was changed from anionic to cationic when the ANP is functionalized by a polar neutral amino acid having a non-polar -R group. The antimicrobial assay of these functionalized ANP's is under study. The detailed results will be discussed in the presentation.

Biography:

The author is currently doing his Ph.D. in chemistry from Central University of Gujarat, India, on synthesis of metal nanoparticles and their application as biosensors, catalyst & antimicrobial agents. He completed his graduation & post-graduation from University of Delhi and his research area of interest is nanoparticles & interactions involving biomolecules and surfactants. He has published research works based on these in reputed journals like "JCT (Elsevier) and JCED (ACS)". He has presented his works at international conferences, one of them sponsored by RSC and was selected to attend UGC sponsored Winter School on Computational Chemistry at University of Hyderabad.