

N, S doped carbon dots - Au nanocomposites for visible light photocatalytic reduction of 4-Nitrophenol

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Abstract: Carbon dot-metal/metal oxide nanocomposites (CMN) are gaining attention in designing efficient catalytic systems where the water soluble Carbon dots (CDs) show dual functionality of a stabilizing agent as well as a reducing agent for the generation of metal nanoparticles in situ. The CDs in the nanocomposites, not only help in modulating electronic band structures of metal/metal oxides by its unique electron transfer property but they are also expected to significantly influence on their morphology and surface properties. Herein, we report the synthesis of NSCDs– Gold (NSCDs-Au) nanocomposites through solution method and have explored their catalytic property in the reduction of 4-Nitrophenol (4-NP). The NSCDs, synthesized through microwave pyrolysis of a mixture of tartaric acid (TA) and thioacetamide, were dissolved in Millipore water and then added into aqueous solution of HAuCl_4 to obtain a solution of the NSCDs – Au nanocomposites. The synthesized NSCDs and colloidal solution of NSCDs - Au nanocomposites were characterized in detail using UV-Vis spectroscopy, FT IR, XRD, TEM, EDX and XPS analysis. The catalytic efficacy of the NSCDs – Au nanocomposites were premised on real time monitoring of the reduction of 4-Nitrophenol (4-NP) by NaBH_4 using UV–Visible absorption spectroscopy. The apparent rate constant (k_{app}) and turn over frequency of reduction of the 4-NP in the presence of the nanocatalysts were found to follow the pseudo-first-order kinetics having value of $1.37 \times 10^{-1} \text{ s}^{-1}$ and 47.3 min^{-1} respectively. The as-synthesized NSCDs@Au nanoparticles have been applied in catalysis effectively.

References:

1. M. K. Mahto, D. Samanta, S. Konar, H. Kalita., A. Pathak. N, S doped carbon dots Plasmonic Au nanocomposites for visible light photocatalytic reduction of nitroaromatics:J. Material Research, 2018, 33, 3906-3916.