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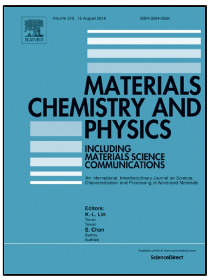

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Highly Stable Functionalized Cuprous Oxide Nanoparticles for Photocatalytic Degradation of Methylene Blue

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Abstract

We report the synthesis and characterization of Cu_2O nanoparticles (NPs) in the presence of the coordinating ligands like L-glutamic acid (Glu-Cu_2O) and D-glucosamine (GlcN-Cu_2O). Even if $–NH_2$ group is common to both the ligands, L-glutamic acid is a straight chain compound containing additional two –COOH groups, whereas, glucosamine is a cyclic compound with additional four –OH groups and an ether (-O-) linkage. Thus the coordinating ligands are different in the nature of the functional groups as well as their molecular skeletons leading to cubic morphology (~350 nm of average edge length) for L-glutamic acid coordinated Cu_2O and spherical morphology (~250 nm of average diameter) for glucosamine one as observed by Field Effective Scanning Electron Microscopy (FE-SEM) and Transmission Electron Microscopy (TEM) images. The observed band gap of Cu_2O of 1.89 eV is decreased to 1.84 ev for both the ligated structures. Both the ligated cuprous oxide (Cu_2O) nanoparticles (NPs) were used for the photocatalytic degradation of methylene Blue (MB). The spherical GlcN-Cu_2O showed 98% degradation of MB in 105 minutes and after 3 cycles of operation, the photocatalytic activity was enough for the 93% degradation of the dye, whereas, the cubic Gu-Cu_2O could degrade MB up to 97% in 135 minutes and after three cycles, only 86% of the dye was degraded. This indicates, the molecular skeleton and functional groups on the ligand control the shape and size of the