Kinetic and Mechanistic Studies of Advanced Nanomaterials

ABSTRACT

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ABSTRACT

The thesis entitled "**Kinetic and Mechanistic Studies of Advanced Nanomaterials"** consists of six chapters. The main objective was to synthesize the nanomaterials by chemical reduction and green route. The kinetics of these nanomaterials was also studied. The nanomaterials were characterized by various spectroscopic techniques like UV-vis spectroscopy, transmission electron microscopy, scanning electron microscopy, and X-ray diffraction to confirm their size, shape and crystalline nature. In addition to this, the nanoparticles were employed as catalysts for the degradation of hazardous dyes.

Chapter I: Introduction: Chapter 1 gives brief idea about the size, classification and historical back ground of the nanomaterials. The role of surfactants in the stability of nanomaterials has also been presented. The advantage of using nanoparticles for the catalytic degradation of the dyes and their byproducts has also been briefly explained.

Chapter II: Encapsulation of Silver Nanocomposites and Effect of Stabilizers

Silver nanoparticles have been synthesized by chemical reduction from silver nitrate and sodium borohydride. The ageing of $NaBH_4$ aqueous solution and mixing order of reagents have shown strong influence on the morphology of AgNPs. The iodometric titration was used to confirm the encapsulation of AgNPs inside the helical structure of starch. The effect of electrolytes on the stability AgNPs has also been observed.

Chapter III: Synthesis, Optical Properties, Stability, and Encapsulation of Cu-nanoparticles: Starch-capped copper nanoparticles were prepared by chemical reduction method using hydrazine, copper sulphate and starch as reducing, oxidizing

and stabilizing agents, respectively. The stability of the CuNPs was found very much dependent on the stabilizer (starch). The hexahedral along with some irregular shaped CuNPs were obtained in presence of starch with diameter 900 nm.

Chapter IV: Natural Sugar Surfactant Capped Gold Nano-disks: Aggregation, Green Synthesis and Morphology: Sugar based bola bio-surfactant, crocin, was used as reducing and capping agent to the one pot controlled green synthesis of gold nanoparticles. Crocin was also used as probe to the determination of CMC of CTAB. The addition of CTAB changes the morphology of AuNPs drastically to triangular and pentagonal from spherical nano dots as obtained in absence of CTAB.

Chapter V: Influence of Stabilizing Agents on the Microstructure of Co-nanoparticles for Removal of Congo Red: A reduction method was used to the synthesis of Co-nanoparticles in absence and presence of stabilizers. The morphology, stability and color of cobalt sols strongly depends on the nature and/or presence of stabilizers. UV–visible absorption spectroscopy was used to quantify the decolorization of congo red by Co-nanoparticles with and without sun light at different time intervals.

Chapter VI: Cationic Surfactant Assisted Morphology of Ag@Cu, and their Catalytic Reductive Degradation of Rhodamine B: This chapter deals with the synthesis of bimetallic Ag@CuNPs using the reductant, and oxidant as hydrazine hydrate and silver nitrate, copper nitrate, respectively. The bimetallic nanoparticles obtained were large spherical aggregates in absence of CTAB. The stability of the bimetallic nanoparticles was found to increase on increases the [hydrazine]. The role of CTAB to stabilize the Ag@CuNPs was found to be very much dominant. The Rhodamine B degradation was mainly attributed to the N-de-ethylation of the chromophore skeleton in presence of NaBH4 and Ag@CuNPs.