Abstract

The metal and metal oxide nanomaterial has drawn enormous attention due to their multifarious application. The rich surface plasmon of Au and Ag nanoparticles have attracted scientists over the years. The metal oxides, such as TiO2 and MnO2 are ubiquitous and sometimes lattice oxygen facilitate various oxidation processes. The first chapter of the thesis depicts the important up-to-date information and scope of the present as well as future studies. The second chapter of the thesis describes the biopolymer alginate gel mediated photochemical growth of mono and bimetallic gold and silver nanocluster. Then the materials have been exploited as substrate in surface enhanced Raman scattering (SERS) for the detection of 2-aminothiophenol and 1,10- phenanthroline probe molecules. The third chapter presents the photochemical green synthesis of calcium alginate gel stabilized silver and gold nanoparticles and their applications in catalytic reduction of 4-nitrophenol. The fourth chapter reports a simple, reproducible, wet chemical synthesis of spherical arsenic nanoparticles using sodium borohydride in absence of any stabilizer. The synthesis of stable, spherical, red colored Au nanocrystals (AuNC) was carried out using the as-prepared As(0) as reducing agent. The AuNC was further exploited as SERS substrate for the detection of Rhodamine 6G, 4-mercaptopyridine and 4-aminothiophenol probe molecules. The fifth chapter encompasses an account of photocatalytic degradation of malachite green (MG) by nano Ag impregnated various commercial TiO2. It has been shown that the nano Ag impregnation caused better mineralization of MG. The sixth chapter presents the gram level synthesis of pseudo spherical MnO2 which eventually evolves octahedral molecular sieves with 2 × 2 tunnel structure (OMS-2). The highly porous material efficiently decolorized and degraded the MG dye under ambient condition. The seventh chapter describes the synthesis of porous nano MnO2 (OMS-2) material using different precursor salts at room temperature. These materials were used for the removal of methylene blue (MB) dye from water. The effect of modified hydrothermal treatment of all the OMS-2 materials encountered different growth processes. A comparative account has been drawn
for MB dye removal by all the as obtained materials.

Keywords: *Calcium alginate gel, Photochemical reduction, Mono and bimetallic silver and gold nanocluster, Surface enhanced Raman scattering, Heterogeneous catalysis, As(0) nanoparticle, Commercial TiO_2, Malachite green photodegradation, Nano MnO_2, Octahedral molecular sieves, Modified hydrothermal treatment, Oxidative removal of methylene blue.*