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Title of Thesis: Synthesis, Characterization and Catalytic Activity of Silver nanoparticles.

Abstract

In the 21st century nanotechnology is seen to significantly influence science, economy and everyday life. Nanotechnology is the science of the small; the very small. It is the use and manipulation of matter at a tiny scale. In particular, metallic nanostructure materials have been the subject of intense scientific research by virtue of their fundamental importance and potential applications. Metal nanoparticles have attractive tremendous interest due to their high specific surface area and a high fraction of surface atoms. Because of the unique physicochemical characteristics of nanoparticles, including catalytic activity, optical properties, electronic properties, antibacterial properties, and magnetic properties. Metal nanoparticles such as Silver nanoparticles have attracted much attention and have found applications in diverse area, including medicine, catalysis, textile engineering, biotechnology and bioengineering.Here in this thesis we can demonstrate to the simple chemical reduction method to synthesize the stable and various shape of Ag-nanoparticles. This research will also examine the effect of surfactant in the presence of organic and inorganic reducing salt in the formation of Ag-nanoparticles. The proper knowledge of kinetics and mechanism is beneficial to understand the reaction process condition and yield of product. Different techniques such TEM and UV-Visible spectroscopy will be used for the characterization of Ag-nanoparticles.

Chapter 1. deals with the brief introduction of nanotechnology, metal nanoparticles, surface plasma resonances and also discussed the various synthesis method and different characterization techniques.

Chapter 2. deals with the Experimental work: Preparation of solutions, Kinetic measurement, Free radical detection, Product identification, Critical Micelles Concentration (CMC) determination and Characterization techniques.

Chapter 3. Time dependence of nucleation and growth of silver nanoparticles

In this chapter, we report a very simple, low-cost and green chemical method to the preparation of silver nanoparticles on the basis of the modified "silver mirror" reaction. To the best of our knowledge, study on time dependent UV–visible absorption behaviour of silver nanoparticles prepared using different concentrations of ammonia and reducing sugar in aqueous media is limited in literature. In this work, we have used the different NH_3 and glucose concentrations to determine how the size distribution and optical properties of the Ag-nanoparticles would be affected in the presence of ammonia and/or glucose. A possible formation mechanism for the observed silver nanoclusters is also discussed.

Chapter 4. Silver nanoplates and nanowires by a simple chemical reduction method

In this work we investigate the silver nanoparticles formation based on the Tollens process with a view to having an insight into the role of cationic CTAB surfactant and silver ions concentrations in the mechanism of silver sol. The rates, size and shapes of advanced silver nonmaterial's can be either accelerated or changed, depending on the chemical system, nature of stabilizers, the types of reducing sugars and the surfactant.

Chapter 5. Silver Nanoparticles: Green Route, Stability and Effect of Additives

This chapter deals with the preparation and characterization of silver nanoparticles involving oxalic acid. In this work we determine the effect of variables on the rate of silver nanoparticles and also to determine the effect of additives and ammonia on the growth and stability of the Ag-nanoparticles.

Chapter 6. Silver nanoparticles: preparation, characterization, and kinetics

In this chapter we will demonstrate the simple chemical reduction aniline route to the synthesis of silver nanoparticles. Aniline one of the water soluble aromatic amine, well known weak reducing agent, has an ability of one step reduction and coordinates with silver ion. Reduction of silver by chemical methods proceeds through a one step process to produce a colored silver sol because surface of a metal having free electrons in the conduction band and positively charged nuclei. The Studies revealed that the reaction conditions ([CTAB] and [aniline]) content have great influence on the morphologies of silver nanoparticles. The synthetic conditions were optimized by changing the concentrations of aniline, CTAB and Ag^+ ions.