

Effect of incorporation of synthesized Fe @ Ag core-shell nanoparticles on optical parameters of polyvinyl alcohol

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Abstract. The present research work reports the fabrication of polyvinyl alcohol (PVA) based core shell nanocomposite films by assimilation of various concentrations of Fe @ Ag core shell nanoparticles in PVA matrix. Ex-situ chemical reduction approach was used for synthesis of core shell nanoparticles in which sodium borohydride (NaBH_4) and tri-sodium citrate were used as a reducing and capping agent respectively and subsequently Fe @ Ag-PVA nanocomposite films were fabricated via solution casting method. These nanocomposite films were further characterized to examine the effect of varying concentration of core shell nanoparticles on PVA matrix by using UV-Visible spectrophotometer so as to study the absorbance behavior and to calculate the electrical conductivity of core shell nanocomposite. Morphological studies of the Fe @ Ag-PVA nanocomposite films were carried out using Transmission electron microscopy (TEM).

INTRODUCTION

Core-shell nanoparticles have received immense attention owing to their tunable physical and chemical properties through controlling chemical composition and relative sizes of core and shell [1]. The core-shell nanoparticles are the structures having a core (inner material) and a shell (outer layer material) made up of different materials, both at nano-meter range [2]. In addition, Core shell structures with magneto-plasmonic behavior are of special interest in which the combining effects of both magnetic and plasmonic properties are observed that not only depends on the constituents but also on the core-shell volume ratio. In view point, the nanometer sized iron (Fe) nanoparticles are very promising contenders for the core material due to their controlled delivery of drugs in human beings [3] and silver (Ag) nano particles have special attention among all noble metals due to its exceptional plasmonic activity, antibacterial activities, chemical stability, good thermal and catalytic properties [4]. The pairing of plasmonic effect of silver with magnetic properties of iron has shown great promise in biomedical applications, such as integrated imaging, diagnosis, targeted delivery, and photo-thermal therapy [5]. The synthesized core shell nanoparticles can also be used for tuning different parameters of polymers.

In the present research work, Fe @ Ag nanoparticles were synthesized via chemical reduction method and their effect on the optical parameters of polyvinyl alcohol (PVA) has been studied.

EXPERIMENTAL

$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (mol. wt 278.006 g/mol), AgNO_3 (mol. wt 169.87 g/mol), tri-sodium citrate dehydrate (mol. wt 294.10 g/mol) and sodium borohydride (mol. wt 37.83 g/mol) were purchased from Rankem. Polyvinyl alcohol (mol. wt 1, 25,000 g/mol) was purchased from Ranbaxy. All the chemicals were of analytical grade and were used without further purification. De-ionized water was used as solvent for synthesis.