ABSTRACT

This thesis details the preparation and characterization of some metal nanoparticles and studying their effects on the fluorescence of dye doped polymer. Nanoparticles of gold and silver were prepared by chemical reduction method at different times when the temperature stabilized at 80^{O}C. TEM results confirmed the formation of AuNPs, most of them with spherical shapes but also a few with pyramidal and cylinder shapes. The particle size was 11 nm in the sample prepared at 1 min, whereas the average particle size was 13 nm for AuNPs synthesized at 10 min. Silver nanoparticles are formed with spherical shapes, and a few with prisms, with average size 13 nm at 1 min; hexagonal, cylindrical, and spherical shapes with an average particle size of 19 nm are formed at 3 min. The results of FTIR for polyacrylic acid (PAA) doped by an equivalent amount of RhB, AuNPs with 11 nm and 13 nm, RhB and AgNPs with 13 nm and 19 nm at different molar ratios showed that an absorption bands appeared between 1683 cm^{-1} and 1243 cm^{-1}, which are assigned to both C=O and C-O of PAA, were shifted to higher or lower wavenumber after doping due to electrostatic interaction between AuNPs and AgNPs with PAA through the C=O and C-O functional groups. The effects of preparation time on the surface plasmon resonance (SPR) and particle sizes of both AuNPs and AgNPs were explained using UV-visible spectra. Also, a new band appeared at 560 nm, with a shoulder between 525 nm and 560 nm, a small band at about 408 nm appeared in the UV-visible measurements of PAA doped by RhB, AuNPs with 11 nm and 13 nm, RhB and AgNPs with 13 nm and 19 nm, respectively. The bands are characterized by RhB, AuNPs, and AgNPs. The crystallization and particles sizes of PAA doped by RhB, AuNPs with 11 nm and 13 nm, RhB and AgNPs were determined by X-ray

diffraction, where the particle crystallite sizes were estimated using Scherrer equation, and found to be comparable to the sizes calculated from TEM images. Comparing to TEM images, SEM images of PAA doped by an equivalent amount of RhB, AuNPs with 11 nm and 13 nm. RhB, and AgNPs with 13 nm and 19 nm at different molar ratios revealed an increase in nanoparticle size due to the aggregation of nanoparticles during their embedding in PAA. Results of fluorescence measurements from PAA doped by an equivalent amounts of RhB, AuNPs with 11 nm and 13 nm, RhB and AgNPs with 13 nm and 13 nm at different molar ratios indicated that an emission band appeared between 585 nm and 590 nm for AuNPs 11 nm, 13 nm and between 587 nm and 440 nm for AgNPs with 13 nm and 19 nm, respectively. Peak emissions have a wavelength higher than the excited wavelength, indicating the electronic transition from surface plasmon resonance of the nanoparticles and π-π^* of RhB to PAA. In conclusion, gold and silver nanoparticles with Rhodamin B enhance the fluorescence spectra of polymer and therefore can improve the laser dye.