Enhancement by gold nanoparticles of luminol chemiluminescence

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Luminol, a popular chemiluminescent reagent, can react with a variety of oxidants giving rise to light emission. In some cases, metal ions can catalyze the luminol chemiluminescence (CL). However, to the best of our knowledge, no research has been carried out about the effect of metal nanoparticles on the luminol CL. In this work, gold nanoparticles of different sizes were synthesized by the reduction of hydrochloroauric acid and the effect of gold nanoparticles and Au(III) ions on luminol-hydrogen peroxide and luminol-potassium ferricyanide chemiluminescent systems were studied by using a flow injection system. For luminol-hydrogen peroxide system, gold nanoparticles were observed to induce much stronger light emission than Au(III) ions; for luminol-potassium ferricyanide system, Au(III) ions showed minor effect on the light emission, whereas gold nanoparticles exhibited strong enhancement. CL spectrum studies showed that the luminophor for the two chemiluminescent systems did not change after the addition of gold nanoparticles or Au(III) ions. UV-visible absorption spectra and fluorescence spectra showed that Au(III) ions were reduced to be Au(0) whereas gold nanoparticles did not change after the reactions. Therefore, the enhancement was assigned to catalytic activity of the gold nanoparticles. The relationship between the particle size of the gold nanoparticles and the chemiluminescence intensity has been found for the two chemiluminescent systems, which may be helpful for investigating effects of particle size on their catalytic activity of gold nanoparticles. The results imply that gold nanoparticles involving in biosensing and immuno labelling techniques may be detected by the luminol CL reactions.