Thermal Diffusivity Determination of Protoporphyrin IX Solution Mixed with Gold Metallic Nanoparticles

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Nanoparticles appear to be ideally suited for application for targeted thermal effects in medical therapies and photo thermally activated drug delivery, which all depend critically on the thermal transport between the nanoparticles and the surrounding liquid. In this work, we used thermal lens spectroscopy (TLS) to determine the thermal diffusivity of protoporphyrin IX (PpIX) solution mixed with gold metallic nanoparticles. We used PpIX disodium salt (DS), in a 25 % HCl solution. Fluids containing Gold (Au) nanoparticles with different concentrations were prepared and added to the PpIX solution. From each solution, an optical absorption spectrum was obtained using UV-Vis spectroscopy; TEM was also used in order to obtain the gold nanoparticle size. From the TLS signal intensity it was possible to determinate the characteristic time constant of the transient thermal lens by fitting the experimental data to the theoretical expression for a transient thermal lens. From this characteristic time, the thermal diffusivity for each solution was obtained. The results show that the thermal diffusivity of PpIX mixed with gold nanoparticles increases with the increase of metallic nanoparticle concentration, which enhance the thermal diffusivity of the solution. Our investigations are devoted to improving thermal drug treatments for medical applications.