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Utilization of silver nanoparticles as chemisensors of 5-fluorouracil

J. E. Andrade(1) and F. Cunha(1)*
(1) Physics Department, Federal University of Sergipe, Brazil, e-mail: cunhaf@ufs.br
* Corresponding author.

Abstract – Silver colloids were synthesized through chemical reduction and to verify the colloid stability we performed experiments where the pH, final concentration of the reagents, surface modification through adsorption of 5-fluorouracil and age were changed. The DLS, TEM and STM results indicated that the colloids were composed of almost monodisperse silver nanoparticles with an average diameter between 5 and 10 nm. We tested the nanoparticles as chemisensors and those prepared in the 4-5 pH range displayed an appropriate behavior when, upon adsorption of 5-fluorouracil, induced a color change. TEM micrographs indeed show that the aggregation process induced by the organic film led to the formation of rod-like particles.

Silver colloids were synthesized through chemical reduction of silver nitrate ($AgNO_3$) by sodium borohydrate ($NaBH_4$) at initial concentrations of 1 $mmol.L^{-1}$ and controlled temperature at 5ºC. In order to verify the colloid stability we performed experiments where the pH, final $AgNO_3$ concentration, surface modification through adsorption of 5-fluorouracil and age were changed. The colloids were characterized by UV-Vis absorption spectroscopy, dynamic light scattering (DLS), transmission electron microscopy (TEM) and scanning tunneling microscopy (STM).

The DLS, TEM and STM results indicated that the colloids were composed of almost monodisperse silver nanoparticles with an average diameter between 5 and 10 nm. The colloids as prepared presented the typical yellowish color corresponding to absorption peak at 390 nm, which is due to the resonant plasmon oscillation of the surface electrons (SPR). We have established that the final $AgNO_3$ concentration is directly related to the final number of particles in solution, but it does not change the average size and dispersion. Concentrations higher than 15.10^{-5} $mol.L^{-1}$ however lead to colloidal agglomeration. The nanoparticles remain stable for as long as 96 hours. We tested the nanoparticles as chemisensors and those prepared in the 4-5 pH range displayed an appropriate behavior when, upon adsorption of 5-fluorouracil, induced a color change. UV-Vis absorption spectroscopy indicates the onset of a second absorption maximum at 550 nm, which is interpreted as a second SPR oscillation mode. TEM micrographs indeed show that the aggregation process induced by the organic film led to the formation of rod-like particles.

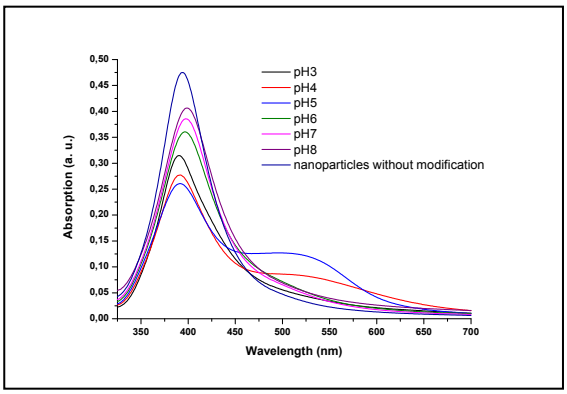

Figure 1: The extinction spectrum shows the effect of the adsorption of 5 fluorouracil on the silver colloids after pH variation.

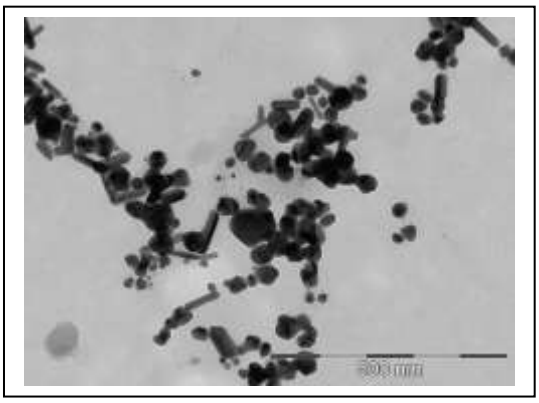

Figure 2: TEM micrograph of silver nanoparticles modified by the adsorption of 5-fluorouracil.

References

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